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(AUTONOMOUS)

2210001: MATRIX ALGEBRA AND CALCULUS (Common to all)

B.Tech. I Year I Sem

L	T	P	C
3	1	0	4

Pre-requisites: Mathematical Knowledge at pre-university level

Course Objectives: To learn

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

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

- Write the matrix representation of a set of linear equations and to analyses the solution of the System of equations.
- Find the Eigen values and Eigen vectors and reduce the quadratic form tocanonical form using orthogonal transformations.
- Solve the applications on the mean value theorems, and evaluate the improper integrals using Beta and Gamma functions.
- Find the extreme values of functions of two variables with/ without constraints.
- Evaluate the multiple integrals and apply the concept to find areas, 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.

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(AUTONOMOUS)

UNIT-II: Eigen values and Eigen vectors

Eigen vectors 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 proofs). Definition of Improper Integral: Beta and Gamma functions and their applications.

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

Partial Differentiation: Euler's heorem,Totalderivative, Jacobian,Functionaldependence-independence. Applications: Maxima and minima of functions of two variablesand three variables using method of Lagrange multipliers.

UNIT-V: Multivariable Calculus (Integration)

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

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Erwin kreyszig, Advanced Engineering Mathematics, 9thEdition, John Wiley & Sons,2006.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition,Pearson, Reprint, 2002.
3. H. K. Dassand Er. Rajnish Verma, Higher Engineering Mathematics, SChand and Company Limited, NewDelhi.

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2210008: APPLIED PHYSICS

B.Tech. I Year I Sem

L	T	P	C
3	1	0	4

Prerequisites: 10 + 2 Physics

Course Objectives: The objectives of this course for the student are to:

- Understand the basic principles of quantum physics and band theory of solids.
- Understand the underlying mechanism involved in construction and working principles ofvarious semiconductor devices.
- Study the fundamental concepts related to the dielectric, magnetic and energy materials.
- Identify the importance of nanoscale, quantum confinement and various fabricationstechniques.
- Study the characteristics of lasers and optical fibres.

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

- 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.
- Identify the role of semiconductor devices in science and engineering Applications.
- Explore the fundamental properties of dielectric, magnetic materials and energy fortheir applications.
- Appreciate the features and applications of Nanomaterials.
- Understand various aspects of Lasers and Optical fiber and their applications in diverse fields.

UNIT - I: QUANTUM PHYSICS AND SOLIDS

Quantum Mechanics: Introduction to quantum physics, Blackbody radiation, Photoelectric effect, de-Broglie Hypothesis, Matter waves, Davisson and Germer experiment, Heisenberg uncertainty principle, Born interpretation of the wave function, Time independent Schrodinger's wave equation, Particle in one dimensional potential box.

Solids: Free electron theory (Drude & Lorentz, Sommerfeld) (qualitative), Bloch's theorem - Kronig-Penney model, Effective mass of an electron, 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, MAGNETIC AND ENERGY MATERIALS

Dielectric Materials: Basic definitions, Types of polarizations (qualitative), Ferroelectric, Piezoelectric, and Pyroelectric materials, Applications.

Magnetic Materials: Domain theory of ferromagnetism, Soft and Hard magnetic materials, Magnetostriction, Magnetoresistance, Applications.

Energy Materials: Conductivity of liquid and solid electrolytes, Superionic conductors, Materials and electrolytes for super capacitors.

UNIT - IV: NANOTECHNOLOGY

Nano scale, Quantum confinement, Surface to volume ratio, Bottom-up fabrication: Sol-gel, precipitation methods, Top-down fabrication: Ball milling, Physical vapor deposition (PVD), Characterization techniques: XRD, SEM and TEM, Applications of nano materials.

UNIT - V: LASER AND FIBER OPTICS

Lasers: Laser beam characteristics, Three quantum processes, Einstein coefficients and their relations, Lasing action, Population inversion, Pumping methods, Ruby laser, He-Ne laser, Nd: YAG laser, Applications of laser.

Fiber Optics: Introduction to optical fibers, Total internal reflection, Construction of optical fiber, Classification of optical fibers, Acceptance angle - Numerical aperture, Losses in optical fibers, Optical fiber for communication system, Applications of optical fibers.

TEXT BOOKS:

1. M. N. Avadhanulu, P.G. Kshirsagar & TVS Arun Murthy" A Text book of EngineeringPhysics", 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, TypicalCreatives NANO DIGEST, 1st Edition, 2021.

REFERENCE BOOKS:

1. Quantum Physics, H.C. Verma, TBS Publication, 2nd Edition 2012.
2. Fundamentals of Physics – Halliday, Resnick and Walker, John Wiley &Sons,11th Edition,2018.
3. Introduction to Solid State Physics, Charles Kittel, Wiley Eastern, 2019.
4. Elementary Solid State Physics, S.L. Gupta and V. Kumar, Pragathi Prakashan, 2019.
5. A.K. Bhandhopadhya - Nano Materials, New Age International, 1stEdition, 2007.

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6. Energy Materials a Short Introduction to Functional Materials for Energy Conversion andStorage Aliaksandr S. Bandarenka, CRC Press Taylor & Francis Group
7. Energy Materials, Taylor & Francis Group, 1st Edition, 2022.

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2210501: PROGRAMMING FOR PROBLEM SOLVING

B.Tech. I Year I Sem

L	T	P	C
3	1	0	4

Course Objectives:

- To learn the fundamentals of computers.
- To understand the various steps in program development.
- To learn the syntax and semantics of the C programming language.
- To learn the usage of structured programming approaches in solving problems.

Course Outcomes: The student will learn

- To write algorithms and to draw flowcharts for solving problems.
- To convert the algorithms/flowcharts to C programs.
- To code and test a given logic in the C programming language.
- To decompose a problem into functions and to develop modular reusable code.
- To use arrays, pointers, strings and structures to write C programs.
- Searching and sorting problems.

UNIT - I: Introduction to Programming

Compilers, compiling and executing a program.

Algorithm – Flowchart / Pseudocode withexamples, Program design and structuredprogramming

Introduction to C Programming Language: variables (with data types and space requirements), Syntax and Logical Errors in compilation, object and executable code, Operators, expressions and precedence, Expression evaluation, Storage classes (auto, extern, static and register), type conversion, The main method and command line arguments Bitwise operations: Bitwise AND, OR, XOR and NOT operators

Conditional Branching and Loops: Writing and evaluation of conditionals and consequent branching with if, if-else, switch-case, ternary operator, goto, Iteration with for, while, do- while loops

I/O: Simple input and output with scanf and printf, formatted I/O, Introduction to stdin, stdout and stderr.Command line arguments

UNIT - II: Arrays, Strings, Structures and Pointers:

Arrays: one and two dimensional arrays, creating, accessing and manipulating elements of arrays Strings: Introduction to strings, handling strings as array of characters, basic string functions available in C (strlen, strcat, strcpy, strstr etc.), arrays of strings

Structures: Defining structures, initializing structures, unions, Array of structures Pointers: Idea of pointers, Defining pointers, Pointers to Arrays and Structures, Use of Pointers in self- referential structures, usage of self referential structures inlinked list (no implementation) Enumerationdata type

UNIT - III: Preprocessor and File handling in C:

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

Files: Text and Binary files, Creating and Reading and writing text and binary files, Appending data to

existing files, Writing and reading structures using binary files, Random access using fseek, ftell andrewind functions.

UNIT - IV: Function and Dynamic Memory Allocation:

Functions: Designing structured programs, Declaring a function, Signature of a function, Parameters and return type of a function, passing parameters to functions, call by value, Passing arrays to functions, passing pointers to functions, idea of call by reference, Some C standard functions and libraries

Recursion: Simple programs, such as Finding Factorial, Fibonacci series etc.,Limitations of Recursive functions Dynamic memory allocation: Allocating and freeing memory, Allocating memory for arrays ofdifferent data types

UNIT - V: Searching and Sorting:

Basic searching in an array of elements (linear and binary search techniques), Basicalgorithms to sort array of elements (Bubble, Insertion and Selection sort algorithms), Basic concept of order of complexitythrough the example programs

TEXT BOOKS:

1. Jeri R. Hanly and Elliot B.Koffman, Problem solving and ProgramDesign in C 7th Edition,Pearson
2. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rdEdition)

REFERENCE BOOKS:

1. Brian W. Kernighan and Dennis M. Ritchie, The C ProgrammingLanguage, Prentice Hall ofIndia
2. E. Balagurusamy, Computer fundamentals and C, 2nd Edition, McGraw-Hill
3. Yashavant Kanetkar, Let Us C, 18th Edition, BPB
4. R.G. Dromey, How to solve it by Computer, Pearson (16th Impression)
5. Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.
6. Herbert Schildt, C: The Complete Reference, Mc Graw Hill, 4th Edition
7. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

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(AUTONOMOUS)

2210372: ENGINEERING WORK SHOP

B.Tech. I Year I Sem

L	T	P	C
0	1	3	2.5

Course Objectives:

- To Study of different hand operated power tools, uses and their demonstration.
- To gain a good basic working knowledge required for the production of various engineering products.
- To provide hands on experience about use of different engineering materials, tools,equipments and processes those are common in the engineering field.
- To develop a right attitude, team working, precision and safety at work place.
- It explains the construction, function, use and application of different working tools, Equipment and machines

Course Outcomes:

- Explain the design and model different prototypes in the carpentry trade such as Cross lap joint, Dove tail joint. (L4)
- Demonstrate the design and model various basic prototypes in the trade of fitting such as Straight fit, V- fit. (L4)
- Understand to make various basic prototypes in the trade of Tin smithy such as rectangular tray, and open Cylinder. (L4)
- Demonstrate the design and model various basic prototypes in the trade of Welding. (L4)
- Explain to make various basic prototypes in the trade of Black smithy such as J shape, and S shape. (L4)
- Understand to perform various basic House Wiring techniques such as connecting one lamp with one switch, connecting two lamps with one switch, connecting a fluorescent tube, Series wiring, Go down wiring. (L4)

UNIT I - CARPENTRY & FITTING

- **Carpentry** – Introduction, Carpentry tools, sequence of operations and applications (T-Lap Joint, Dovetail Joint, Mortise & Tenon Joint)
- **Fitting** – Introduction, fitting tools, sequence of operations and applications (V-Fit, Dovetail Fit & Semi-circular fit)

Learning Outcomes: Students should be able to,

- Understand the trade of carpentry and fitting. (L2)
- Explain the tools involved in manufacturing operations. (L3)
- Evaluate the applications of carpentry and fitting. (L4)

UNIT II - TIN SMITHY AND BLACKSMITHY

- **Tin-Smithy** – Introduction, Tin smithy tools, sequence of operations andapplications (Square Tin, Rectangular Tray & Conical Funnel).
- **Blacksmithy-** Introduction, Blacksmithy tools, sequence of operations andapplications (Round to Square, Fan Hook and S-Hook)

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(AUTONOMOUS)

Learning Outcomes: Students should be able to,

- Understand the oldest manufacturing methods. (L2)
- Describe the sequence of operations involved. (L3)
- Explain the safety precautions and tools usage. (L4)

UNIT III - HOUSE WIRING AND WELDING

- **House-wiring** – Introduction, Electrical wiring tools, sequence of operations andapplications (Parallel & Series, Two-way Switch and Tube Light)
- **Welding Practice** – Introduction, electrode, welding tools, and sequence of operations. Advantages and applications (Arc Welding)

Learning Outcomes:

- Students should be able to,
- Discuss the topic of Heat engines.(L3)
- Identify types of Heat engines cycles.(L5)
- Evaluate the Factors affecting routing procedure, Route Sheet.(L4)

Text Books:

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

References:

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

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2210010: English for Skill Enhancement

B.Tech. I Year I Sem

L	T	P	C
2	0	0	2

Course Objectives: This course will enable the students to:

- Improve the language proficiency of students in English with an emphasis onVocabulary,Grammar, Reading and Writing skills.
- Develop study skills and communication skills in various professional situations.
- Equip students to study engineering subjects more effectively and criticallyusing thetheoretical and practical components of the syllabus.

Course Outcomes: Students will be able to:

- Understand the importance of vocabulary and sentence structures.
- Choose appropriate vocabulary and sentence structures for their oral and writtencommunication.
- Demonstrate their understanding of the rules of functional grammar.
- Develop comprehension skills from the known and unknown passages.
- Take an active part in drafting paragraphs, letters, essays, abstracts, précis andreports invarious contexts.
- Acquire basic proficiency in reading and writing modules of English.

UNIT - I

Chapter entitled '***Toasted English***' **by R. K. Narayan** from ***"English: Language, Context andCulture"*** published by Orient BlackSwan, 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 andCulture"published*** by Orient BlackSwan, Hyderabad

Vocabulary: Words Often Misspelt - Homophones, Homonyms and Homographs

Grammar: Identifying Common Errors in Writing with Reference to Noun-pronoun Agreementand

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(AUTONOMOUS)

Subject-verb Agreement.

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

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 Hurst etal** from ***"English: Language, Context and Culture"*** published by Orient BlackSwan, Hyderabad.**Vocabulary**: Words Often Confused - Words from Foreign Languages and their Use inEnglish.**Grammar:** Identifying Common Errors in Writing with Reference to MisplacedModifiers and Tenses.

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

Writing: Format of a Formal Letter-Writing Formal Letters E.g.., Letter of Complaint, Letter ofRequisition, Email Etiquette, Job Application with CV/Resume.

UNIT - IV

Chapter entitled **'Art and Literature' by Abdul Kalam** from ***"English: Language, Context andCulture"*** published by Orient BlackSwan, Hyderabad.**Vocabulary**: Standard Abbreviations in English

Grammar: Redundancies and Clichés in Oral and Written Communication. **Reading**: Survey, Question, Read, Recite and Review (SQ3R Method) - Exercisesfor 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 andCulture"*** published by Orient BlackSwan, Hyderabad.

Vocabulary: Technical Vocabulary and their Usage

Grammar: Common Errors in English (*Covering all the other aspects of grammar which were notcovered 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 Format) -Types of Reports - Writing a Report.

Note: ***Listening and Speaking Skills which are given under Unit-6 in AICTE Model Curriculum arecovered 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

MARRI LAXMAN REDDY INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(AUTONOMOUS)

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.

TEXT BOOK:

1. "English: Language, Context and Culture" by Orient BlackSwan Pvt. Ltd, Hyderabad. 2022. Print.EFERENCE BOOKS:

1. Effective Academic Writing by Liss and Davis (OUP)
2. Richards, Jack C. (2022) Interchange Series. Introduction, 1,2,3. CambridgeUniversity 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 forEngineeringStudents. Mc Graw-Hill Education India Pvt. Ltd.
7. Swan, Michael. (2016). Practical English Usage. Oxford University Press. FourthEdition

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(AUTONOMOUS)

2210376: ELEMENTS OF MECHANICAL ENGINEERING

B.Tech. I Year I Sem

L	T	P	D	C
0	0	2	0	1

Course Objectives: The objectives of this course are to

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

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

- Understand the operation, usage and applications of different measuring instruments and Tools.
- Examine the different characteristics of instruments like accuracy, precision etc
- Prepare simple composite components and joining different materials using soldering process.
- Identify tools & learn practically the process of turning, milling, grinding onmild steel pieces
- 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 andvolume of an irregular lamina using micrometer screw gauge.
3. Use of straight edge and sprit 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 planeusing 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 irregularsolids.
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 usingammeters 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
16. Determination of C.O.P of a Domestic Refrigerator.

MARRI LAXMAN REDDY INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(AUTONOMOUS)

2210071: 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

- Capable of handling instruments related to the Hall effect and photoelectric effect Experiments and their measurements.
- 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.
- Able to measure the characteristics of dielectric constant of a given material.
- Study the behavior of B-H curve of ferromagnetic materials.
- Understanding the method of least squares fitting.

Course Outcomes: The students will be able to:

- Know the determination of the Planck's constant using Photo electric effect and identifythe material whether it is n-type or p-type by2 Hall experiment.
- Appreciate quantum physics in semiconductor devices and optoelectronics.
- Gain the knowledge of applications of dielectric constant.
- Understand the variation of magnetic field and behavior of hysteresis curve.
- Carried out data analysis.

LIST OF EXPERIMENTS:

1. Determination of work function and Planck's constant using photoelectric effect.
2. Determination of Hall co-efficient and carrier concentration of a given semiconductor.
3. Characteristics of series and parallel LCR circuits.
4. V-I characteristics of a p-n junction diode and Zener diode.
5. Input and output characteristics of BJT (CE, CB & CC configurations).
6. V-I and L-I characteristics of light emitting diode (LED) and LASER.
7. V-I Characteristics of solar cell.
8. Determination of Energy gap of a semiconductor.
9. To determine the time constant of R-C circuit.
10. Determination of Acceptance Angle and Numerical Aperture of an optical fiber.
11. Understanding the method of least squares – Torsional pendulum as an example.
12. Determination of magnetic field induction along the axis of a current carrying coil.

REFERENCE BOOK:

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

MARRI LAXMAN REDDY INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(AUTONOMOUS)

2210571: PROGRAMMING FOR PROBLEM SOLVING LABORATORY

B.Tech. I Year -I Semester. **L T P C**

0 0 2 1

[Note: The programs may be executed using any available Open Source/ Freely availableIDESome of the Tools available are:

CodeLite: https://codelite.org/ Code:

Blocks: http://www.codeblocks.org/

DevCpp:

http://www.bloodshed.net/evcpp.html

Eclipse: http://www.eclipse.org

This list is not exhaustive and is NOT in any order of preference]

Course Objectives: The students will learn the following:

To work with an IDE to create, edit, compile, run and debug programs

To analyze the various steps in program development.

- To develop programs to solve basic problems by understanding basicconcepts in C like operators, control statements etc.
- To develop modular, reusable and readable C Programs using theconcepts like functions, arrays etc.
- To create, read from and write to text and binary files

Course Outcomes: The candidate is expected to be able to:

Formulate the algorithms for simple problems

- Able to develop programs based on condition checking
- Implement pyramid programs
- Able to perform matrix applications
- Modularize the code with functions so that they can be reused
- Create, read and write to and from simple text and binary files

Simple numeric problems:

a. Write a program for the simple, compound interest.
b. Write a program to implement bit-wise operators.
c. Write a program for converting Fahrenheit to Celsius.
d. Write a simple program that converts one given data type to anotherusing auto conversion and casting. Take the values from standard input.
e. Writeasimpleprogramtofindlargestoftwoandthreenumbersusingconditionalop erator.
f. Write a program for swapping two numbers with and without using thirdvariable and using bitwise operators.

MARRI LAXMAN REDDY INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(AUTONOMOUS)

Condition branching and statements:

a. Write a program for finding larges of three numbers.
b. Write a program that declares Class awarded for a given percentage of marks, where marks<40%=Failed, 40% to<60% = Second class, 60% to<70%=First class, >=70%=Distinction. Read percentage from standard input.
c. Write a C program to find the roots of a Quadratic equation.
d. 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)

Condition branching and loops:

a. Write a program to find whether the given number is a prime or not.
b. Write a C program to find the sum of individual digits of a positive integer and test given number is palindrome.
c. Write a program that prints a multiplication table for a given number and the number of rows in the table. For example, number=5 and no. of rows = 3, the output should be:

5x1=5
5x2=10
5x3=15

d. Write a program that shows the binary equivalent of a given positive number between0to255.
e. 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. Write a C program to generate the first n terms of the sequence.
f. Write a C program to generate all the prime numbers between 1 and n, where nis a value supplied by the user.
g. Write a C program to calculate the following ,where x is a fractional value.1- $x/2+x^2/4-x^3/6$
h. Write a C program to read in two numbers, x and n, and then compute the sum ofthis geometric progression:$1+x+x^2+x^3+\ldots.+x^n$. For example: if n=3 and x=5, then the program compute1+5+25+125.
i. Write a C program to construct a pyramid of numbers as follows:

1	*	1	1	*
12	**	23	22	**
123	***	456	333	***
			4444	**
				*

j. Write a C program to find given number is Armstrong number or not.
k. Write a C program to find given number is Perfect number or not.

Arrays, Strings, Pointers and Structures:

a. Write a C program to find the minimum, maximum and average in an array ofintegers.
b. Write a program to compute Mean, Variance, Standard Deviation,

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(AUTONOMOUS)

Sorting of nelements in single dimension array.

c. Write a C program that perform the following:
   i. Addition of Two Matrices
   ii. Multiplication of Two Matrices
   iii. Transposeofamatrixwithmemorydynamicallyallocatedforthene wmatrixasrowandcolumncounts may not be same.
d. Write a C program that sorts a given array of names.
e. Write a C program that perform the following operations:
   i. To insert a sub-string into a given main string from a given position.
   ii. To delete n Characters from a given position in a given string.
f. Write a program for reading elements using pointer in to array and display thevalues using array.
g. Write a program for display values reverse order from array using pointer.
h. Write a program through pointer variable to sum of n elements from array.
i. Write a program to implement student information by using structure to function.
j. Write a program to sort student id or name using structures.

Functions:

a. Write a C program to find factorial of a given number using functions.
b. Write a C program to perform swapping using functions.
c. Write a C program to find LCM, GCD of two numbers using functions.
d. Write a C program to implement sorting using functions.
e. Write a C program to create and print two dimensional array using functions.
f. Write a C program to find factorial of a given number using recursion.
g. Write a C program to find Fibonacci series using recursion
h. Write a C program to implement Towers of Hanoi problem using recursion.

Files:

a. Write a C program to display the contents of a file to standard out put device.
b. Write a C program which copies one file to another, replacing all lower casecharacters with their upper case equivalents.
c. Write a C program to count the occurrence of a character in a text file. The filename and the character are supplied as command line arguments.
d. Write a C program to merge two files in to a third file (i.e. ,the contents of thefirst file followed by those of these cond are put in the third file).

CASE STUDY I: Develop Sample Student Data base

Create a structure to specify data on students given below: Roll number, Name,Department, Course, Year of joining

Assume that there are not more than 15 students in the collage.

(a) Write a function to print names of all students who joined in a particular year.
(b) Write a function to print the data of a student whose roll number is given.

CASE STUDY 2: Perform simple Bank Transactions

Create a structure to specify data of customers in a bank. The data to be stored is: Account number, Name, Balance in account. Assume

maximum of 20 customers in the bank.

(a) Write a function to print the Account number and name of each customer with balance below Rs. 100.

(b) If a customer request for withdrawal or deposit, it is given in the form: Acct. no, amount, code (1 for deposit, 0 for withdrawal)

Write a program to give a message, "The balance is insufficient for the specified with drawal".

CASE STUDY 3: Provide Serial Numbers for Engine parts

An automobile company has serial number for engine parts starting from AA0 to FF9. The other characteristics of parts to be specified in a structure are: Year of manufacture, material and quantity manufactured.

(a) Specify a structure to store information corresponding to a part.

(b) Retrieve information on parts with serial numbers between BB1 and CC6.

Reference Books

1. Byron Gottfried, Schaum"s Outline of Programming with C, Mc Graw-Hill
2. Let us C by YashavantKanetkar BPB publications(16th Edition)
3. B.A.ForouzanandR.F.GilbergCProgrammingandDataStructures,Cengage Learning, (3rd Edition)
4. BrianW.KernighanandDennisM.Ritchie,TheCProgrammingLanguage ,Prentice HallofIndia
5. R. G. Dromey, How to solve It by Computer, Pearson(16th Impression)
6. Programming in C, Stephen G.Kochan, Fourth Edition, and Pearson Education.
7. Herbert Schildt, C:TheCompleteReference, McGrawHill,4th Edition.

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(AUTONOMOUS)

2210073: English Language and Communication Skills Laboratory

B.Tech. I Year -I Semester. **L T P C**

0 0 2 1

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

Course Objective

- ✓ To facilitate computer-assisted multi-media instruction enabling individualizedandindependent language learning
- ✓ To sensitize the students to the nuances of English speech sounds, wordaccent,intonation and rhythm
- ✓ To bring about a consistent accent and intelligibility in students'pronunciation ofEnglish by providing an opportunity for practice in speaking
- ✓ To improve the fluency of students in spoken English and neutralize the impactofdialects.
- ✓ To train students to use language appropriately for public speaking, groupdiscussions and interviews

Course Outcomes: Students will be able to:

- ✓ Understand the nuances of English language through audio- visual experience andgroupactivities
- ✓ Neutralise their accent for intelligibility
- ✓ Speak with clarity and confidence which in turn enhances their employability skills

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

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 rolein theLSRW skills approach to language and improve their pronunciation
2. To equip students with necessary training in listening, so that they can comprehendthe speechof people of different backgrounds and regions

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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 andprofessionalcontexts

- Oral practice
- Describing objects/situations/people.Role play – Individual/Group activities
- Just A Minute (JAM) Sessions

The following course content is prescribed for the **English Language and Communication SkillsLab**.

Exercise – ICALL 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 – IICALL Lab:

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

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

ICS Lab:

Understand: Features of Good Conversation – Strategies for Effective Communication. *Practice:* Situational Dialogues – Role Play- Expressions in Various Situations –MakingRequestsand Seeking Permissions - Telephone Etiquette.

Exercise - IIICALL Lab:

Understand: Errors in Pronunciation-Neutralising Mother Tongue Interference (MTI). *Practice:* Common Indian Variants in Pronunciation – Differences between Britishand AmericanPronunciation -*Testing Exercises*

ICS Lab:

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

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

Exercise – IVCALL Lab:

Understand: Listening for General Details.

Practice: Listening Comprehension Tests - *Testing Exercises*

ICS Lab:

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

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

Exercise – VCALL 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 ELCS Lab:

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 learningsoftware for self- study by students.

System Requirement (Hardware component):

Computer network with LAN facility (minimum 40 systems with multimedia) with thefollowingspecifications:

i) Computers with Suitable Configuration
ii) High Fidelity Headphones

2. **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):

- *Exercises in Spoken English. Part 1,2,3.* 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:

- Cambridge Advanced Learners' English Dictionary with CD.
- Grammar Made Easy by Darling Kindersley.
- Punctuation Made Easy by Darling Kindersley.
- Oxford Advanced Learner's Compass, 10th Edition.
- English in Mind (Series 1-4), Herbert Puchta and Jeff Stranks with Meredith Levy,Cambridge.

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- English Pronunciation in Use (Elementary, Intermediate, Advanced) CambridgeUniversityPress.
- English Vocabulary in Use (Elementary, Intermediate, Advanced) CambridgeUniversityPress.
- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE byCLIFFS).
- Digital All
- Orell Digital Language Lab (Licensed Version)

REFERENCE BOOKS:

1. (2022). *English Language Communication Skills – Lab Manual cum Workbook.* CengageLearning India Pvt. Ltd.
2. Shobha, KN & Rayen, J. Lourdes. (2019). *Communicative English – A workbook.* CambridgeUniversity Press
3. Kumar, Sanjay & Lata, Pushp. (2019). *Communication Skills: A Workbook.* Oxford UniversityPress
4. Board of Editors. (2016). *ELCS Lab Manual: A Workbook for CALL and ICSLab Activities.* Orient Black Swan Pvt. Ltd.
5. Mishra, Veerendra et al. (2020). *English Language Skills: A Practical Approach.* CambridgeUniversity Press.

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2210021: ENVIRONMENTAL SCIENCE

B. Tech. I Year -I Semester. **L T P C**

0 0 2 1

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 regulationswhich in turn helps in sustainable development.

UNIT - I

Ecosystems: Definition, Scope, and Importance of ecosystem. Classification, structure, andfunction of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Bio magnification, ecosystem value, services and carryingcapacity, Field visits. 2

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.

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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,R22 B.Tech. ECE Syllabus JNTU HYDERABAD biological and Socio-economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP).

Towards Sustainable Future: Concept of Sustainable Development Goals, Population andits 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 Bharuchafor
   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 PHLLearning 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 INDIAedition.
4. Environmental Studies by Anubha Kaushik, 4th Edition, New age internationalpublishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BSPublications.
6. Introduction to Environmental Science by Y. Anjaneyulu, BS. Publications.

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2220002: **DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS (Common to all)**

B.Tech. I Year-II Semester

L	T	P	C
3	1	0	4

Pre-requisites: Mathematical Knowledge at pre-university level

Course Objectives: To learn

- Methods of solving the differential equations of first order and first degree.
- Concept of higher order liner differential equations.
- Concept, properties of Laplace transforms, solving ordinary differential equationsby using Laplace transforms techniques.
- The physical quantities involved in engineering field related to vector valuedfunctions.
- The basic properties of vector valued functions and their applications toline, surface and volume integrals.

Course outcomes:

- After learning the contents of this paper the student must be able toIdentify whether the given first order differential equation is exact or not.
- Solve higher differential equation and apply the concept of differential equationto real world problems.
- Use the Laplace transforms techniques for solving ODE's.
- Apply the Del operator to scalar and vector point functions.
- Evaluate the line, surface and volume integrals and converting them from one toanother.

UNIT-I: First Order ODE **8L**

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 **10 L**

Second order linear differential equations with constant coefficients: Non-Homogeneous terms of the type e^{ax}, sin ax , cos ax, polynomials in x, e^{ax} V(x) and x V(x), method of variation of parameters, Equations reducible to linear ODE with constant coefficients: Legendre's equation, Cauchy-Euler equation.

UNIT-III: Laplace transforms **10 L**

Laplace Transforms: Laplace Transform of standard functions, First shifting theorem, Secondshifting theorem, Unit step function, Dirac delta function, Laplace transforms of functions when they are multiplied and divided by 't', Laplace

transforms of derivatives and integrals of function, Evaluation of integrals by Laplace transforms, Laplace transform of periodic functions, Inverse Laplace transform by different methods, convolution theorem (without proof). Applications: solving Initial value problems by Laplace Transform method.

IT-IV: Vector Differentiation 10 L

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

UNIT-V:Vector Integration 10 L

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

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9thEdition, John Wiley & Sons, 2006.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
3. H. K. Dassand Er. Rajnish Verma, Higher Engineering Mathematics, SChand and Company Limited, NewDelhi.

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2220009: ENGINEERING CHEMISTRY

B.Tech. I Year- II Semester **L T P C**

3 1 0 4

Course Objectives:

- To bring adaptability to new developments in Engineering Chemistry and to acquire the skills required to become a perfect engineer.
- To include the importance of water in industrial usage, fundamental aspects of battery chemistry, significance of corrosion it's control to protectthe structures.
- To imbibe the basic concepts of petroleum and its products.
- To acquire required knowledge about engineering materials like cement, smart materials and Lubricants.

Course Outcomes:

- Students will acquire the basic knowledge of electrochemical procedures related to corrosion and its control.
- The students are able to understand the basic properties of water and its usage in domestic and industrial purposes.
- They can learn the fundamentals and general properties of polymers and other engineering materials.
- They can predict potential applications of chemistry and practical utility in order to become good engineers and entrepreneurs.

UNIT - I: Water and its treatment: [8]

Introduction to hardness of water – Estimation of hardness of water by complex metric 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 break - point chlorination. DE fluoridation- 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 [8]

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

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impressed current methods.

UNIT - III: Polymeric materials: [8]

Definition – Classification of polymers with examples – Types of polymerization – addition (free radical addition) and condensation polymerization with examples – Nylon6:6, 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, Butyland Thiokol rubber.

Conducting polymers: Characteristics and Classification with examples-mechanism ofconduction in trans-polyacetylene and applications of conducting polymers.

Biodegradable polymers:

Concept and advantages - Polylactic acid and poly vinyl alcohol and their applications.

UNIT - IV: Energy Sources: [8]

Introduction, Calorific value of fuel – HCV, LCV- Dulongs formula. Classification- solid fuels: coal – analysis of coal – proximate and ultimate analysis and their significance. Liquid fuels – petroleum and its refining, cracking types – moving bed catalytic cracking. Knocking – octane and cetane rating, synthetic petrol - Fischer-Tropsch's process; Gaseousfuels – composition and uses of natural gas, LPG and CNG, Biodiesel – Transesterification, advantages.

UNIT - V: **Engineering Materials: [8]**

Cement: Portland cement, its composition, setting and hardening.

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.

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, Cengagelearning, 2016
3. A text book of Engineering Chemistry by M. Thirumala Chary, E. Laxminarayana and K.Shashikala, Pearson Publications, 2021.
4. Textbook of Engineering Chemistry by Jaya Shree Anireddy, Wiley Publications.

5. REFERENCE BOOKS:

6. Engineering Chemistry by Shikha Agarwal, Cambridge University Press, Delhi (2015)
7. Engineering Chemistry by Shashi Chawla, Dhanpatrai and Company (P) Ltd. Delhi (2011)

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2220371: ENGINEERING DRAWING PRACTICE

B.Tech. I Year – II Semester

L	T	P	C
1	0	4	3

Pre-requisites: Knowledge in dimensions and units, Usage of geometrical instruments andanalytical ability

COURSE OBJECTIVES

- To provide basic concepts in engineering drawing.
- To impart knowledge about standard principles of orthographic projection of objects.
- To draw sectional views and pictorial views of solids.

COURSE OUTCOMES: After completion of the course the student is able to

- Familiarize with BIS standards and conventions used in engineering graphics. (L3)
- Draw various engineering curves e.g., ellipse, parabola, cycloids and involutes etc. andconstructvarious reduced scales e.g., plain and diagonal scale. (L2)
- Ability to draw orthographic projections and isometric projections of given engineeringcomponents. (L3)
- Visualize different views like elevation and plan for a given line, plane figures or solidobjects. (L2)
- Develop the lateral surfaces of simple solids. (L5)
- To know about isometric projection. (L2)

UNIT – 1

Introduction To Engineering Drawing

Principles of Engineering Graphics and their Significance-Drawing Instruments and their Uses-Conventions in Drawing-BIS -Lettering and Dimensioning.

Geometrical Constructions: Bisecting a Line, Arc. Dividing A Line into 'N' Equal Parts,Constructionof Polygons, Division of Circle into Equal Parts (8 And 12)

Construction of Scales: Plain and Diagonal Scale.

Conic Sections: Ellipse, Parabola, Hyperbola and Rectangular Hyperbola- GeneralMethods only.

Engineering Curves: Cycloid, Epicycloid, Hypo cycloid.

Involutes: For Circle, Triangle, Square, Pentagon and Hexagon.

LEARNING OUTCOME:

- To understand the basic standards, conventions of engineering drawing and how to use theinstruments in drawing. (L1)
- Learn and draw the various types of curves used in engineering application. (L2)

UNIT – 2

Orthographic Projections Principles- Assumptions- Different Angles of Projection.

Projections of Points- Located in all the quadrants

Projections of Lines- Parallel, Perpendicular, inclined to one plane and inclined to both planes.

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LEARNING OUTCOME:

- Knowledge in various planes of projections. (L1)
- To draw the front view, top view and side views of the given geometrical elements. (L2)

UNIT – 3

Projections Of Solids

Classification of solids- simple and inclined to one plane position of Prisms, Pyramids, Cylinder andCone

LEARNING OUTCOME:

- To understand the various solid types. (L2)
- To draw all the views of the given solid in all possible orientations. (L3)

UNIT – 4

Section Of Solids

Types of Section Planes, Sectioning of Prisms, Pyramids, Cylinders and Cones.

Development Of surfaces

Development of surfaces of right Regular Solids- Parallel Line Method, Radial Line Method.

LEARNING OUTCOME:

- To identify the cut surfaces and represent the sectional views graphically when the solid issectioned. (L4)
- To develop the surfaces of solid using various methods. (L5)

UNIT – 5

Isometric Projections

Principles, Isometric Views of Planes, Solids- Box Method, Offset Method, Compound solids, Sectioned Solids. Conversion of Isometric to Multi view projection. And vice versa

LEARNING OUTCOME:

- Knowledge in principles of isometric projection. (L2)
- Conversion of isometric to orthographic and vice-versa. (L2)

TEXT BOOKS:

1. N.D.Bhatt, Elementary Engineering Drawing, Charotar Publishers,2012.
2. K.Veenugopal, –Engineering Drawing and Graphics + AutoCAD New Age International Pvt. Ltd,2011.

REFERENCE BOOKS:

1. **Engineering graphics with Auto CAD- R.B. Choudary/Anuradha Publishers EngineeringDrawing- Johle/Tata Macgraw Hill.**
2. **Basanth Agrawal and C M Agrawal –Engineering Drawing 2nd Edition -McGraw-Hill Education (India) Pvt.Ltd**

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2220321: ENGINEERING MECHANICS

	L	T	P	C
B.Tech. I Year II Sem	**3**	**0**	**0**	**3**

PRE REQUESTS: Intermediate Mathematics and Physics.

COURSE OBJECTIVES:

- To solve the resultant of any force system.
- To analyze the types of frication for moving bodies and problems related to friction.
- To determine the centroid of an area and center of gravity of body.
- To understand the concept of area moment and mass moment about any axes.
- Understand the work-energy principle

COURSE OUTCOMES : After completion of the course the student is able to

- Determine the resultant of coplanar concurrent and special force systems and analyse the bodies forequilibrium to find the unknown forces.(L1)
- Analyze the bodies on rough horizontal and inclined planes and connected Bodies (L4)
- Determine the centroid of composite areas, centre of gravity of composite bodies (L3)
- Determine the moment of inertia of simple areas and mass moment of inertia of simple bodies.(L3).
- Apply work-energy principle to solve the rigid body problems.(L3).
- Appraise the influences of a human factor considerations on engineering design (L6)

UNIT – 1

Introduction to Mechanics: Basic Concepts, system of Forces Coplanar Concurrent Forces - Components in Space -Resultant -Moment of Forces and its Application - Couples and Resultant of Force Systems. Equilibrium of system of Forces: Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems.

LEARNING OUTCOME:

- Determine the resultant of coplanar concurrent and special force systems and analyse the bodies forequilibrium to find the unknown forces.(L1)

UNIT – 2

Friction: Types of friction -Limiting friction -Laws of Friction -static and Dynamic Frictions – Types of friction – Dry friction – Ladder friction – Wedge friction – Screw friction – Simple Screw Jack – differentialScrew jack

LEARNING OUTCOME:

- Analyze the bodies on rough horizontal and inclined planes and connected Bodies (L_4)
-

UNIT – 3

Centroid and Center of Gravity: Introduction – Centroids of lines – Centroids of area - Centroids of Composite figures - Theorem of Pappus -Centre of Gravity - Center of gravity of composite bodies.

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LEARNING OUTCOME:

- Determine the centroid of composite areas, centre of gravity of composite bodies (L_3)

UNIT – 4

Area moments of Inertia: Introduction – Definition of Moment of Inertia -Polar Moment of Inertia – Radius of gyration - Transfer Theorem for moment of inertia – Moments of inertia by integration - Moments of Inertia of Composite Figures- Product of Inertia.

Mass Moment of Inertia: Introduction - Moment of Inertia of Masses – Radius of gyration - Transfer Formula for Mass Moments of Inertia – Mass moments of inertia by integration - Mass moment of inertia of
composite bodies.

LEARNING OUTCOME :

- Determine the moment of inertia of simple areas and mass moment of inertia of simple bodies.(L_3)

UNIT – 5

Kinetics of Rigid Bodies: Types of motion, D'Alemberts principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies kinetic of rigid body rotation.

LEARNING OUTCOME :

- Understanding basic laws and principles of kinetics of particle and rigid body.(L_2)
- Apply work-energy principle to solve the rigid body problems.(L_3)

TEXT BOOK :

1. Singer's Engineering Mechanics Statics and Dynamics/ K. Vijaya Kumar Reddy and J.Suresh KumarBSP
2. Engineering Mechanics/ Irving Shames, G.Krishna Mohan Rao / Prentice Hall.

REFERENCE BOOK :

1. Engineering Mechanics/ Bhattaharyya/ Oxford.
2. Tayal A.K.(2010), Engineering Mechanics. Umesh Publications.
3. Engg. Mechanics by S.S. Bhavikati & K.G. Rajasekharappa

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2220322: ENGINEERING MATERIALS

B.Tech. I Year II SEM

L	T	P	C
2	0	0	2

PRE-REQUISITES: Basic knowledge in Physics and chemistry

COURSE OBJECTIVES

- Provide basic understanding of engineering materials, classification and usage.
- Introduce the testing methods for various material properties and ASTM standards used in testing.
- Understand the various materials used in mechanical engineering like metals, ceramics,polymers, composite materials and other new materials.

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

- Classify the various materials that will be essential for the mechanical engineering applications.
- Express the mechanical properties of metals and their testing procedures.
- Understand the application of materials and their processing
- Understand the requirement and need for the development of the new materials.

UNIT – 1

Classification of Engineering Materials, Mechanical Properties of Metals and their testing equipment/procedures, ASTM standards for testing, Stress–Strain Behaviour of various materials.

LEARNING OUTCOME:

After successful completion of the unit, students can able to understand

- Classifications of engineering materials (L2)
- Identify ASTM standards for testing (L1)

UNIT – 2

Ferrous Materials

Plain carbon steels – classifications of steels, properties and applications of steels. Alloy steels – effect of alloying elements, functions and uses. High strength low alloy steels. Stainless steels – physical properties, mechanical properties. Cast Irons – White cast iron, grey cast iron, ductile iron, malleable
cast iron – properties and applications.

LEARNING OUTCOME:

After successful completion of the unit, students can able to understand

- Classifications of steels (L2)
- Applications of Stainless steels and cast-iron steels(L3)
-

UNIT – 3

Non – Ferrous Materials

Copper and its alloys – properties & applications – brasses, bronzes, copper nickel alloys.
Aluminium and its alloys – properties and applications
Classification of alloys and applications-Nickel, zinc, titanium, magnesium

LEARNING OUTCOME:

After successful completion of the unit, students can able to understand

- Classifications of Copper and aluminium alloys (L2)
- Applications and types of Ni, Zn, Ti and Mg alloys (L3)

UNIT – 4

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Plastics and Polymers: Structure of polymers, classification of polymers, chain formation by addition mechanism, chain formation by condensation mechanism, degree of polymerisation.
Ceramic Materials: Properties & applications of clay, cement & Concrete, glasses, refractories. Advanced ceramic materials – alumina, boron carbide, silicon carbide, sialon, zirconia.

LEARNING OUTCOME:
After successful completion of the unit, students can able to understand

- Classifications of polymers (L2)
- Illustarte the different Advanced ceramic materials (L3)

UNIT – 5
Advanced materials: Composites: Definitions, Reinforcements and matrices, Types of reinforcements, Types of matrices, Classification of composites, Properties of composites in comparison with standard materials. Semiconductors, Nano materials, smart materials and shaper memory alloys.

LEARNING OUTCOME:
After successful completion of the unit, students can able to understand

- Classifications of composite materials (L2)
- Describe different Advanced materials like semiconductors, shape memory alloys and nano materials (L2)

TEXT BOOK:

1. Introduction to Physical Metallurgy: Avner, 2nd ed., Tata McGraw-Hill Education, 2010.
2. Materials Science and Metallurgy : Kodgire V.D. 25th ed., Everest Publishing House, 2009

REFERENCE BOOK:

1. Physical Metallurgy : Raghavan V., 2nd ed., PHI, 2006
2. Materials Science and Metallurgy : Khanna O.P. 5th ed., Dhanpat Rai and Sons, 2009.

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(AUTONOMOUS)

2220572: DATA STRUCTURES LABORATORY

B.Tech. I Year - II Semester.

L	T	P	C
0	1	2	2

Prerequisites: A Course on "Programming for problem solving".Course Objectives:

- It covers various concepts of C programming language
- It introduces searching and sorting algorithms
- It provides an understanding of data structures such as stacks and queues.Course Outcomes:
- Ability to develop C programs for computing and real life applications using basic
- elements like control statements, arrays, functions, pointers and strings, and data
- structures like stacks, queues and linked lists.
- Ability to Implement searching and sorting algorithms

List of Experiments

1. Write a program that uses functions to perform the following operations on singlylinked list.: i) Creation ii) Insertion iii) Deletion iv) Traversal
2. Write a program that uses functions to perform the following operations on doublylinked list.: i) Creation ii) Insertion iii) Deletion
3. Write a program that uses functions to perform the following operations on circularlinked list: i) Creation ii) Insertion iii) Deletion
4. Write a program that implement stack operations using i) Arrays ii) Pointers
5. Write a c program to implement infix to postfix conversion using stack.
6. Write a c program to implement postfix evaluation.
7. Write a program that implement Queue operations using i) Arrays ii) Pointers
8. Write a program that implements the following sorting methods to sort a given list ofIntegers in ascending order i) Bubble sort ii) Selection sort iii) Insertion sort
9. Write a program that implements the following sorting methods to sort a given list ofIntegers in ascending order i) Merge sort ii) Quick sort
10. Write a program that use both recursive and non-recursive functions to perform theFollowing searching operations for a Key value in a given list of integers: i) Linearsearch ii).Binary search
11. Write a program to implement the tree traversal methods
12. Write a program to implement the graph traversal methods.

CASE STUDY-1 Balanced Brackets

A bracket is considered to be any one of the following characters: (,), {, }, [, or]. Two brackets are considered to be a *matched pair* if the an opening bracket (i.e., (, [, or {) occurs to the left of a closing bracket (i.e.,),], or }) *of the exact same type*. There are threetypes of matched pairs of brackets: [], {}, and ().

A matching pair of brackets is *not balanced* if the set of brackets it encloses are not matched.For example, {[(])} is not balanced because the contents in between { and } are not balanced.The pair of square brackets encloses a single, unbalanced opening bracket, (, and the pair of parentheses encloses a single, unbalanced closing square bracket,].

By this logic, we say a sequence of brackets is *balanced* if the following conditions are met:

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- It contains no unmatched brackets.
- The subset of brackets enclosed within the confines of a matched pair of brackets isalso a matched pair of brackets.
- Given strings of brackets, determine whether each sequence of brackets is balanced. If astring is balanced, return YES. Otherwise, return NO.

CASE STUDY-2 Minimum Average Waiting Time

Mr. Raju owns a pizza restaurant and he manages it in his own way. While in a normal restaurant, a customer is served by following the first-come, first-served rule, Raju simply minimizes the average waiting time of his customers. So he gets to decide who is served first, regardless of how sooner or later a person comes.

Different kinds of pizzas take different amounts of time to cook. Also, once he starts cooking a pizza, he cannot cook another pizza until the first pizza is completely cooked. Let's say we have three customers who come at time t=0, t=1, & t=2 respectively, and the time needed to cook their pizzas is 3, 9, & 6 respectively. If Raju applies first-come, first- served rule, then the waiting time of three customers is 3, 11, & 16 respectively. The average waiting time in this case is (3 + 11 + 16) / 3 = 10. This is not an optimized solution. After serving the first customer at time t=3, Raju can choose to serve the third customer. In that case, the waiting time will be 3, 7, & 17 respectively. Hence the average waiting time is(3 + 7 + 17) / 3 = 9.

Help Raju achieve the minimum average waiting time. For the sake of simplicity, just find the integer part of the minimum average waiting time.

Note:

- The waiting time is calculated as the difference between the time a customer orderspizza (the time at which they enter the shop) and the time she is served.
- Cook does not know about the future orders.

TEXT BOOKS:

1. Fundamentals of data structures in C, E.Horowitz, S.Sahni and Susan AndersonFreed, 2nd Edition, Universities Press.
2. Data structures using C, A.S.Tanenbaum, Y. Langsam, and M.J. Augenstein,PHI/pearson education.

REFERENCES:

1. Data structures: A Pseudocode Approach with C, R.F.GilbergAndB.A.Forouzan, 2ndEdition, Cengage Learning.
2. Introduction to data structures in C, Ashok Kamthane, 1st Edition, PEARSON

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2220072: ENGINEERING CHEMISTRY LABARORARY

B.Tech. I Year – II Semeste **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:

- Estimation of hardness of water to check its suitability for drinking purpose.
- Students are able to perform estimations of acids and bases using conductometry, potentiometry and pH metry methods.
- Students will learn to prepare polymers such as Bakelite and nylon-6 in the laboratory.
- 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:

- Determination of parameters like hardness of water and rate of corrosion of mild steel invarious conditions.
- 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.
- Students are able to prepare polymers like bakelite and nylon-6.
- Estimations saponification value, surface tension and viscosity of lubricant oils.

List of Experiments:

II. **Volumetric Analysis:** Estimation of Hardness of water by EDTA Complexometrymethod.

III. **Conductometry:** Estimation of the concentration of an acid by Conductometry.

IV. **Potentiometry:** Estimation of the amount of Fe^{+2} by Potentiomentry.

V. **pH Metry:** Determination of an acid concentration using pH meter.

VI. **Preparations:**

1. Preparation of Bakelite.
2. Preparation Nylon – 6.

II. **Lubricants:**

1. Estimation of acid value of given lubricant oil.
2. Estimation of Viscosity of lubricant oil using Ostwald's Viscometer.

III. **Corrosion:** Determination of rate of corrosion of mild steel in the presence and absence ofinhibitor.

IV. **Virtual lab experiments**

1. Construction of Fuel cell and its working.
2. Smart materials for Biomedical applications
3. Batteries for electrical vehicles.

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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).

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2220377: FUELS & LUBRICANTS LABORATORY

B.Tech. I Year – II Semester

L	T	P	C
0	0	2	1

PRE-REQUISITES: Engineering Physics & Chemistry

COURSE OBJECTIVES

- To understand the fuels and lubricants Properties
- To understand the knowledge of automobile fuels and lubricants.
- To understand the viscosity of lubricants and its variation with temperature
- To understand the distillation characteristics of petroleum products

COURSE OUTCOMES: After completion of the course the student is able to

- Find the kinematic viscosity of lubricants and its variation with temperature
- Determine the flash point, fire point, cloud point and pour point of liquid fuels
- Determine the calorific value of solid, liquid and gaseous fuels
- Determination of the dropping point of lubricating grease
- 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: Pen sky Martens Apparatus.
3. Determination of Carbon residue test: Liquid fuels.
4. Determination of Viscosity of Liquid lubricants and Fuels using: Say bolt Viscometer.
5. Determination of Viscosity of Liquid lubricants and Fuels using: Redwood Viscometer –I.
6. Determination of Viscosity of Liquid lubricants and Fuels using: Redwood Viscometer – II.
7. Determination of Viscosity of Liquid lubricants and Fuels using: Engler Viscometer.
8. Determination of Calorific value of Gaseous fuels using: Junkers Gas Calorimeter.
9. Determination of Calorific value: Solid/Liquid/ fuels using: Bomb Calorimeter.
10. Drop point and Penetration Apparatus for Grease.
11. ASTM Distillation Test Apparatus.
12. Cloud and Pour point Apparatus.

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2230323: MECHANICS OF SOLIDS

B.Tech. II Year I Sem	**L**	**T**	**P**	**C**
PRE-REQUISITES: Basics of Engineering mechanics	**3**	**-**	**-**	**3**

COURSE OBJECTIVES:

This course will advance the students' development of the following broad capabilities:

- Students will be able to understand basic concepts of stress, strain and their relations based on linear elasticity. Material behaviors due to different types of loading will be discussed.
- Students will be able to understand and know how to calculate stresses and deformation of a bar due to an axial loading under uniform and non-uniform conditions.
- Students will understand how to develop shear-moment diagrams of a beam and find the maximum moment/shear and their locations
- Students will understand how to calculate normal and shear stresses.

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

- Determine the resistance and deformation in member's subjected to axial, flexural and torsional loads. Evaluate the forces in pin joint – plane frames. (L3)
- Determine the deflections of beams using different methods. Analyze and design thin, thick cylinders and springs (L2,L3)

UNIT – 1

SIMPLE STRESSES AND STRAINS: Elasticity and plasticity – Types of stresses and strains – Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

LEARNING OUTCOME:

1. Restate definition of stress, strain, strain energy and resilience (L2)
2. Calculate stress and relation between the elastic moduli temperature stresses(L3)

UNIT – 2

SHEAR FORCE AND BENDING MOMENT: Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads , u.d.l, uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

LEARNING OUTCOME:

1. Apply shear force and bending moment concepts on cantilever, simply supported and overhanging beams (L3)
2. state the behavior of beams under different loadings (L1)

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UNIT – 3

FLEXURAL STRESSES:

Theory of simple bending – Assumptions Derivation of bending equation: M/I=f/y=E/R Neutral axis – Determination bending stresses – section modules of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections – Design of simple beam sections.

Shear Stresses: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T angle sections.

LEARNING OUTCOME:

1. Calculate bending stresses for the following rectangular and circular cross-section(L4)
2. Illustrate shear stress distribution for cross-section rectangular, circular, triangular, I, and T angle sections (L3)

UNIT – 4

ANALYSIS OF PIN-JOINTED PLANE FRAMES: Determination of Forces in members of plane, pin-joined, perfect trusses by (i) method of joints and (ii) method of sections. Analysis of various types of cantilever and simply – supported trusses – by method of joints and method of sections.

DEFLECTION OF BEAMS: Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, - U.D.L. uniformly varying load. Mohr's theorems – Moment area method – application to simple cases including overhanging beams.

LEARNING OUTCOME :

- To identify zero-force member in a structure (L1)
- Analyze the mathematical expression to determine the slope and deflection of cantilever and simply supported beams subjected to different types of loads. (L3)

UNIT – 5

Torsion of Circular Shafts: Theory of pure torsion – Derivation of Torsion equations: $T/J = q/r = N\theta/L$- Assumptions made in the theory of pure torsion – Torsional moment of resistance – Polar section modulus – Power transmitted by shafts – Combined bending and torsion and end thrust – Design of shafts according to theories of failure.

Thin Cylinders: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – changes in dia, and volume of thin cylinders– Thin spherical shells.

LEARNING OUTCOME :

- To calculate torsion problems in bars (L4)
- Analyze the mathematical expression for circumferential and longitudinal stresses in thin cylinders (L3)

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TEXT BOOK :

1. Strength of Materials by Ramamruthan / 4th Edition / Dhantatrai publishers
2. Strength of Materials – Bhavikatti/ 4th Edition / Vikas publishers

REFERENCE BOOK :

1. Strength of Materials by Bansal / 6th Edition / Lakshmi Publications
2. Strenght of Mateirals by Rajput / 5th Edition/ S.Chand publishers
3. Strength of Materials by Sadhu Singh / 9th Edition / Khanna publishers

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2230324: MATERIAL SCIENCE AND METALLURGY

B.Tech. II Year I Sem

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To understand of the correlation between the internal structure of the materials their mechanical properties and various methods to quantify their mechanical integrity and failure criteria.
- To provide a detailed interpretation of equilibrium phase diagram.
- To learn about heat treatment methods to tailor the properties of Fe-C alloys.
- To introduce various materials related to properties and applications.

COURSE OUTCOMES : After completion of the course the student is able to

- Explain the crystal structures and defects of materials (L2)
- Analyze the binary phase diagrams of alloys including Fe-Fe3C, brass, and bronze.(L4)
- Outline the different ferrous and non-ferrous materials and their applications (L1)
- Analyze the different heat treatment processes (L4)
- Understand the properties of smart materials, piezoelectric materials, biomaterials, composite materials etc.(L1)

UNIT – 1

Structure of metals: Lattices, basic idea of symmetry. Bravais lattices, unit cells, crystal structures, crystal planes and directions, co-ordination number. Imperfections in solids: point defects, line defects, surface defects. Grain and grain boundaries, effect of grain boundaries on the properties of metal / alloys, determination of grain size.

Constitution of alloys: Necessity of alloying, types of solid solutions, Hume Rotherys rules, intermediate alloy phases, and electron compounds.

LEARNING OUTCOMES:

1. To understand the types of crystal structures and relate it to the final properties. (L2)
2. Compare among different of crystal imperfections. (L3)

UNIT – 2

Equilibrium diagrams: Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid-state allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of Fe-Fe3C, equilibrium phase diagram**.**

LEARNING OUTCOME:

- Understand the concept of equilibrium diagrams.(L2)
- Explain the Fe-Fe_3C diagram. (L2)

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UNIT – 3

Cast irons and steels: Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheroidal graphite cast iron, Alloy cast irons. Classification of steels, structure and properties of plain carbon steels, tool and die steels.

Non-ferrous metals and alloys: Structure and properties of copper and its alloys, Aluminium and its alloys. Titanium and its alloy.

LEARNING OUTCOME:

- Classify different cast iron and steels and mention their applications. (L2)
- Explain the structure-property correlation of ferrous and non-ferrous materials. (L2)

UNIT – 4

Heat treatment of alloys: Effect of alloying elements on Fe-Fe3C system, Annealing, normalizing, Hardening, TTT diagrams, tempering, Hardenability, surface hardening methods, Age hardening treatment, Cryogenic treatment of alloys. Special metals and alloys- Super alloys maraging steels.

LEARNING OUTCOME :

- Analyze the types of the heat treatment process for a particular requirement. (L4)
- Explain the importance of special materials. (L4)

UNIT – 5

Ceramic materials: Crystalline ceramics, glasses, cermets, abrasive materials, nanomaterials - definition, properties and applications.

Composite materials: Classification of composites, particle - reinforced materials, fibre reinforced materials, metal ceramic mixtures, metal matrix composites and C – C composites.

LEARNING OUTCOME :

- Explain the properties of different ceramic materials and their applications. (L2)
- Classify thetypes of composite materials and mention its applications (L2)

TEXT BOOK :

1. Introduction to Physical Metallurgy by Sidney H. Avener, Tata McGraw hill education (P) Ltd, New Delhi, India./ 2nd edition
2. Materials Science and Engineering by V. Raghavan (2015), PHI Learning Private Ltd, India./ 6thEdition.

REFERENCE BOOK :

1. Mechanical Metallurgy by Dieter, George Ellwood, Copyright © 1988 McGraw-Hill Book Company (UK) Limited./3rd Edition
2. Engineering Materials properties & selection by Kenneth G, G.Budiniski /Prentice hall of India/8th edition.
3. Mechanics of composite materials, ROBERT M. JONES, Taylor & Francis ,U.S.A Balram Gupta et al Aerospace Materials, S B Chand & Company Ltd, January 2009./2nd edition.

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(AUTONOMOUS)

2230325: THERMODYNAMICS

B.Tech. II Year I Sem

PRE REQUESTS: Engineering Physics & Mathematics

COURSE OBJECTIVES

- To impart the knowledge of basic concepts of thermodynamics.
- To illustrate the concept of first law of thermodynamics and applications
- To illustrate the concept of second law of thermodynamics
- To facilitate the students to know the concepts of pure substance and their properties.
- To help the students learn the properties of gas mixtures and power cycles

COURSE OUTCOMES : After completion of the course the student is able to

- Explain the fundamental definitions used in thermodynamics (L_1)
- Outline the temperature principles of thermometry (L_4)
- Apply first law of thermodynamics to various thermodynamic systems (L_3)
- Analyze the concepts of second law of thermodynamics (L_3)
- Compare various power cycles (L_6)

UNIT – 1

Basic concepts of thermodynamics: Introduction, system, boundary, surrounding, control volume, universe, types of system, Macroscopic and Microscopic View Point, concept of Continuum, control volume, control space, Thermodynamic Equilibrium, State, property, process, cycle, Reversibility, Quasi static process, irreversible process, causes of irreversibility energy in state and energy in transition, types of work and heat, point and path function. Zeorth law of Thermodynamics- Concept of temperature principles of thermometry, reference points, constant volume gas thermometer, Scales of temperature, ideal gas scale

UNIT – 2

First law of thermodynamics: Joule's Experiment- First law of thermodynamics, PMM-I, Corollaries- First law applied to a Process, applied to a system, Steady Flow Energy Equation, throttling and free expansion processes. Energy Balance, deviations from perfect gas model, Vander walls equation of state,compressibility charts, variable specific heats, gas tables.

LEARNING OUTCOME:

1. Apply first law of thermodynamics for closed systems and construct conservation of mass and energy equations (L3).
2. Apply the first law of thermodynamics to the open systems (L3).

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UNIT – 3

Second law of thermodynamics: Limitations of first law of thermodynamics, thermal reservoir, heat engine, heat pump, parameters of performance, second law of thermodynamics, Kelvin Planck and Clausius statements and their equivalence collieries, PMM-II, Carnot Principle, Carnot cycle and its specialties. Thermodynamic scale of temperature, Clausius inequality, Entropy, principle of entropy increase, energy equation, availability and irreversibility, thermodynamic potentials, Gibbs and Helmholtz functions, Maxwell relations elementary treatment of the third law of thermodynamics.

LEARNING OUTCOME:

1. Calculate thermal efficiency and coefficient of performance for heat engine, refrigerators and heatPumps(L5)
2. Apply the concept of Entropy, Calculate heat, work and other important thermo dynamics(L3)

UNIT – 4

Properties of Pure Substances: Pure substance, P-V-T surfaces, T-S & h-s diagrams, Mollier charts, phase transformations, triple point, at critical state properties during the change of phase, dryness fraction, Clausius Clapeyron equation property tables. Various thermodynamic processes, energy transfer, steam calorimetry.

Properties of Gas Mixtures & Thermodynamic Cycles: Mixture of perfect gases, mole fraction, mass fraction, gravimetric & volumetric analysis, Dalton's law of partial pressure, Avogadro's law of additive volumes, equivalent gas constant, molecular internal energy, enthalpy of specific heats and entropy of mixture of perfect gasses, vapour and atmospheric air.

LEARNING OUTCOME :

1. Generate mass and energy balance equations for gas-vapor mixtures(L3).
2. Determine changes in internal energy and enthalpy for ideal gases (L3).

UNIT – 5

Air Standard Cycles: Carnot Cycle, Otto Cycle, Diesel & Dual Cycle. Mean Effective Pressures on Air standard basis – Comparison of Cycles, Sterling Cycle, Atkinson Cycle, Ericson Cycle, Lenoir Cycle.

Refrigeration Cycles: Carnot cycle, Bell Coleman cycle, Vapor Refrigeration cycles Description andrepresentation on P–V and T-S diagram, Thermal Efficiency.

LEARNING OUTCOME :

- To calculate efficiencies of gas power cycles(L5).
- To calculate coefficient of performance of refrigeration cycles(L5).

TEXT BOOK :

1. Engineering Thermodynamics, P.K. Nag, Tata McGraw Hill Publishers, 5th Edition
2. Heat Engineering, V.P.Vasandhani & D.S Kumar, Metropolitan Book Depot, 2nd Edition

REFERENCE BOOK :

1. Thermodynamics: An Engineering Approach Y.A. Cengel and M.A. Boles, Tata Mc-Graw HillPublishers, 7th Edition.
2. Engineering Thermodynamics, Mayhew and Rogers, Longman Green & Co Ltd., London,E.L.B.S, 8th Edition
3. Fundamentals of Classical Thermodynamics (SI Version), Van Wylen. G.J. and Sonntag. R.E,2ND Edition.

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(AUTONOMOUS)

2230326: **FLUID MECHANICS & HYDRAULIC MACHINES**

B.Tech. II Year I Sem

L	T	P	C
3	0	0	3

COURSE OBJECTIVES: To enable the student:

- To understand the basic principles of fluid mechanics
- To identify various types of flows.
- To understand boundary layer concepts and flow through pipes
- To evaluate the performance of hydraulic turbines
- To understand the functioning and characteristic curves of pumps

COURSE OUT COMES : After completion of the course the student is able to

- Able to explain the effect of fluid properties on a flow system.
- Able to identify type of fluid flow patterns and describe continuity equation.
- To analyze a variety of practical fluid flow and measuring devices and utilize Fluid Mechanics principles in design.
- To select and analyze an appropriate turbine with reference to given situation in power plants.
- To estimate performance parameters of a given Centrifugal and Reciprocating pump.
- Able to demonstrate boundary layer concepts.

UNIT – 1

Fluid statics: Dimensions and units: physical properties of fluids- specific gravity, viscosity, and surface tension - vapour pressure and their influence on fluid motion- atmospheric, gauge and vacuum pressures – measurement of pressure- Piezometer, U-tube and differential manometers.

LEARING OUTCOME:

- Identify which property can be suitable to apply in a particular application.
- In a position to choose which pressure measuring instrument can be suitable and how to convert the reading into required units.

UNIT – 2

Fluid kinematics: Stream line, path line and streak lines and stream tube, classification of flows steady & unsteady, uniform & non-uniform, laminar & turbulent, rotational & ir-rotational flows, equation of continuity for one dimensional flow and three-dimensional flows.

Fluid dynamics: Surface and body forces – Euler's and Bernoulli's equations for flow along a stream line.

Measurement of flow: Pitot tube, venture meter, and orifice meter, Flow nozzle.

Momentum equation and its application on force on pipe bend.

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LEARNING OUTCOME:

- Identify the flow behavior of a fluid.
- Practical application of flow measuring instruments

UNIT – 3

Closed conduit flow: Reynold's experiment, Darcy Weisbach equation, Minor losses in pipes, pipes in series and pipes in parallel, total energy line & hydraulic gradient line.
Boundary Layer Concepts: Definition, thicknesses, characteristics along thin plate, laminar and turbulent boundary layers (No derivation) boundary layer in transition, separation of boundary layer, submerged objects – drag and lift.

LEARNING OUTCOME:

- In a position to identify how much head to be supplied to the fluid to maintain the flow by overcoming the various losses taking place in the piping system.
- What is purpose of propeller used in submarines and aircraft and also the necessity for the change of wings orientation.

UNIT – 4

Basics of turbo machinery: Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.
Hydraulic Turbines: Classification of turbines, Heads and efficiencies, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design –draft tube theory- functions and efficiency.
Performance of hydraulic turbines: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.

LEARNING OUT COME:

- Importance of each and every element of the hydraulic machine.
- How to correlate the results obtained in model and prototype.

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UNIT – 5

Centrifugal pumps: Classification, working, work done – barometric head- losses and efficiencies specific speed- performance characteristic curves, NPSH.

Reciprocating pumps: Working, Discharge, slip, indicator diagrams.

LEARNING OUT COME:

- Importance of each and every element of the roto dynamic and positive displacement pumps.
- Comparison and identifying the suitable pump for a particular applicaiton.

TEXT BOOK:

1. Hydraulics, Fluid mechanics and Hydraulic Machinery - MODI and SETH, 21st Edition, standard Book House.
2. Fluid Mechanics and Hydraulic Machines by Er. R. K. Rajput, S. Chand,2019.

REFERENCE BOOK :

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, S.K. Kataria & Sons,2018
2. Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International publishers.
3. Hydraulic Machines by T.R.Banga & S.C. Sharma, 7th Edition, Khanna Publishers Efstathios E (Stathis) Michaelides, Alternative Energy Sources, Springer, Berlin, Heidelberg, 2010. 2nd Edition.

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2230327: PRODUCTION TECHNOLOGY

B.Tech. II Year I SEM

L	T	P	C
3	0	0	3

PRE-REQUISITES: NONE

COURSE OBJECTIVES

- To expose the students to fundamentals of casting and to provide the insight into sand casting process.
- To impart the fundamentals of welding and teach the principles of advanced welding process along with their application.
- To provide the understanding of various sheet metal forming and processing of plastics.
- To impart the basic knowledge on powder metallurgy and need for the additive manufacturing in industry.
- Toprovideatechnicalunderstandingofdifferentmetalformingprocesseslikeextrusion,forgingand high
- Energy rate forming processes.

COURSE OUT COMES:

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

- Classify the different types of casting process
- Selection of welding processes according to the given material
- Understand the principles and process of Forging, Rolling, Extrusion, drawing and designing of die
- Gain the Knowledge in powder metallurgy and Additive manufacturing
- Identify and analyse the forging defects.
- Analyze the forces in various extrusion processes

UNIT – 1

Casting:

Steps involved in making a casting – Advantage of casting, defects and its applications. – Type sand Properties of moulding sands, Patterns and Pattern making – Types of patterns – Materials used for patterns, pattern allowances and their construction, Principles of Gating, Gating ratio and design of Gating system, Basic principles and applications of Centrifugal casting, Die casting and Investment casting. Methods of Melting-Crucible melting and cupola operation.

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LEARNING OUTCOME:

- Understand the sand casting process.(L2)
- Able to design the gating system for the given pattern type.(L5)

UNIT – 2

Classification of welding processes, types of welded joints, Gas welding, Different types of flames and uses, Oxy – Acetylene Gas cutting. Basic principles of Arc welding, Manual metal arc welding, Sub merged arc welding, Inert Gas welding- TIG & MIG welding.

Resistance welding, Solid state welding processes- Friction welding, Friction stir welding, Forge welding, Thermit welding, Plasma welding, Soldering & Brazing. Heat affected zones in welding, Weld ability of metals, welding defects – causes and remedies – destructive and nondestructive testing of welds, Design of welded joints.

LEARNING OUTCOME:

- Identify the type of welding process based on the material given (L1).
- Interpret the welding defect and its cause (L6).

UNIT – 3

Sheet metal forming: Blanking and piercing, Deep drawing, Stretch forming, Bending, and its, Coining, Spinning: hot and cold spinning processes, Types of presses and press tools.

Processing of Plastics: Types of Plastics, Properties, Applications and their processing methods, Blow and Injection molding..

LEARNING OUTCOME:

- Understand the various sheet metal processes(L2).
- Differentiate the types of plastics and their application (L4).

UNIT – 4

Powder Metallurgy: Introduction- steps in powder metallurgy processes, typical industrial applications.

Additive Manufacturing : Need for Additive Manufacturing, Fundamentals of Additive Manufacturing, AM Process Chain, Advantages and Limitations of AM, Classification of AM process, Distinction between AM and CNC.

LEARNING OUTCOME:

- Understand other than basics of Powder metallurgy(L2)
- Conclude the process parameter using invarious AMT method(L3)

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UNIT – 5 **CLASSES :09**

Extrusion of Metals: Basic extrusion process and its characteristics. Forward extrusion andbackwardextrusion–Impactextrusion–Tubeextrusion-Hydrostaticextrusion.Forcesinextrusion

ForgingProcesses: Forgingoperationsandprinciples–Tools–Forgingmethods–Smithforging,DropForging–Rollforging–Forginghammers-forgingdefects.Forcesin forgingoperations

LEARNING OUTCOME:

- Identify the different types of extrusion processes.(L4)
- Explain the various types of operations carried out inforging.(L2)

TEXT BOOK :

1. ManufacturingTechnology/P.N.RaoVol.1&2/McGrawHill/3rdEdition.
2. Manufacturing Engineering & Technology / SeropeKalpakjian / Steven R. Schmid /Pearson/5thEdition.

REFERENCE BOOK:

1. ProductionTechnology/P.c.Sharma/S.Chand/3rd Edition.
2. AmitabhGhosh&Mallick,"ManufacturingScience",Assoc.EastwestPressPvt.Ltd/4thEdition.
3. WorkshopTechnology (vol.1)/HajraChowdary/AsiaPublishingHouse/5thEdition.

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2230378: MATERIAL SCIENCE AND MECHANICS OF SOLIDS LAB

B.Tech. II Year I Sem	**L**	**T**	**P**	**C**
PRE-REQUISITES:	**0**	**0**	**3**	**1**

COURSE OBJECTIVES:

- Determination of mechanical properties of different materials.
- Establish the constitutive relations in metals using destructive methods.
- Understand the behaviour of members during twisting and transverse loading.
- Familiarize with standard test specimens
- .Prepare samples for investigating microstructure of different materials.

COURSE OUTCOMES :

- Understand the microstructures of pure metals, steels, cast irons, non-ferrous alloys and heat-treated steels. (L1)
- Estimate the hardenability of steels by the Jominy End Quench test. (L2)
- Analyse the hardness of various treated and untreated steels by using the Brinells hardnesstest & Rockwell hardness test. (L4)
- Practice different tests such as direct tension test, torsion test, and impact test and punchshear test on metal rod. (L3)
- Illustrate the bending test on a ssimply supported and cantilever beam. (L4)
- Analyze the mechanical properties of different materials. (L4)

LIST OF EXPERIMENTS USING CADD (A minimum of 12 experiments to be conducted)

1. Preparation and study of crystal models for simple cubic, body centered cubic, facecentered cubic and close packed structures.
2. Preparation and study of the Microstructure of pure metals like Iron, Cu and Al.
3. Preparation and study of the Microstructure of Mild steels, low carbon steels, high – C steels.
   4.Study of the Microstructures of Cast Irons.
4. Study of the Microstructures of Non-Ferrous alloys.
5. Hardenability of steels by Jominy End Quench Test.
6. Find The Hardness of the Various Treated and Untreated plain carbon Steels
7. Direct tension test
8. Bending test on Simple supported beam.
9. Bending test on Cantilever beam
10. Torsion test
11. Brinell hardness test / Rockwell hardness test
12. Test on springs
13. Izod Impact test / Charpy Impact test.

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2230379: FLUID MECHANICS & HYDRAULIC MACHINES LABORATORY

B.Tech. II Year I Sem

L	T	P	C
0	0	2	1

COURSE OBJECTIVES

- To understand the basic principles of fluid mechanics.
- To identify various types of flows.
- To understand boundary layer concepts and flow through pipes.
- To evaluate the performance of hydraulic turbines.
- To understand the functioning and characteristic curves of pumps.

COURSE OUT COMES: After completion of the course the student is able to

- Able to explain the effect of fluid properties on a flow system.
- Able to identify type of fluid flow patterns and describe continuity equation.
- To analyze a variety of practical fluid flow and measuring devices and utilize fluid mechanics principles in design.
- To select and analyze an appropriate turbine with reference to given situation in power plants.
- To estimate performance parameters of a given Centrifugal and Reciprocating pump.
- Able to demonstrate boundary layer concepts

LIST OF EXPERIMENTS (A minimum of 12 experiments to be conducted)

1. Verification of Bernoulli's Theorems.
2. Calibration of Venturimeter.
3. Calibration of Orifice meter.
4. Determination of friction factor for a given pipe line.
5. Determination of loss of head due to sudden contraction in a pipeline.
6. Impact of jets on Vanes.
7. Performance Test on Pelton Wheel.
8. Performance Test on Francis Turbine.
9. Performance Test on Kaplan Turbine.
10. Performance Test on Single Stage Centrifugal Pump.
11. Performance Test on Multi Stage Centrifugal Pump.
12. Performance Test on Reciprocating Pump.

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2230380: PRODUCTION TECHNOLOGY LABORATORY

B.Tech. II Year I Sem	**L**	**T**	**P**	**C**
PRE-REQUISITES: Production Technology	**0**	**0**	**2**	**1**

COURSE OBJECTIVES

- Know about the basic Physical, Chemical Properties of materials
- Learn the basic operation of various manufacturing processes
- Design and fabricate a simple product

COURSE OUTCOMES: After completion of the course the student is able to

- Analyze the given problem and conducts investigation on the experimental setup.
- Operate different types of welding machines
- Perform operations on mechanical press.
- Get familiarity with processing of Plastics.
- Effectively communicate and explain the experimental analysis

LIST OF EXPERIMENTS (A minimum of 12 experiments to be conducted)

I Metal Casting Lab:

1. Pattern Design and making - for one casting drawing.
2. Sand properties testing - Exercise -for strengths, and permeability – 1
3. Moulding Melting and Casting - 1 Exercise

II. Welding Lab:

1. ARC Welding Lap & Butt Joint - 2 Exercises
2. Spot Welding - 1 Exercise
3. TIG Welding - 1 Exercise
4. Plasma welding and Brazing - 2 Exercises

III. Mechanical Press Working:

1. Blanking & Piercing operation and study of simple, compound and progressive press tool.
2. Hydraulic Press: Deep drawing and extrusion operation.
3. Bending and other operations

IV. Processing of Plastics

1. Injection Moulding
2. Blow Moulding

REFERENCE BOOK:

1. Dictionary of Mechanical Engineering – G.H.F. Nayler, Jaico Publishing House

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(AUTONOMOUS)

2230023: CONSTITUTION OF INDIA

II Year B. Tech. MECH I – Sem

L	T	P	D	C
3	0	0	0	0

The Constitution of India is the supreme law of India. Parliament of India cannot make any law which violates the Fundamental Rights enumerated under the Part III of the Constitution. The Parliament of India has been empowered to amend the Constitution under Article 368, however, it cannot use this power to change the "basic structure" of the constitution, which has been ruled and explained by the Supreme Court of India in its historical judgments. The Constitution of India reflects the idea of "Constitutionalism" – a modern and progressive concept historically developed by the thinkers of "liberalism" – an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state. The historic revolutions in France, England, America and particularly European Renaissance and Reformation movement have resulted into progressive legal reforms in the form of "constitutionalism" in many countries. The Constitution of India was made by borrowing models and principles from many countries including United Kingdom and America.

The Constitution of India is not only a legal document but it also reflects social, political and economic perspectives of the Indian Society. It reflects India's legacy of "diversity". It has been said that Indian constitution reflects ideals of its freedom movement; however, few critics have argued that it does not truly incorporate our own ancient legal heritage and cultural values. No law can be "static" and therefore the Constitution of India has also been amended more than one hundred times. These amendments reflect political, social and economic developments since the year 1950. The Indian judiciary and particularly the Supreme Court of India has played an historic role as the guardian of people. It has been protecting not only basic ideals of the Constitution but also strengthened the same through progressive interpretations of the text of the Constitution. The judicial activism of the Supreme Court of India and its historic contributions has been recognized throughout the world and it gradually made it "as one of the strongest court in the world".

Course content

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the fundamental rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States

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8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
9. Amendment of the Constitutional Powers and Procedure
10. The historical perspectives of the constitutional amendments in India
11. Emergency Provisions: National Emergency, President Rule, Financial Emergency
12. Local Self Government – Constitutional Scheme in India
13. Scheme of the Fundamental Right to Equality
14. Scheme of the Fundamental Right to certain Freedom under Article 19
15. Scope of the Right to Life and Personal Liberty under Article 21

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2230026: MACHINE LEARNING

III Year B.Tech. MECH II – Sem.

L	T	P	C
0	3	0	0

PRE-REQUISITES: Knowledge on Data Structures, and Statistical methods

COURSE OBJECTIVES:

- This course explains machine learning techniques such as decision tree learning,Bayesian learning etc.
- To understand computational learning theory.
- To study the pattern comparison techniques.

COURSE OUTCOMES:

At the end of this course, students will be able

- Understand the concepts of computational intelligence like machine learning
- Ability to get the skill to apply machine learning techniques to address the real timeproblems in different areas
- Understand the Neural Networks and its usage in machine learning application.

UNIT-I

Introduction - Well-posed learning problems, designing a learning system, Perspectives and issues in machine learning, supervised versus unsupervised learning. Concept learning and the general to specific ordering – introduction, a concept learning task, concept learning assearch, FIND-S: finding a maximally specific hypothesis, version spaces and the candidateelimination algorithm, remarks on version spaces and candidate elimination, inductive bias. Decision Tree Learning – Introduction, decision tree representation, appropriate problems fordecision tree learning, the basic decision tree learning algorithm, hypothesis space search in decision tree learning, inductive bias in decision tree learning, issues in decision treelearning.

UNIT–II

Artificial Neural Networks- Introduction, neural network representation, appropriate problems for neural network learning, perceptions, multilayer networks and the back-propagation algorithm, Remarks on the Back-Propagation algorithm, An illustrative example: face recognition, advanced topics in artificial neural networks.

Evaluation Hypotheses – Motivation, estimation hypothesis accuracy, basics of sampling theory, a general approach for deriving confidence intervals, difference in error of two hypotheses, comparing learning algorithms.

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UNIT–III

Bayesian learning – Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum Likelihood and least squared error hypotheses, maximum likelihood hypotheses for predicting probabilities, minimum description length principle, Bayes optimal classifier, Gibbs algorithm, Naïve.

Bayes classifier, an example: learning to classify text, Bayesian belief networks. Computational learning theory – Introduction, probably learning an approximately correct (PAC) hypothesis, the mistake bound model of learning.

Instance-Based Learning- Introduction, k-nearest neighbour (KNN) algorithm, locally weighted regression, radial basis functions, remarks on lazy and eager learning.

UNIT–IV

Genetic Algorithms – Motivation, Genetic algorithms, an illustrative example, hypothesis space search, Genetic programming.

Learning Sets of Rules – Introduction, sequential covering algorithms, learning rule sets: summary, learning First-Order rules, learning sets of First-Order rules: FOIL, Induction as inverted deduction, inverting resolution.

Reinforcement Learning – Introduction, the learning task, Q-learning.

UNIT - V

Analytical Learning- Introduction, learning with perfect domain theories: PROLOG-EBG, remarks on explanation-based learning, explanation-based learning of search control knowledge.

Combining Inductive and Analytical Learning – Motivation, inductive-analytical approaches to learning, using prior knowledge to initialize the hypothesis, Using prior knowledge to alter the search objective, using prior knowledge to augment search operators.

TEXTBOOKS:

1. Machine Learning – Tom M. Mitchell, - MGH

REFERENCE BOOKS::

1. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis

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(AUTONOMOUS)

2240202: BASIC ELECTRICAL AND ELECTRONIC ENGINEERING

II Year B. Tech. MECH II – Sem.

L	T	P	C
2	0	0	2

Course Objectives:

- To introduce the concepts of electrical circuits and its components
- To understand magnetic circuits, DC circuits and AC single phase & three phase circuits
- To study and understand the different types of DC/AC machines and Transformers.
- To import the knowledge of various electrical installations.
- To introduce the concept of power, power factor and its improvement.
- To introduce the concepts of diodes & transistors, and
- To impart the knowledge of various configurations, characteristics and applications.

Course Outcomes:

- To analyze and solve electrical circuits using network laws and theorems.
- To understand and analyze basic Electric and Magnetic circuits
- To study the working principles of Electrical Machines
- To introduce components of Low Voltage Electrical Installations
- To identify and characterize diodes and various types of transistors.

UNIT - I:

D.C. CIRCUITS

Electrical circuit elements (R, L and C), voltage and current sources, KVL&KCL, analysis of simple circuits with dc excitation.

A.C. CIRCUITS

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits , Three-phase balanced circuits, voltage and current relations in star and delta connections.

UNIT - II:

ELECTRICAL INSTALLATIONS

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

UNIT - III:

ELECTRICAL MACHINES

Working principle of Single-phase transformer, equivalent circuit, losses in transformers, efficiency, Three-phase transformer connections. Construction and working principle of DC generators, EMF equation, working principle of DC motors, Torque equations and Speed control of DC motors, Construction and working principle of Three-phase Induction motor, T orques equations and Speed control of Three- phase induction motor. Construction and working principle of synchronous generators.

UNIT - IV:

PN JUNCTIONANDZENERDIODE: PrincipleofOperationDiodeequation, Volt-Ampere characteristics, Temperaturedependence, Idealversuspractical, Staticanddynamicresistances, Equivalentcircuit, Zener diode characteristics andapplications.

RECTIFIERS AND FILTERS: P-N junction as a rectifier - Half Wave Rectifier, Ripple Factor -Full Wave Rectifier, Bridge Rectifier, Harmonic components in Rectifier Circuits, Filters –

Inductor Filters, Capacitor Filters, L- section Filters, π- section Filters.

UNIT - V:

BIPOLAR JUNCTION TRANSISTOR (BJT): Construction, Principle of Operation, Amplifying Action, Common Emitter, Common Base and Common Collector configurations, Comparison of CE, CB and CC configurations.

FIELD EFFECT TRANSISTOR (FET): Construction, Principle of Operation, Comparison of BJT and FET, Biasing FET.

TEXT BOOKS:

1. Basic Electrical and electronics Engineering –M S Suita TK Nagasaki Oxford University
2. Basic Electrical and electronics Engineering-D P Kothari. I J Nazareth, McGrawHill Education

REFERENCES:

1. Electronic Devices and Circuits – R. L. Boylston and Louis Nashelsky, PEI/PHI, 9th Ed,2006.
2. Millman's Electronic Devices and Circuits – J. Millman and C. C. Halkias, SatyabrataJit, TMH, 2/e,1998.
3. Engineering circuit analysis- by William Hayt and Jack E. Kemmerly, McGraw HillCompany, 6th edition.
4. Linear circuit analysis (time domain phasor and Laplace transform approaches) - 2nd edition by Raymond A. De Carlo and Pen-Min-Lin, Oxford UniversityPress-2004.
5. Network Theory by N. C. Jagan & C. Lakshminarayana, B.S.Publications.
6. Network Theory by Sudhakar, Shyam Mohan Palli,TMH.
7. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press,2011.
8. E. Hughes, "Electrical and Electronics Technology", Pearson,2010.
9. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India,1989

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(AUTONOMOUS)

2250328: METROLOGY AND MACHINE TOOLS

B.Tech. II Year II Sem **L T P C**

PRE-REQUISITES: Production technology **3 - - 3**

COURSE OBJECTIVES

- Impart the fundamental aspects of the metal cutting principles and their application in studying the behavior of various machining processes.
- Understand working of lathe, shaper, planer, drilling, milling and grinding machines
- To develop fundamental knowledge on tool materials, cutting fluids and tool wear mechanisms
- Acquire the knowledge of Engineering metrology and its practice which is having increasing importance in industry

COURSE OUTCOMES : After completion of the course the student is able to

- Understand the cutting tool geometry, mechanism of chip formation and mechanics of orthogonal cutting (L_1)
- Identify basic parts and operations of machine tools including lathe, shaper, planer, drilling, boring, milling and grinding machine (L_3)
- Comprehend speed and feed mechanis ms of machine tools (L_3)
- Select a machining operation and corresponding machine tool for a specific application in real time. (L5)
- Identify techniques to minimize the errors in measurement(L3)
- Student will have the knowledge of various methods and devices for measurement of length, angle, gear& thread parameters, surface roughness and geometric features of parts (L_3)

UNIT – 1

Metal cutting: Introduction, elements of cutting process – Geometry of single point tools. Chip formation and types of chips. Mohr's circle, Merchant circle, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Mach inability.
Engine lathe – Principle of working, types of lathe, specifications. Taper turning– Lathe attachments. Capstan and Turret lathe – Single spindle and multi-spindle automatic lathes – tool layouts

LEARNING OUTCOME:

1. Mechanism of chip formation (L2)
2. Recognize various lathe machines(L2)

UNIT – 2

Drilling and Boring Machines – Principles of working, specifications, types, operations performed; twist drill. Types of Boring machines and applications. Shaping, slotting and planning machines - Principles of working.

LEARNING OUTCOME:

1. Select appropriate machines for producing various components (L4)
2. Differentiate various working mechanisms of machines (L2)

UNIT – 3

Milling machines – Principles of working – Types of milling machines – Geometry of milling cutters – methods of indexing. Operations on milling machine.

Grinding – theory of grinding – classification of grinding machines. Types of abrasives, bonds. Selection of a grinding wheel. Lapping, honing and broaching machines, comparison and Constructional features, - Gear cutting, gear hobbling and gear shaping – gear finishing methods.

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LEARNING OUTCOME:

1. Apply the method of indexing to divide the parts periphery (L3)
2. Select the appropriate finish operations for given components (L3)

UNIT – 4

Limits, fits and tolerances- Unilateral and bilateral tolerance system, hole and shaft basis system. Interchangeability and selective assembly.

Limit Gauges: Taylor's principle, Design of GO and NO GO gauges

Measurement of angles, Bevel protractor, Sine bar.

Measurement of flat surfaces, straight edges, surface plates, optical flat and auto collimator.

LEARNING OUTCOME :

1. Will be able to identify best practice to measure various physical entities. (L3).
2. To measure various inclinations of the components. Determine roughness of the given surface (L2).

UNIT – 5

Surface Roughness Measurement: Roughness, Waviness. CLA, RMS, Rz Values. Methods of measurement of surface finish, Talysurf.

Screw thread measurement, Gear measurement; Machine Tool Alignment Tests on lathe, milling and drilling machines. Lasers in metrology - Advantages of lasers – Laser scan micrometers; Laser interferometers – Applications – Straightness, Alignment; Ball bar tests.

LEARNING OUTCOME :

1. Determine roughness of the given surface (L3).
2. Difference between conventional and unconventional process (L2).

TEXT BOOK :

1. Production Technology by R.K. Jain and S.C. Gupta /17th Edition
2. Engineering Metrology by I C Gupta., Dan path Rai/5th Edition

REFERENCE BOOK :

1. Production Technology by H.M.T. (Hindustan Machine Tools)/1st Edition
2. Metrology and measurements by Anand k bewoor, Tata mc grawhill Publishers/1stEdition
3. Production technology by O.P. khanna, Danpath Rai publications/1st Edition

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2240329: KINEMATICS OF MACHINERY

B.Tech. II Year II Sem

L	T	P	C
3	1	0	3

COURSE OBJECTIVES

- Understand the fundamental concepts of kinematics and their application in machinery.
- Analyze the motion of simple mechanisms and determine their displacement, velocity, and acceleration.
- Develop an understanding of the design and analysis of simple mechanisms such as linkages of cams.
- Design and analyze gear trains and tooth gearing for a range of applications.
- Evaluate the effectiveness of kinematic principles in the design and analysis of robotic systems.

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

- Understand the principles of kinematics and their role in machinery at the **Knowledge** level.
- Analyze the motion of simple mechanisms and determine their displacement, velocity, and acceleration at the **Comprehension** level.
- Design and analyze cam mechanisms for a variety of applications at the **Application** level.
- Design and analyze gear trains and tooth gearing for a range of applications at the **Synthesis** level.
- 5. Apply kinematic principles to the design and analysis of robotic systems at the **Evaluation** level.

UNIT – 1

Introduction: Basics of mechanism: Terminology and definitions, kinematic pairs, degrees of freedom - Grubler's criterion, Grashoffs law; Kinematic inversions: Four bar chain, single and double slider crank chains.
Straight line motion mechanisms: Exact and approximate copiers and generated types - Peaucellier - Hart - Scott Russel – Grasshopper - Pantographs.
Steering Mechanism: Types - Davis Steering gear, Ackerman's steering gear; Condition for correct steering.
LEARNING OUTCOME:

- Understand the basics of mechanisms, kinematic pairs, and degrees of freedom at the **Knowledge** level.
- Analyze the steering mechanisms used in vehicles, including the types of steering mechanisms, and the conditions required for correct steering at the **Analysis** level.

UNIT – 2 CLASSES:12

Kinematic Analysis: Displacement, velocity and acceleration analysis of simple mechanisms- graphical method (slider crank, four bar and toggle mechanism), Relative Velocity, Rubbing Velocity, Mechanical Advantage, instantaneous centre method (slider crank, four bar and toggle mechanism)- Aronhold Kennedy Theorem, Kliens construction - Coriolis component of acceleration.

LEARNING OUTCOME:

- Apply the graphical method for displacement, velocity, and acceleration analysis of simple mechanisms at the **Application** level.
- Analyze the mechanical advantage, Coriolis component of acceleration in simple mechanisms at the **Analysis** level.

UNIT – 3

Cams: Definitions of cam and followers – their uses – Types of followers and cams – Terminology – Types of follower motion - Uniform velocity, Simple harmonic motion and uniform acceleration and retardation. Maximum velocity and maximum acceleration during outward and return strokes in the above 3 cases.

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(AUTONOMOUS)

LEARNING OUTCOME:

- Evaluate the use of cams and followers, differentiate between the different types of followers and cams at the **Analysis** level.
- Compute the maximum velocity and maximum acceleration during the outward and return strokes for the three types of follower motion at the **Application** level.

UNIT – 4 CLASSES :10

Gears: Friction wheels and toothed gears – types – law of gearing, condition for constant velocity ratio for transmission of motion – velocity of sliding Forms of teeth, cycloidal and involutes profiles – phenomena of interferences – Methods of interference. Condition for minimum number of teeth to avoid interference – expressions for arc of contact and path of contact.

Gear Trains: Simple, compound, reverted and planetary gear trains; sun and planet gear train (Tabular method only).

LEARNING OUTCOME:

- Evaluate the different types of gear trains, including simple, compound, reverted, and planetary gear trains, and calculate the velocity ratio and gear ratio using tabular methods. **Evaluation.**
- This outcome is at the analysis level, where learners will be able to distinguish between different types of gears and understand the various forms of teeth used in gears. **Analysis.**

UNIT – 5 CLASSES :08

Robot kinematics Introduction: robot classification – drive technology, work envelope geometries, robot specifications, direct kinematics the arm equation-rotations, homogeneous coordinates, link coordinates, inverse kinematics- general properties solution, tool configuration, inverse and direct kinematics of four axis SCARA robot.

LEARNING OUTCOME:

- **Analyze** and differentiate between different types of robots based on their classification, including drive technology, work envelope geometries, and robot specifications.
- **Apply** the concepts of direct and inverse kinematics to solve the arm equation and determine the position and orientation of a robot's end effector.

TEXT BOOK:

1. Theory of Machines and Mechanisms/JOSEPH E. SHIGLEY/ Oxford
2. Theory of Machines / S. S. Rattan / Mc Graw Hill Publishers.

REFERENCE BOOK:

1. Robert J. Schilling, Fundamentals of Robotics Analysis and Control, PHI Learning, 2009.
2. Theory of Machines / Sadhu Singh / Pearson.
3. Theory of Machines / Thomas Bevan/CBS.

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(AUTONOMOUS)

2240330: THERMALENGINEERING-1

B.Tech. II Year II Sem **L T P C**

PRE-REQUISITE: THERMODYNAMICS **3 0 0 3**

COURSE OBJECTIVES:

- To impart the knowledge on working of IC engine and the various losses.
- To teach the basic concepts of combustion phenomena on and knocking in S.I. and C.I. Engines
- Analyze the stages of combustion to improve the performance of IC engines with respect to fuel economy and control of emissions in global, environmental and social context.
- Understand and evaluate the performance analysis of the major components andsystems of IC engines and their applications

COURSE OUTCOMES:

- Understand the functionality of the major components of the IC Engines and effects of operating conditions on their performance (L2)
- Understand the function of engine systems (L2)
- Explore the combustion stages of SI and CI engines, and factors influence for better combustion (L4)
- Calculate the performance test on IC engines. (L4)
- Will be analyze the concepts of alternate hybrid vehicles(L4)

UNIT – 1

I.C. Engines: Classification - Working principles of Four & Two stroke engine, SI & CI engines, Valve and Port Timing Diagrams, Air – Standard, air-fuel and actual cycles - Engine systems – Carburetor and Fuel Injection Systems for SI engines, Fuel injection systems for CI engines, Ignition, Cooling and Lubrication system, Fuel properties and Combustion Stoichiometry.

LEARNING OUTCOME :

At the end of this unit, the students will be able to

- Recognize and define basic elements and subsystems of an IC Engine with theirfunctions.(L3)
- Able to know the working principle of various types of engine systems, Fuel injection system, lubrication system and cooling systems of IC Engines.(L2)

UNIT – 2

Combustion in SI Engines: Normal Combustion and abnormal combustion in SI engines – Importance of flame speed and effect of engine variables – Abnormal combustion, pre-ignition and knocking in SI Engines – Fuel requirements and fuel rating, anti-knock additives – combustion chamber – requirements, types of SI engines.

Combustion in CI Engines: Four stages of combustion in CI engines – Delay period and its importance – Effect of engine variables – Diesel Knock– Need for air movement, suction, compression and combustion induced turbulence in Diesel engine – open and divided combustion chambers and fuel injection– Diesel fuel requirements and fuel rating.

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LEARNING OUTCOME :

At the end of this unit, the students will be able to

- Explore the combustion stages of SI and CI engines, and factors influence for better combustion(L3)

UNIT – 3

Testing and Performance: Parameters of performance - measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power – Determination of frictional losses and indicated power – Performance test – Heat balance sheet and chart Classification of compressors – Fans, blowers and compressors – positive displacement and dynamic types – reciprocating and rotary types.

Reciprocating Compressors: Principle of operation, work required, Isothermal efficiency volumetric efficiency and effect of clearance volume, staged compression, under cooling, saving of work, minimum work condition for staged compression

LEARNING OUTCOME:

At the end of this unit, the students will be able to

- Evaluate the testing and performance parameters of IC engine.(L4)

UNIT – 4

Rotary Compressor (Positive displacement type): Roots Blower, vane sealed compressor, mechanical details and principle of working – efficiency considerations.

Dynamic Compressors: Centrifugal compressors: Mechanical details and principle of operation – velocity and pressure variation. Energy transfer-impeller blade shape-losses, slip factor, power input factor, pressure coefficient and adiabatic coefficient – velocity diagrams – power.

Axial Flow Compressors: Mechanical details and principle of operation – velocity triangles and energy transfer per stage degree of reaction, work done factor - isentropic efficiency- pressure rise calculations – Polytropic efficiency.

LEARNING OUTCOME :

At the end of this unit, the students will be able to

- Explain the function and working principles of rotary, reciprocating, dynamic axial compressors.(L2)

UNIT – 5

Need for alternate fuel: Availability and properties of alternate fuels, LPG, hydrogen, ammonia, CNG and LNG, vegetable oils and biogas, merits and demerits of various alternate fuels,

Electric, Hybrid, Fuel Cell And Solar Cars : Concept of hybrid electric drive train, types, architecture of series and parallel hybrid electric drive train, merits and demerits, high energy and power density batteries, fuel cell vehicles, solar powered vehicles–Working operations

LEARNING OUTCOME:

At the end of this unit, the students will be able to

- Will be analyze the concept of alternate fuels and hybrid vehicles

TEXT BOOK :

1. I.C. Engines, V. Ganesan, 4th Edition, Mc Graw Hill
2. Thermal Engineering, Mahesh M Rathore, 2nd Edition Tata Mc Graw Hill, 2010

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REFERENCE BOOK :

1. Applied Thermodynamics for Engineering Technologists, Eastop& McConkey, Pearson 5th edition
2. Fundamentals of Classical Thermodynamics, Vanwylen G.J., Sonntag R.E., Wiley Eastern. 6th edition
3. Internal Combustion Engines Fundamentals, John B. Heywood, McGraw Hill.3rd Edition.

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2240007: PROBABILITY DISTRIBUTIONS& COMPLEX VARIABLES

II Year B. Tech. MECH II – Sem

L	T	P	C
3	1	0	4

Course Objectives:

- The ideas of probability and random variables and various discrete and continuous probability distributions and theirproperties.
- The basic ideas of statistics including measures of central tendency, correlationand regression.
- The statistical methods of studying data samples.
- Differentiation and integration of complex valued functions.
- Evaluation of integrals using Cauchy's integral formula and Cauchy's residue theorem.
- Expansion of complex functions using Taylor's and Laurent'sseries.

Course outcomes:

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

- Formulate and solve problems involving random variables and apply statistical methods for analyzing experimental data.
- Analysethecomplexfunctionwithreferencetotheiranalyticity,integrationusingCauchy'sintegral and residuetheorems.
- Taylor's and Laurent's series expansions of complex function.

UNIT - I: Basic Probability

Probability spaces, conditional probability, independent events, and Bayes' theorem. Random variables: Discrete and continuous random variables, Expectation of RandomVariables, Variance of random variables.

Learning Outcomes:

- Understand the sample space and events
- Explain the notion of random variable, distribution functions and expected value.
- Apply Baye's theorem to real time problems
- Analyse the mean and variance of random variables
- Evaluate the probability of event for more complex outcomes.

UNIT - II: Probability distributions

Binomial, Poisson, evaluation of statistical parameters for these distributions, Poisson approximation to the binomial distribution
Continuous random variables and their properties, distribution functions and density functions, Normal and exponential, evaluation of statistical parameters forthese distributions

Learning Outcomes:

- Understand the concept of Probability distribution.
- Explain discrete probability distributions
- Apply Binomial, Poisson and Geometric distributions for real data to compute
- Probabilities, theoretical frequencies.
- Analyse the properties of Binomial, Poisson and Geometric distributions and its applications.

- Evaluate probabilities, theoretical frequencies.

UNIT - III: Testing of Hypothesis

Test of significance: Basic of testing of Hypothesis. Null and alternate Hypothesis, types of errors, level of significance, critical region. Large sample test for single proportion, difference of proportions, single mean, difference of means; small sample tests: Test for single mean, difference of means and test for ratio of variances

Learning Outcomes:

- Understand the concept of testing of hypothesis
- Explain the single proportions and difference of proportions.
- Apply the concept of hypothesis testing for large samples.
- Testing hypothesis for small samples to draw the inference.
- Evaluate single mean and difference of means for small samples.

UNIT - IV: Complex Variables (Differentiation)

Limit, Continuity and Differentiation of Complex functions, Analyticity, Cauchy-Riemann equations (without proof), finding harmonic conjugate; Milne-Thomson method for constructing analytic functions.

LEARNING OUTCOMES:

- Understand the basic theory of complex functions
- Explain the concepts of limit, continuity, differentiability, analyticity.
- Apply C-R equations to different complex functions
- Analyse the harmonic functions
- Evaluate the Bilinear Transformation.

UNIT - V: Complex Variables (Integration)

Line integral, Cauchy's theorem, Cauchy's Integral formula, Zeros of analytic functions, Singularities, Taylor's series, Laurent's series; Residues, Cauchy Residue theorem, Conformal mappings, Mobius transformations and their properties.(All theorems are without proof)

LEARNING OUTCOMES:

- Understand the concept of complex integration.
- Explain the Cauchy's integral theorem
- Apply Complex integration over the stream flow functions
- Analyse the contour Integration.

- Evaluation of a line integral along a path.

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2240272: Basic Electrical and Electronics Engineering Lab

II Year B. Tech. MECH II – Sem

L	T	P	C
-	-	2	1

Pre-requisites: Basic Electrical and Electronics Engineering

Course Objectives:

- To introduce the concepts of electrical circuits and its components
- To understand magnetic circuits, DC circuits and AC single phase & three phase circuits
- To study and understand the different types of DC/AC machines and Transformers.
- To import the knowledge of various electrical installations.
- To introduce the concept of power, power factor and its improvement.
- To introduce the concepts of diodes & transistors, and
- To impart the knowledge of various configurations, characteristics and applications.

Course Outcomes:

- To analyze and solve electrical circuits using network laws and theorems.
- To understand and analyze basic Electric and Magnetic circuits
- To study the working principles of Electrical Machines
- To introduce components of Low Voltage Electrical Installations
- To identify and characterize diodes and various types of transistors.

List of experiments/demonstrations:

PART A: ELECTRICAL

1. Verification of KVL andKCL
2. (I) Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-Phase Transformer
   (ii) Verification of Relationship between Voltages and Currents (Star-Delta, Delta-Delta, Delta- star, Star-Star) in a Three Phase Transformer
3. Measurement of Active and Reactive Power in a balanced Three-phase circuit
4. Performance Characteristics of a Separately Excited DC Shunt Motor
5. Performance Characteristics of a Three-phase Induction Motor
6. No-Load Characteristics of a Three-phase Alternator

PART B: ELECTRONICS

1. Study and operation of
   (i) Multi-meters (ii) Function Generator (iii) Regulated Power Supplies (iv)CRO.
2. PN Junction diode characteristics
3. Zener diode characteristics and Zener as voltage Regulator
4. Input & Output characteristics of Transistor in CB / CEconfiguration
5. Full Wave Rectifier with & without filters
6. Input and Output characteristics of FET in CSconfiguration

TEXT BOOKS:

1. Basic Electrical and electronics Engineering -M S Sukija TK Nagasarkar OxfordUniversity
2. Basic Electrical and electronics Engineering-D P Kothari. I J Nagarath, McGraw HillEducation

REFERENCES:

1. Electronic Devices and Circuits – R. L. Boylestead and Louis Nashelsky, PEI/PHI, 9th Ed,2006.
2. Millman's Electronic Devices and Circuits – J. Millman and C. C. Halkias, Satyabrata Jit, TMH, 2/e,1998.
   Engineering circuit analysis- by William Hayt and Jack E. Kemmerly, McGraw Hill Company, 6th edition.

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(AUTONOMOUS)

2240573: PYTHON PROGRAMMING LAB

II Year B. Tech. MECH I – Sem

L	T	P	C
0	1	2	2

Exercise 1 - Basics

a) Running instructions in Interactive interpreter and a Python Script
b) Write a program to purposefully raise Indentation Error and Correct it

Exercise 2 -Operations

a) Write a program to compute distance between two points taking input from the user (Pythagorean Theorem)
b) Write a program add.py that takes 2 numbers as command line arguments and prints its sum.

Exercise - 3 Control Flow

a) Write a Program for checking whether the given number is a even number or not.
b) Using a for loop, write a program that prints out the decimal equivalents of 1/2, 1/3, 1/4, ..., 1/10
c) Write a program using a for loop that loops over a sequence. What is sequence?
d) Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero.

Exercise 4 - Control Flow -Continued

a) Find the sum of all the primes below two million.
b) Each new term in the Fibonacci sequence is generated by adding the previous two terms. By starting with 1 and 2, the first 10 terms will be:
c) 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, ...
d) By considering the terms in the Fibonacci sequence whose values do not exceed four million, find the sum of the even-valued terms.

Exercise - 5 Files

a) Write a program to print each line of a file in reverse order.
b) Write a program to compute the number of characters, words and lines in a file

Exercise - 6 Functions

a) Write a function ball_collide that takes two balls as parameters and computes if they are colliding. Your function should return a Boolean representing whether or not the balls are colliding.
b) Hint: Represent a ball on a plane as a tuple of (x, y, r), r being the radius
c) If (distance between two balls centers) <= (sum of their radii) then (they are colliding)
d) Find mean, median, mode for the given set of numbers in a list.

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Exercise - 7 Functions - Continued

a) Write a function nearly_equal to test whether two strings are nearly equal. Two strings a and b are nearly equal when a can be generated by a single mutation on b.
b) Write a function dups to find all duplicates in the list.
c) Write a function unique to find all the unique elements of a list.

Exercise - 8 - Functions - Problem Solving

a) Write a function cumulative_ product to compute cumulative product of a list of numbers.
b) Write a function reverse to reverse a list. Without using the reverse function.
c) Write function to compute gcd, lcm of two numbers. Each function shouldn't exceed one line.

Exercise 9 - Multi-D Lists

a) Write a program that defines a matrix and prints
b) Write a program to perform addition of two square matrices
c) Write a program to perform multiplication of two square matrices

Exercise - 10 GUI, Graphics

a) Write a GUI for an Expression Calculator usingtk
b) Write a program to implement the following figures using turtle

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2240381: THERMAL ENGINEERING LAB

B.Tech. II Year II Sem	**L**	**T**	**P**	**C**
PRE-REQUISITES: Thermodynamics	**0**	**0**	**2**	**1**

COURSE OBJECTIVES

- To provide the knowledge to the student about working of IC Engines.
- To train the student to conduct performance and heat balance test on IC Engines
- To practice the student to calculate the frictional losses in an IC Engine
- To impart practical exposure on performance of reciprocating air compressor.
- To make the student to understand the working principle of various types of boilers.

COURSE OUTCOMES : After completion of the course the student is able to

- Identify the various parts of an IC Engine.
- Sketch the Valve and Port Timing diagrams for IC Engines
- Determine the performance of various types of IC Engines.
- Prepare the heat balance sheet for various types of IC Engines.
- Calculate the frictional power in various types of IC Engines
- Analyze the performance of reciprocating air compressor

LIST OF EXPERIMENTS

1 Draw the valve and port timing diagrams for four and two stroke engines.
2 Evaluate the performance of 4 –stroke Diesel engines.
3 Evaluate the performance of 2-stroke Petrol engine.
4 Evaluate the performance of 4 –stroke Petrol engines.
5 Evaluation of frictional power by conducting Morse test on 4-stroke multi cylinder petrolengine.
6 Draw the heat balance sheet for 4-stroke Single cylinder Diesel engine.
7 Draw the heat balance sheet for 4- stroke multi cylinder petrol engine.
8 Calculate the performance of variable compression ratio engines.
9 Performance test on reciprocating air compressor unit.
10 Study of Steam boilers.
11 Disassembly / assembly of engines.

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2240022: Gender Sensitization

II Year B. Tech. MECH II – Sem

L T P C
0 0 3 0

Course Objectives:

- To develop students' sensibility with regard to issues of gender in contemporary India.
- To provide a critical perspective on the socialization of men and women.
- To introduce students to information about some key biological aspects of genders.
- To expose the students to debates on the politics and economics of work.
- To help students reflect critically on gender violence.
- To expose students to more egalitarian interactions between men and women.

Course Outcomes:

- Students will have developed a better understanding of important issues related to gender in contemporary India.
- Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
- Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
- Students will acquire insight into the gendered division of labour and its relation to politics and economics.
- Men and women students and professionals will be better equipped to work and live together as equals.

UNIT – I

UNDERSTANDINGGENDER

Gender: Why Should We Study It? (*Towards a World of Equals:* Unit ---- 1)
Socialization: Making Women, Making Men (*Towards a World of Equals:* Unit--- 2)
Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities.

UNIT - II

GENDER AND BIOLOGY

Missing Women: Sex Selection and Its Consequences (*Towards a World of Equals:* Unit 4)
Declining Sex Ratio. Demographic Consequences.
Gender Spectrum: Beyond the Binary (*Towards a World of Equals:* Unit 10)
Two or Many? Struggles with Discrimination.

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UNIT - III

GENDER AND LABOUR

Housework: the Invisible Labour (*Towards a World of Equals:* Unit -3)"My Mother doesn't Work." "Share the Load."

Women's Work: Its Politics and Economics (*Towards a World of Equals:* Unit -7)

Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions of Work.

UNIT - IV

ISSUESOFVIOLENCESexual Harassment: Say No! (*Towards a World of Equals:* Unit -6) Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "Chupulu".

Domestic Violence: Speaking Out (*Towards a World of Equals:* Unit -8) Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading: New Forums for Thinking about Sexual Violence (*Towards a World of Equals:* Unit -11) Blaming the Victim-"I Fought for my Life…." - Additional Reading: The Caste Face of Violence **UNIT – V**

GENDER: CO - EXISTENCE

Just Relationships: Being Together as Equals (*Towards a World of Equals:* Unit -12) Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Additional Reading: Rosa Parks-The Brave Heart.

TEXTBOOK:

1. All the five Units in the Textbook, **"*Towards a World of Equals: A Bilingual Textbookon Gender*"** written by A. Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama
2. Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharuand published by **Telugu Akademi, Hyderabad**,Telangana State in the year **2015**.

REFERENCE BOOKS:

1. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012
2. Abdulali Sohaila. "I Fought For My Life…and Won."Available online
3. at: http://www.thealterna_tive.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

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(AUTONOMOUS)

2250331: DYNAMICS OF MACHINERY

III Year B. Tech. MECH I – Sem

L	T	P	C
3	0	0	3

PRE-REQUISITES: Kinematics of Machinery

COURSE OBJECTIVES

- To impart the knowledge of basic concepts on gyroscopic couple and its effect on aero plane, ship, two and four wheel drive.
- To illustrate the mathematical models used in static and dynamics of machinery.
- To Impart the knowledge of Various Governors, Brakes and operation of Dynamometers.
- To facilitate the students to know the concepts of balancing of rotating masses and reciprocating masses.
- To introduce mathematical models and solution methods to study Vibration of the mechanical systems.

COURSE OUTCOMES:

- After completion of the course the student is able to
- Analyze complete motion analysis of machines in running condition and able to know friction and its effect on mechanical efficiency.(L2)
- Outline various mechanisms of machines which were used in real life and explain how to get equilibrium condition of machine members while the machine is in running condition.(L2)
- Apply the knowledge regarding use of turning moment diagram and energy fluctuations with in systems.(L3)
- Explain how to balance forces and moments produced by rotating or reciprocating masses of machine members.(L2)
- Analyze the vibrations, which is the major disturbance in machines while in the running condition and also precautions to reduce vibration. (L4)
- Illustrate various Governors, Brakes and operation of Dynamometers. (L2)

UNIT – I

Gyroscopes:Introduction,Precision,angular motion, Gyroscopic couple,effect of gyroscopic couple on an aeroplane, effect of gyroscopic couple on a naval ship during steering, gyroscopic couple on a naval ship during pitching, Gyroscopic couple on a naval ship during rolling, stability of a four wheel drive moving in a curved path, stability of a two wheel vehicle taking a turn.

LEARNING OUTCOME:

- Discuss basic concepts on gyroscopic couple and its effect on aero plane, ship, two and four wheel drive.(L1).
- Applying concepts in calculating precision and determining the effect of gyroscope.(L3).

UNIT – II

Static Force Analysis: Introduction, Static Equilibrium, Equilibrium of Two force and three force members, Member with Two force

Dynamic Force Analysis: Introduction, D'Alemberts principle, Dynamic analysis of Four bar and Single slider mechanisms, Piston effort, Turning moment on crankshaft, Inertia of connecting rod, Inertia forces in reciprocating Engines.

LEARNING OUTCOME:

- Apply D'Alemberts principle for dynamic analysis in calculating forces on engine. (L3)
- Apply two force and three force equilibrium in calculating forces in static condition. (L3)

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UNIT – III

Governors: Introduction, types of governors, Watt governor, Porter governor, Proell governor, Hartnell governor, Sensitiveness of governor, Hunting, Isochronism, Stability, effort of governor, Power of governor

Brakes and Dynamometers: Types of brakes: Simple block brake,band and block brake,internal expanding shoe brake-effect of braking of a vehicle. Dynamometers-absorption and transmission types. General description and methods of operation.

LEARNING OUTCOME:

- Calculate the effectiveness of various governors and understand its applications(L3)
- Understand the concept of dynamometers and its working (L2)

UNIT – IV

Balancing of Rotating Masses: Introduction-Balancing of single rotating mass in same and different plane,balancing of several masses rotating in same and different plane.

Balancing of Reciprocating Masses:Primary,Secondary,and higher balancing of reciprocating masses, graphical methods.Unbalanced forces and couples,examination of"V"multi cylinder inline and radial engines for primary and Secondary balancing, locomotive balancing Hammer blow, Swaying couple, variation of tractive efforts.

LEARNING OUTCOME:

- Calculating balancing of rotary and reciprocating masses. (L3).
- Understand the concept of balancing various engines. (L2).

UNIT – V

Vibrations: Free Vibration of mass attached to vertical spring–Transverse loads–vibrations of beams with concentrated and distributed loads.Dunkerly's method. Whirling of shafts–critical speed–torsional vibrations–one,two and three rotor systems.

LEARNING OUTCOME:

- To analyze torsional vibrations occur during running condition (L3).
- To understand various disturbances in machines during vibrations and precautions to reduce it.(L2).

TEXTBOOKS:

1. Theory of Machines/S.SRatan/Mc.GrawHillPubl./ 5th Edition.
2. Theory of machines/Khurmi/S.Chand./ 14th Edition.

REFERENCE BOOKS:

1. Theory of Machines by Thomas Bevan/CBS/ 3rd Edition.
2. Theory of Machines/R.K Bansal/ 4th Edition.
3. Theory of Machines Sadhu Singh Pearson's/ 3rd Edition.
4. Mechanism and Machine Theory/JSRao and RVDukkipati/NewAge/2nd Edition.

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2250332: DESIGN OF MACHINE ELEMENTS

III Year B. Tech. MECH I – Sem.

L	T	P	C
3	0	0	3

PRE-REQUISITES: Study of engineering mechanics and theory of machines.

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for:

- Designing machine members subjected to static and variable loads.
- Designing shafts and couplings for various applications.
- Analyzing bolted and welded joints for various kinds of loads.
- Designing helical and leaf springs for various applications.
- Analyzing Riveted and cotter joints for various kinds of loads.

COURSE OUTCOMES:

The main learning objective of this course is to prepare the students for:

- Designing machine members subjected to static and variable loads.
- Designing shafts and couplings for various applications.
- Analyzing bolted and welded joints for various kinds of loads.
- Designing helical, leaf springs and flywheels for various applications.
- Designing of Riveted and cotter joints for various kinds of loads.
- Knowledge on using design data book.

Note: (Use of standard Design Data Book is permitted in the University examination)

UNIT – I

Introduction to the design process - factors influencing machine design, selection of materials based on mechanical properties - Preferred numbers- Direct, Bending and torsional loading - Factor of safety – Combined loads – Principal stresses – Eccentric loading –theories of failure – Design based on strength and stiffness – stress concentration – Fluctuating stresses – Endurance limit- Gerber's curve– Goodman's line– Soderberg's line. –Design for finite and infinite life under variable loading.

LEARNING OUTCOME:

After successful completion of the unit, students will be able to

- Understand importance of design concept. (L2)
- Understand the design process and various theories given by experts. (L2)

UNIT – II

RivetedJoints: Riveted joints- methods of failure of riveted joints-strengthequations-efficiency of riveted joints-eccentrically loaded riveted joints.

Welded joints-Design of fillet welds-axial loads-circular fillet welds under bending, torsion. Welded jointsunder eccentric loading.

Power screws: – types of screw - Design of screw fasteners – screw subjected to initial tightening- screw subjected to external load, tensile load, shear load, combined load - Design of joints under eccentric loading – locking devices.

LEARNING OUTCOME:

After successful completion of the unit, students can

- Illustrate design procedures for various joints. (L2)

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- Make use of those design procedures in modeling components.(L3)

UNIT – III

Keys, Cotters and Knuckle Joints: Design of keys-stresses in keys-cottered joints-spigot and socket, sleeve and cotter, Gib and cotter joints-Knuckle joints.

LEARNING OUTCOME:

After successful completion of the unit, students can

- Illustrate design procedures for various joints. (L2)
- Make use of those design theories in modelling components in design softwares.(L3)

UNIT – IV

Types of springs, design of helical and concentric springs–surge in springs, Design of laminated springs – Flywheel - coefficient of fluctuation of speed – Fluctuation of Energy – Maximum Fluctuationenergy - coefficientof Fluctuationenergy – energy stored in a flywheel -Flywheels considering stresses in rims and arms.

LEARNING OUTCOME:

After successful completion of the unit, students can

- Illustrate design procedures for shafts and couplings. (L2)
- Make use of those design theories in assembling shafts and couplings in design soft wares. (L3)

UNIT – V

Shafts and Axles - Design of solid and hollow shafts based on strength, rigidity and critical speed – – Rigid coupling- Muff, Clamp and Flange couplingsand flexible couplings -Bushed Pin.

LEARNING OUTCOME:

After successful completion of the unit, students can

- Illustrate design procedures for shafts and couplings. (L2)
- Make use of those design theories in assembling shafts and couplings in design soft wares. (L3)

TEXT BOOK:

- 1. Shigley. J., Mischke. C., Budynas, R., and Nisbett. K., "Mechanical Engineering Design", 10 th Edition, Tata McGraw-Hill, 2014.

2. Bhandari V, "Design of Machine Elements", 15th Reprint, Tata McGraw-Hill Book Co, 2014 R2. New Technology – Bhattacharya A, The Institution of Engineers, India 1984.

REFERENCE BOOK:

1. Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine component Design",6th Edition, Wiley, 2017.
2. Md. Jalaludeen , Machine Design, Volume II, Design of Transmission Systems, 4th edition, Anuradha Publications, 2014.
3. C.S.Sharma, KamleshPurohit, "Design of Machine Elements", 1st editionPrentice Hall of India,Pvt. Ltd., 2004.

MARRILAXMANREDDY INSTITUTEOFTECHNOLOGYANDMANAGEMENT

(AUTONOMOUS)

2250016: BUSINESS ECONOMICS & FINANCIAL ANALYSIS

III Year B. Tech. MECH I – Sem

L	T	P	C
3	0	0	3

PRE REQUESTS: Not required

COURSE OBJECT:

- To learn the basic Business types, impact of the Economy on Business and Firms specifically.
- To analyze the Business from the Financial Perspective.

COURSE OUTCOMES:

After Completion of Syllabus The students will understand the

- Various Forms of Business and the impact of economic variables on the Business.
- The Demand, Supply, Production, Cost, Market Structure, Pricing aspects are learnt.
- The Students can study the firm's financial position by analyzing the Financial Statements of a Company.

UNIT – I

Introduction to Business and Economics: Business: Structure of Business Firm, Types of Business Entities, Limited Liability Companies, Economics: Significance of Economics, Micro and Macro Economic Concepts, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist.

LEARNING OUTCOME:

- By going through this unit, technical students can have the scope of learning about different economic concepts, business cycles and nature of business economists.

UNIT – II

Demand Analysis: Elasticity of Demand: Elasticity, Types of Elasticity, Law of Demand, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Demand Forecasting: Steps in Demand Forecasting, Methods of Demand Forecasting.

LEARNING OUTCOME:

- By going through this content, student can learn about different types of demand, its determinants and elasticity of demand concepts thoroughly and how to forecast the demand of different things by using different agreed upon techniques.

UNIT –III

Production, Cost, Market Structures & Pricing: Production Analysis: Factors of Production, Production Function, Different Types of Production Functions. Cost analysis: Types of Costs, Short run and Long run Cost Functions. Market Structures: Features of Perfect competition,

Monopoly, Oligopoly, and Monopolistic Competition. Pricing: Types of Pricing, Break Even Analysis, and Cost Volume Profit Analysis.

LEARNING OUTCOME:

- By reading this chapter, student can learn different pricing techniques in different market structures and different cost functions that determine products life cycle in a long term basis.

UNIT – IV

Capital Budgeting: Importance of Capital Budgeting, methods of Capital Budgeting: Traditional Methods: Pay Back Period, Accounting Rate of Return, and Discounting Methods: Net Present Value, Profitability Index, Internal Rate of

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Return; Financial Analysis through Ratios: Concept of Ratio Analysis, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios (simple problems).

LEARNING OUTCOME:

- By going thoroughly through this unit, students can have the scope of learning about different techniques by which a project can be evaluated from financials perspective and utilization of ratios at different times to assess the business position for decision making.

UNIT – V

Financial Accounting: Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, and Preparation of Final Accounts.

LEARNING OUTCOME:

Students can learn the methodology of accounting cycle which is valid from stakeholders' point of view and they can learn the comparison of the different firms at a time, so that they can take appropriate decision of either investment or to become an entrepreneur.

TEXT BOOK:

1. D. D. Chaturvedi, S. L. Gupta, Business Economics - Theory and Applications, International Book House Pvt. Ltd. 2013.
2. Dhanesh K Khatri, Financial Accounting, Tata McGraw Hill, 2011.
3. Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury, Managerial Economics, 2e, Tata McGraw Hill Education Pvt. Ltd. 2012.
4. I.M. Pandey, Financial Management, 11th Edition, Kindle Edition, 2015.

REFERENCE BOOKS:

1. Paresh Shah, Financial Accounting for Management 2e, Oxford Press, 2015.
2. S. N. Maheshwari, Sunil K Maheshwari, Sharad K Maheshwari, Financial Accounting, 5e, Vikas Publications, 2013

WEB REFERENCES:

1. www. accounting for management
2. www. skoda minotti blog.in
3. www. the economist.in

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2250301: ELEMENTS OF MECHANICAL ENGINEERING
(Open Elective – I)

III Year B. Tech. MECH I – Sem

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Basic machine elements.
- Sources of Energy and Power Generation.
- Various manufacturing processes.
- Power transmission elements, material handling equipment.
- The content of this course shall provide the student the basic concepts of various mechanical systems and exposes the student to a wide range of equipment and their utility in a practical situation.
- It shall provide the fundamental principles of materials, fuels, Steam, I.C. Engines, and transmission systems that usually exist in any process plant.

COURSE OUTCOMES:

After completion of the course the student is able to

- Understand basics Concepts and usage of various engineering Materials. (L1)
- Apply cam terminologies for design of cam profiles. (L3)
- Explain the fundamental definitions used in thermodynamics. (L2)
- To Gain Knowledge about IC Engines, general principles and requirement for refrigeration, manufacturing. (L1)
- Apply the knowledge of various manufacturing processes; identify various processes like welding, Brazing and soldering. (L4)
- Use the knowledge gained by the study of Metal Removal process, using Lathe Drilling Milling Robotics and Automation. (L5)

Tables/Codes: Steam Tables and Mollier Chart

UNIT – I

Introduction to engineering materials-Metals, ceramics, composites-Heat treatment of metals.

Riveted joints- methods of failure of riveted joints-strength equations-efficiency of riveted joints - eccentrically loaded riveted joints.

Machine Elements: Cams: Types of cams and followers

LEARNING OUTCOME:

- Knowledge of physical properties of materials. (L1)
- Apply cam terminologies for design of cam profiles. (L3)

UNIT – II

Power Transmission Elements: Gears terminology of spur, helical and bevel gears, gear trains. Belt drives (types). Chain drives.

Material Handling equipment: Introduction to Belt conveyors, cranes, industrial trucks, bull dozers

Thermodynamics: Statements of zeroth law, 1st, 2nd and 3rd Laws of thermodynamics with their applications.

LEARNING OUTCOME:

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- Apply first law of thermodynamics for closed systems and construct conservation of mass and energy equations (L3)
- Understand the standard geometry, application, failures of Spur and Helical Gear and Design and Developed effectively Gears for different loading conditions. (L4)

UNIT – III

Energy: Power Generation: External and internal combustion engines (layouts, element/component description, advantages, disadvantages, applications).

Refrigeration: Mechanical Refrigeration and types – units of refrigeration – Air Refrigeration system, details and principle of operation –calculation of COP.

Modes and mechanisms of heat transfer – Basic laws of heat transfer –General discussion about applications of heat transfer.

LEARNING OUTCOME:

- To acquire knowledge of thermal efficiency and coefficient of performance for heat engine, refrigerators. (L2)
- Students will demonstrate an understanding of the basic concepts of conduction, radiation, and convection heat transfer. (L3)

UNIT – IV

Manufacturing Processes: Sheet Metal Work: Introduction – Equipments – Tools and accessories – Various processes (applications, advantages / disadvantages).

Welding: Types – Equipments –Techniques employed –welding positions-defects-applications, advantages / disadvantages – Gas cutting – Brazing and soldering.

LEARNING OUTCOME:

- Understand different tools used in sheet metal work process based on industrial applications. (L3).
- Apply knowledge to select appropriate welding process based on the type of industrial application. (L3)

UNIT – V

Casting: Types, equipments, applications.

Machine Tools: Introduction to lathe, drilling machine, milling machine, grinding machine-Operations performed.

LEARNING OUTCOME:

- Analyze the use of casting processes in manufacturing. (L4)
- Knowledge gained by the study of Metal Removal process, using Lathe Drilling and Milling. (L5)

TEXT BOOKS:

1. Kumar, T., Leenus Jesu Martin and Murali, G., Basic Mechanical Engineering, Suma Publications, Chennai /Ist Edition 2007.
2. K.R, Gopalakrishna Sudhir, Gopalakrishna S.C, Sharma, Elements of Mechanical Engineering /9th Edition 2005.

REFERENCE BOOKS:

1. Prabhu, T. J., Jai Ganesh, V. and Jebaraj, S., Basic Mechanical Engineering, SciTech Publications, Chennai/ 7th Edition 2000.
2. Hajra Choudhary, S.K. and Hajra Choudhary, A. K., Elements of Workshop Technology Vols. I & II, Indian Book Distributing Company Calcutta/ 12th Edition 2007.
3. Nag, P.K., Power Plant Engineering, Tata McGraw-Hill, New Delhi, 2008. 4. Rattan, S.S., Theory of Machines, Tata McGraw-Hill, New Delhi/4th Edition 2010.

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(AUTONOMOUS)

2250351: RENEWABLE ENERGY SOURCES

(Professional Elective I)

III Year B. Tech. MECH I – Sem **L T P C**

3 0 0 3

Pre-requisites: -

COURSE OBJECTIVES

- To explain the concepts of Non-renewable and renewable energy systems.
- To outline utilization of renewable energy sources for both domestic and industrial applications.
- To analyze the environmental and cost economics of renewable energy sources in comparisonwith fossil fuels.
- Understand the various forms of conventional energy and renewable energy resources.
- Learn the present energy scenario and the need for energy conservation.
- Outline division aspects and utilization of renewable energy sources for both domestics and industrial application.

COURSE OUTCOMES: After completion of the course the student is able to

- Understanding of renewable energy sources. (L1)
- Understand the principles that underlie the ability of various natural phenomena to deliver solar energy. (L2)
- Appreciate the need of Wind Energy and the various components used in energy generation and know the classifications. (L3)
- Knowledge of working principle of wind energy systems. (L2)
- The students are expected to identify the new methodologies / technologies for effective utilization of renewable energy sources. (L4)
- Capability to carry out basic design of renewable energy systems. (L5)

UNIT – 1

Introduction: Global and National Energy Scenario: Over view of conventional & renewable energy sources, need & development of renewable energy sources, types of renewable energy systems, Future of Energy Use, Global and Indian Energy scenario, Renewable and Non-renewable Energy sources, Energy for sustainable development, Potential of renewable energy sources, renewable electricity and key elements, Global climate change, CO2 reduction potential of renewable energy- concept of Hybrid systems.

LEARNING OUTCOME:

- Understanding of renewable energy sources. (L1)
- Knowledge of working principle of various energy systems. (L2)

UNIT – 2

Solar Energy: Solar energy system, Solar Radiation, Availability, Measurement and Estimation, Solar Thermal Conversion Devices and Storage, Applications Solar Photovoltaic Conversion solar photovoltaic, solar thermal, applications of solar energy systems.

LEARNING OUTCOME:

- Outline the technologies that are used to harness the power of solar energy. (L1)

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- Discuss the positive and negative aspects of solar energy in relation to natural and human aspects of the environment. (L2)

UNIT – 3

Wind Energy: Wind Energy Conversion, Potential, Wind energy potential measurement, Site selection, Types of wind turbines, Wind farms, wind Generation and Control. Nature of the wind, power in the wind, factors influencing wind, wind speed monitoring, classification of wind-characteristics, applications of wind turbines, Betz limit, site selection, wind energy conversion devices. Wind mill component design. Safety and environmental aspects, wind energy potential and installation in India..

LEARNING OUTCOME:

- Ability to analyze the viability of wind energy projects. (L4)
- Capability to integrate various options and assess the business and policy environment regarding wind energy projects.(L6)

UNIT – 4

Biogas: Properties of biogas (Calorific value and composition), biogas plant technology and status, Bio energy system, design and constructional features. Biomass resources and their classification, Biomass conversion processes, Thermo chemical conversion, direct combustion, biomass gasification, pyrolysis and liquefaction, biochemical conversion, anaerobic digestion, types of biogas Plants, applications, alcohol production from biomass, bio diesel production, Urban waste to energy conversion, Biomass energy programme in India.

LEARNING OUTCOME:

- Understand the concept of Biomass energy resources and their classification, types of biogas Plants-applications. (L2)
- To increase the renewable energy production from **biogas** with small-scale. (L3)

UNIT – 5

Other Renewable Energy Sources:

1.Ocean Energy: Ocean wave energy conversion, principle of Ocean Thermal Energy Conversion (OTEC), ocean thermal power plants, tidal energy conversion, Tidal and wave energy its scope and development, Scheme of development of tidal energy.

2. Small hydro Power Plant: Importance of small hydro power plants and their Elements, types of turbines for small hydro, estimation of primary and secondary power.

3. Geothermal Energy: Geothermal power plants, various types, hot springs and steam ejection.

LEARNING OUTCOME:

- Acquire the knowledge wave power, tidal power and geothermal principles and applications. (L2)
- Discuss the environmental effects of hydropower installations. (L2)

TEXT BOOKS:

1. Non-Conventional Energy Sources / G.D Rai/ Khanna Publishers
2. Renewable Energy Sources / Twidell, J.W. and Weir, A./ EFN Spon Ltd., 1986.

REFERENCE BOOKS:

1. Kishore VVN, Renewable Energy Engineering and Technology, Teri Press, New Delhi, 2012
2. Godfrey Boyle, Renewable Energy, Power for a Sustainable Future, Oxford University Press, U.K, 1996.

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(AUTONOMOUS)

2250352: ELECTRICAL VEHICLES & HYBRID VEHICLES

(Professional Elective I)

III Year B. Tech. MECH I – Sem **L T P C**

3 0 0 3

PRE-REQUISITES: Basic knowledge of electrical engineering.

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for

- Understand the design requirements of electrical vehicles.
- Understand the energy sources like fuel cells
- Analyze the power converters and controls.
- Understand the main elements of hybrid electrical vehicles.
- Understand Case study on specification of electric and hybrid vehicles.

COURSE OUTCOMES:

The main learning objective of this course is to prepare the students for:

- Understand the operation and architecture of electric and hybrid vehicles
- Identify various energy source options like battery and fuel cell
- Select a suitable electric motor for applications in hybrid and electric vehicles.
- Explain the role of power electronics in hybrid and electric vehicles
- Analyze the energy and design requirements for hybrid and electric vehicles.

UNIT-1 Design considerations for electric vehicles

Need for Electric vehicle- Comparative study of diesel, petrol, hybrid and electric Vehicles. Advantages and Limitations of hybrid and electric Vehicles. - Design requirement for electric vehicles- Range, maximum velocity, acceleration, power requirement, mass of the vehicle. Various Resistance- Transmission efficiency- Electric vehicle chassis and Body Design, Electric Vehicle Recharging and Refuelling Systems.

LEARNING OUTCOME:

After successful completion of the unit, students will be able to

1. Understand the Design requirements for electric vehicles. (L2)

2. Understand the importance of hybrid vehicles. (L2)

UNIT-2 Energy Sources

Battery Parameters- - Different types of batteries – Lead Acid- Nickel Metal Hydride - Lithium ion- Sodium based- Metal Air. Battery Modelling - Equivalent circuits, Battery charging- Quick Charging devices. Fuel Cell- Fuel cell Characteristics- Fuel cell types-Half reactions of fuel cell. Ultra capacitors. Battery Management System.

LEARNING OUTCOME:

After successful completion of the unit, students will be able to

1. Understand various energy source options like battery and fuel cell. (L2)
2. Understand the Battery Management System. (L2)

UNIT III POWER CONVERTERS AND CONTROLLERS

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Solid state Switching elements and characteristics – BJT, MOSFET, IGBT, SCR and TRIAC - Power Converters – rectifiers, inverters and converters - Motor Drives - DC, AC motor, PMSM motors, BLDC motors, Switched reluctance motors – four quadrant operations –operating modes.

LEARNING OUTCOME:

After successful completion of the unit, students will be able to

1. Understand the power converters and controls. (L2)
2. Understand Solid state Switching elements and characteristics. (L2)

UNIT IV HYBRID AND ELECTRIC VEHICLES

Main components and working principles of a hybrid and electric vehicles, Different configurations of hybrid and electric vehicles. Power Split devices for Hybrid Vehicles - Operation modes - Control Strategies for Hybrid Vehicle - Economy of hybrid Vehicles - Case study on specification of electric and hybrid vehicles.

LEARNING OUTCOME:

After successful completion of the unit, students will be able to

1. Understand design requirements for hybrid and electric vehicles. (L2)
2. Understand Economy of hybrid Vehicles. (L2)

UNIT V Energy Management Strategies

Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies. Introduction to various charging techniques and schematic of charging stations.

LEARNING OUTCOME:

After successful completion of the unit, students will be able to

1. Understand energy management strategies. (L2)
2. Understand various charging techniques. (L2)

TEXT BOOK:

1. Iqbal Husain, " Electric and Hybrid Vehicles-Design Fundamentals", CRC Press,2003
2. Mehrdad Ehsani, " Modern Electric, Hybrid Electric and Fuel Cell Vehicles", CRCPress,2005

REFERENCE BOOK:

1. James Larminie and John Lowry, "Electric Vehicle Technology Explained "John Wiley & Sons,2003
2. Lino Guzzella, "Vehicle Propulsion System" Springer Publications,2005
3. Ron HodKinson, "Light Weight Electric/ Hybrid Vehicle Design", Butterworth Heinemann Publication,2005

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(AUTONOMOUS)

2250353: OPERATIONAL RESEARCH

(Professional Elective I)

III Year B. Tech. MECH I – Sem

L	T	P	C
3	0	0	3

PRE-REQUISITES: None

COURSE OBJECTIVES:

- This course will advance the students development of the following broad capabilities:
- To impart knowledge in concepts and tools of Operations Research
- To understand mathematical models used in Operations Research
- To apply these techniques constructively to make effective business decisions
- To apply various optimization techniques for decision making.
- To Understand the mathematical importance of development of model in a particular optimization model for the issue and solving it.

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

- Understanding the problem, identifying variables & constants, Formulation of optimization model and applying appropriate optimization technique (L2, L3)
- Solve Linear Programming Problems (L3)
- Solve Transportation and Assignment Problems (L3)
- Understand the usage of game theory and its applications. (L3)
- Understand the concept of sequencing and replacement policies(L3)
- Understand the dynamic programming applications to solve LPP. (L3)

UNIT – I

Development – Definition– Characteristics and Phases – Types of models – Operations Research models – applications ALLOCATION: Linear Programming Problem - Formulation – Graphical solution – Simplex method – Artificial variables techniques: Big-M method, Two–phase method.

LEARNING OUTCOME:

- Understanding the basic concepts of operations research. (L2)
- Formulation of LPP and solving its methods. (L3)

UNIT – II

TRANSPORTATION PROBLEM: Formulation – Optimal solution, unbalanced transportation problem – Degeneracy. Assignment problem: Formulation – Optimal solution - Variants of Assignment Problem; Travelling Salesman problem.

LEARNING OUTCOME:

- Formulation of Transportation problem and finding the degeneracy (L3)
- Solving the variations of Assignment problems (L3)

UNIT – III

SEQUENCING: Introduction – Flow –Shop sequencing – n jobs through two machines – n jobs through three machines – Job shop sequencing – two jobs through ‘m’ machines

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REPLACEMENT: Introduction – Replacement of items that deteriorate with time – when money value is not counted and counted – Replacement of items that fail completely- Group Replacement.

LEARNING OUTCOME:

- Solving the different types of sequencing problems (L3)
- Understanding the replacement policies and items replacement. (L2, L3)

UNIT – IV

THEORY OF GAMES: Introduction –Terminology– Solution of games with saddle points and without saddle points- 2 x 2 games –m x 2 & 2 x n games - graphical method – m x n games - dominance principle.

INVENTORY: Introduction – Single item, Deterministic models – Types - Purchase inventory models with one price break and multiple price breaks –Stochastic models – demand discrete variable or continuous variable – Single Period model with no setup cost.

LEARNING OUTCOME:

- Applying game theory to different applications (L3)
- Understanding the importance of inventory and finding the different cost (L2,L3)

UNIT – V

WAITING LINES: Introduction – Terminology-Single Channel – Poisson arrivals and Exponential Service times – with infinite population and finite population models– Multichannel – Poisson arrivals and exponential service times with infinite population.

DYNAMIC PROGRAMMING: Introduction – Terminology- Bellman's Principle of Optimality – Applications of dynamic programming- shortest path problem – linear programming problem.

LEARNING OUTCOME:

- Applying the waiting lines methods to different applications. (L3)
- Applying the bellman's principles to different applications. (L3)

TEXT BOOKS:

1. Operation Research by J.K.Sharma/4th Edition/ MacMilan.
2. Operations Researchby ACS Kumar/1st Edition/ Yesdee

REFERENCE BOOKS:

1. Introduction to OR/Taha/10th Edition/PHI
2. Operations Research/NVS Raju/3rd Revised Edition /SMS Education
3. Operations Research/M.V. Durga Prasad, K.Vijaya Kumar Reddy, J. Suresh Kumar/1st Edition /Cengage

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(AUTONOMOUS)

2250354: SOLAR ENERGY TECHNOLOGY

(Professional Elective-I)

B.Tech. III Year I Sem

L	T	P	C
3	0	0	3

PRE-REQUISITES: Study of engineering mechanics and theory of machines.

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students to:

1. Understand the technical and physical principles of solar cells and solar collectors.(L2)
2. measure and evaluate different solar energy technologies.(L6)
3. Calculate the required size of solar cell systems and solar collectors.(L4)
4. Critical comparisons of different solar energy systems.(L4)
5. Analyse technological, environmental and socio-economic issues of solar energy.(L4)

COURSE OUTCOMES:

1. State the different types of Solar Cells, Modules and Solar Radiation. (L1)
2. Describe the working System components and their functions.(L2)
3. Describe the working of Solar Thermal Power Plants.(L2)
4. Describe the working of Prepare economic analysis. (L2)
5. Understand the large-scale deployment of active solar energy

Unit – I Solar Radiation, Solar Cells and Modules:

Properties of sunlight. Absorption by the atmosphere. Calculation of solar irradiance at surfaces. The function of solar cells from semiconductor physics. Different solar cell technologies and fabrication methods. Concepts for increasing efficiency based on loss analysis. Wavelength sensitivity. Series connection of solar cells to modules. Module function and characteristics. Shading of cells and modules.

LEARNING OUTCOME:

After successful completion of the unit, students will be able to

1. Understand the importance of solar cell fabrication methods. (L2)
2. Understand the solar cell modules. (L2)

Unit – II Solar Cell Systems

System components and their functions. Calculating output and dimensioning of solar cell systems. Analysis and computer simulation of a solar cell system. Concentrated sunlight and solar power (CSP). Properties of optical concentration systems. Solar cells in concentrated sunlight. Overview of the different components in a CSP system and their functions. Examples of CSP-systems globally.

LEARNING OUTCOME:

After successful completion of the unit, students will be able to

1. Analyse and simulate the solar cell system. (L4)
2. Understand the different components in a CSP system. (L2)

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Unit – III Solar thermal

Thermodynamic description of solar collectors. Optical properties of solar collectors and technologies for fabrication. Solar thermal systems for different applications. Storage of solar generated heat.

LEARNING OUTCOME:
After successful completion of the unit, students will be able to
1. Analyse the thermodynamics of solar collectors. (L4)
2. Understand the different applications of solar thermal systems. (L2)

Unit – IV Hybrid systems

Combinations of solar thermal and solar cell systems. Overview of different applications. District heating with solar thermal components.

LEARNING OUTCOME:
After successful completion of the unit, students will be able to
1. Analyse the thermodynamics of solar collectors. (L4)
2. Understand the different applications of solar thermal systems. (L2)

Unit – V Active solar energy in systems:

How large-scale deployment of active solar energy is possible in globally. Buying and selling heat and electric energy. Grid aspects of large-scale deployment of solar cells as well as environmental and social economic aspects.

LEARNING OUTCOME:
After successful completion of the unit, students will be able to
1. Understand the large scale deployment of solar energy. (L2)
2. Understand the environmental aspects of solar cells. (L2)

TEXT BOOK:
1. A Text book of Power System Engineering, A Chakrabarti, M. L Soni, P. V. Gupta, U. S. Bhatnagar, Dhanpat Rai Publication.
2. Renewable Energy Technologies, Solanki, Chetan S. , PHI Learning, New Delhi, 2011

REFERENCE BOOK:
1. Renewable Energy Sources for Sustainable Development, N.S. Rathore and N. L. Panwar, New India Publishing Agency, New Delhi.
2. Electrical Power System, Mehta, V.K. S. Chand and Company Bew Delhi, 2011.

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(AUTONOMOUS)

2250382: KINEMATICS AND DYNAMICS OF MACHINERY LAB

III Year B. Tech. MECH I – Sem

L	T	P	C
0	0	2	1

PRE-REQUISITES: Kinematics of Machinery

COURSE OBJECTIVES:

- To impart the knowledge of basic concepts on kinematics and dynamics of mechanical elements.
- To illustrate the effect of gyroscope for different motions.
- To Impart the knowledge of various Governors.
- To facilitate the students to know the concepts of balancing of rotating masses and reciprocating masses.
- To iintroduce mathematical models and solution methods to study torsional vibration .

COURSE OUTCOMES:

- After completion of the course the student is able to
- Understand types of motion. (L2)
- Analyze forces and torque of components in linkages.(L3)
- Understand forward and inverse kinematics of open loop mechanisms.(L2)
- Illustrate how to balance forces and moments produced by rotating or reciprocating masses of machine members.(L2)
- Understand concept of whirling of shafts to determine critical speed for n conditions (L2).
- Illustrate various Governors, cam and followers. (L2)

LIST OF EXPERIMENTS (A minimum of 10 experiments to be conducted)

- To determine the state of balance of machines for primary and secondary forces
- To determine the frequency of torsional vibration of a given rod
- Determine the effect of varying mass on the centre of sleeve in porter and proell governor
- Find the motion of the follower if the given profile of the cam
- The balance masses statically and dynamically for single rotating mass systems
- Determine the critical speed of a given shaft for different n-conditions
- For a simple pendulum determine time period and its natural frequency
- For a compound pendulum determine time period and its natural frequency
- Determine the effect of gyroscope for different motions
- Determine time period, amplitude and frequency of undamped free longitudinal vibration of single degree spring mass systems.
- Determine the pressure distribution of lubricating oil at various load and speed of a Journal bearing.
- Determine time period, amplitude and frequency of damped free longitudinal vibration of single degree spring mass systems

MARRILAXMANREDDY INSTITUTEOFTECHNOLOGYANDMANAGEMENT

(AUTONOMOUS)

2250383: METROLOGY AND MACHINE TOOLS LAB

III Year B. Tech. MECH I – Sem

L	T	P	C
0	0	2	1

PRE-REQUISITES: Production Technology

COURSE OBJECTIVES

- To import practical exposure to the metrology equipment & Machine tools
- To conduct experiments and understand the working of the same.
- To learn the measurement of bores by internal micrometers and dial bore indicators.
- To learn the measurement of the Angle and taper s by Bevel protractor, Sine bars, etc.
- To learn the Step turning and taper turning and thread cutting Drilling and Tapping on lathe machine
- To the operations of Shaping and milling

COURSE OUTCOMES: After completion of the course the student is able to

- Student will be able to use different measuring instruments towards quality control. (L2)
- Measure the angle and taper using Bevel protractor and Sine bar. (L4)
- Measure screw thread parameters. (L4)
- Perform step turning, taper turning, thread cutting, drilling and tapping operations on lathe. (L3)
- Perform operations on shaper and milling machine. (L3)
- Perform various operation on slotting, shaper and planning machines.(L3)

LIST OF EXPERIMENTS: (A minimum of 10 experiments to be conducted)

1. Step turning and taper turning on lathe machine
2. Thread cutting and knurling on lathe machine
3. Machining of groves using slotter and shaper machines
4. Machining of holes using Drilling and boring machines.
5. Gear cutting on the Milling machine
6. Grinding of Tool angles using Cylindrical / Surface Grinding
7. Measurement of lengths, heights, diameters by vernier calipers, micrometers.
8. Measurement of bores by internal micrometers and dial bore indicators.
9. Use of gear teeth vernier calipers for checking the chordal addendum and chordal height of the spur gear
10. Angle and taper measurements by bevel protractor and sine bars.
11. Thread measurement by 2-wire and 3-wire methods.
12. Surface roughness measurement by Tally Surf.

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(AUTONOMOUS)

2250384: COMPUTER AIDED AND MACHINE DRAWING

B. Tech. III Year I Sem

L	T	P	C
0	0	2	1

PRE-REQUISITES: Study of engineering mechanics and theory of machines.

COURSE OBJECTIVES

1. To recognize with the standard conventions for different materials and machine parts in working drawing.
2. To giant acknowledge of Part drawing including sectional views for various machine elements.
3. To prepare assembly drawings given the details of part drawing.
4. To prepare CAD 2D &3D part models using AUTOCAD and Solid works.
5. To Understand basic sketching commands and Navigational command sin AUTOCAD .

COURSE OUTCOMES: After completion of the course the student is able to

1. Read and interpret machine drawing.
2. Learn conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears.
3. Explore the knowledge on part drawing.
4. 2 D drawing and 3D basic solid models using CAD.
5. Conversion and vice versa manually and by using computer aided drafting.

PART-A

Drawing of machine elements and simple parts:

1. Conventional representation of materials, common machine elements parts such as screws, nuts, bolts, keys , gears.
2. Types of sections-selection of section planes and drawing of sections and auxiliary sectional views, parts not usually sectioned.
3. Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.
4. The boxes, their size ,location and details-common abbreviations and their liberal usage.
5. Types of drawings-working drawings for machine parts, popular forms of screw threads, bolts, nuts, stud bolts, keys, cottered joints and knuckle joint, riveted joints for plates shaft coupling and Socket pipe joint, journal and foot step bearings.

LEARNING OUTCOME:

After successful completion of the unit, students will be able to

- Conventional representation of materials, common machine elements and part such as screws, nuts, bolts, keys, gears (L1)
- 2. Types of sections-selection of section planes and drawing of sections and auxiliary

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PART –B ASSEMBLY DRWAING

Drawing of assembled views for the part drawing of the following conventional& the Drawing proportions.

1. steam engine parts-stuffing box, eccentrics
2. Other machine parts- screw jacks, petrol engine connecting rod.
3. valves-steam stop valve, feed check valve

LEARNING OUTCOME:

1.Types of sections-selection of planes and drawing of sections and auxiliary views(L2)

2. Preparation of engineering and work drawings with dimensions and bill of materials during design and development. developing assembly drawings using part drawing of machine components(L2)

NOTE: First angle projection to be adopted. The students should able to provide working drawing of actual parts

PART -C

1Introduction to drafting software like Auto cad, basic commands ,keyboards shortcuts, coordinate and unit setting, drawing ,editing ,measuring ,dimensioning, plotting commands, layering concepts, matching, detailing, detail drawing.

2. Drawing of shaft coupling and Oldham's coupling.
3. Assembly drawing (2d) w with bill of materials, stuffing box, eccentrics.
4. Assembly drawing (2d) with bill of materials Tail stock, machine vise.
5. Assembly drawing (2D) with bill of materials, screw jack, Plummer block, steam stop value.

LEARNING OUTCOMES:

1. Learn specific software like AUTO CAD basic commands(L1)
2.Apply computer aided drafting tools to 2D drawing i.e. tail stock, eccentric etc(L2)
3.Knowledge on AUTO CAD of shaft couplings.(L1)

TEXT BOOKS:

1. MACHINE drawing by K LNARAYANA, WileyEstern/5TH edition.
2. Machine drawing by N D Bhatt/ charotar / 50th Edition.
3. Machine drawing with AUTOCAD/Gowtham pohit ,gouthamghosh /pearson

Reference books:

1. Machine drawing by BHATTACHARYYA /Oxford /4th edition.
2. Machine drawing by Ajeet singh/Mc Graw Hill/2nd edition.
3.Machine Drawing by P.S. Gill /S.K. KATERIA &sons /2nd edition
4. A primer on computer aided machine drawing-2007;PUBLISHED BY vtu, belgaum.

Note: Question paper consist of PART -A, PART -B& PART-C

1. PART-A consists of Part Drawing.
2. PART- B consists of Assembly Drawing.

PART-C consists of CAD Drawing

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(AUTONOMOUS)

2250027: DATA SCIENCE WITH PYTHON

III Year B. Tech. MECH I – Sem

L	T	P	C
0	3	0	0

COURSE OBJECTIVES:

- The fundamental of basic data science
- Basic concepts in the specification and analysis of R
- Principles for good program design, especially the uses of Machine Learning
- Qualities of a social network qualities and data visualization

LEARNING OUTCOMES:

- At the end of the course, students should be able to:
- Describe what Data Science is and the skill sets needed to be a data scientist.
- Explain in basic terms what Statistical Inference means. Identify probability distributions commonly used as foundations for statistical modeling. Fit a model to data.
- Use R to carry out basic statistical modeling and analysis.
- Explainthesignificanceofexploratorydataanalysis(EDA)indatascience.
- Describe the Data Science Process and how its components interact.
- Create effective visualization of given data (to communicate or persuade).

UNIT- I

Introduction: What is Data Science ,Big Data and Data Science hype–and getting past the hype, Why now? – Datafication, Current landscape of perspectives, Statistical Inference: Populations and samples: Statistical modeling, probability distributions, fitting a model, Intro to R.

UNIT-II

Exploratory Data Analysis and the Data Science Process, Three Basic Machine Learning: Algorithms: Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA, The Data Science Process, Case Study: Real Direct (online real estate firm), Linear Regression, k-Nearest Neighbors(k-NN) k-means, Motivating application: Filtering Spam, Naive Bayes, Data Wrangling.

UNIT-III

Logistics Regression, Timestamp and financial Modelling:

Thought Experiments, Classifiers , M6D Logistic Regression Case Study, Kyle Teague and Get Glue, Timestamps, Cathy O'Neil, Thought Experiment, Financial Modeling, The Kaggle Model: Feature Generation and Feature Selection, Feature Selection algorithms: Filters; Wrappers; Decision Trees; Random Forests

UNIT-IV

Mining Social-Network Graphs and Data Visualization:

Social networks as graphs, clustering of graphs, direct discovery of communities in graphs, partitioning of graphs, Neighborhood properties in graphs: Data Visualization, Basic principles, ideas and tools for data visualization

UNIT-V

Data Engineering, Data Science and Ethical Issues:

Map Reduce, Pregel and Hadoop, Ethical Issues: Discussions on privacy, security, ethics.

TEXT BOOKS:

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly.2014.

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REFERENCES BOOKS:

1. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press. 2014. (freeonline)
2. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. ISBN 0262018020.2013.
3. Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking. ISBN 1449361323. 2013.
4. Trevor Hastie, Robert Tibshirani and Jerome Friedman. Elements of Statistical Learning, Second Edition. ISBN 0387952845. 2009.(free online)
5. Avrim Blum, John Hopcroft and RavindranKannan. Foundations of DataScience.
6. (Note: this is a book currently being written by the three authors. The authors have made the first draft of their notes for the book available online. The material is intended for a modern theoretical course in computer science.)
7. MohammedJ.ZakiandWagnerMieraJr.DataMiningandAnalysis:FundamentalConcepts and Algorithms. Cambridge University Press.2014.
8. JiaweiHan, Micheline Kamber and Jian Pei. Data Mining: Concepts and Techniques, Third Edition. ISBN 0123814790.2011.

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(AUTONOMOUS)

2260333: DESIGN OF TRANSMISSION SYSTEM

B.Tech. III Year II Sem

L	T	P	C
3	1	-	4

PRE-REQUISITES: Study of engineering mechanics, design of machine members-I and theory of machines.

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Designing flexible elements like belt, ropes and chain drives for engineering applications.
2. Designing spur and helical gear drives for power transmission.
3. Designing bevel and worm drives for power transmission.
4. Designing multi speed gear box for machine tool and automotive applications.
5. Designing clutch and brake systems for engineering applications.

COURSE OUTCOMES:

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

1. Design flexible elements like belt, ropes and chain drives for engineering applications.
2. Design spur and helical gear drives for power transmission.
3. Design bevel and worm drives for power transmission.
4. Design multi speed gear box for machine tool and automotive applications.
5. Design clutch and brake systems for engineering applications.

Note: (Use of standard Design Data Book is permitted in the END examination)

UNIT – 1 DESIGN OF FLEXIBLE ELEMENTSCLASSES:09

Transmission of power by Belt and Rope Drives, Transmission efficiencies, Belts – Flat and V types – Ropes - pulleys for belt and rope drives. Design of Transmission Chains and Sprocket.

LEARNING OUTCOME:

After successful completion of the unit, students can

- Illustrate design procedures for belt and rope drives. (L2)
- Make use of those design theories in manufacturing components. (L3)

UNIT – 2DESIGN OF GEARS CLASSES:09

Gear materials - Design of straight tooth spur & helical gears based on speed ratios, number of teeth, Fatigue strength, Factor of safety, strength and wear considerations. Force analysis –Tooth stresses - Helical gears – Module - normal and transverse, Equivalent number of teeth – forces.

Straight bevel gear: Gear materials - Tooth terminology, tooth forces and stresses, equivalent number of teeth, estimation of dimensions of straight bevel gears. Worm Gear: Gear materials - Tooth terminology, Thermal capacity, forces and stresses, efficiency, estimation of dimensions of worm gear pair.

LEARNING OUTCOME:

After successful completion of the unit, students can

- Illustrate design procedures for various gears. (L2)
- Make use of those design theories in design soft wares.(L3)

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UNIT – 3 ENGINE PARTS CLASSES :09

Engine Parts: Connecting Rod: Thrust in connecting rod – stress due to whipping action on connecting rod ends –Pistons, Forces acting on piston – Construction, Design and proportions of piston.

LEARNING OUTCOME:

After successful completion of the unit, students can

- Illustrate design procedures for bevel and worm gears. (L2
- Make use of those design theories in design soft wares. (L3)

UNIT – 4 GEAR BOXESCLASSES :09

Geometric progression - Standard step ratio - Ray diagram, kinematics layout -Design of sliding mesh gear box - Design of multi speed gear box (6,9,12 speed gear box) for machine tool applications- Constant mesh gear box - Speed reducer unit. – Variable speed gear box.

LEARNING OUTCOME:

After successful completion of the unit, students can

- Illustrate design procedures for assembling gear box. (L2)
- Make use of those design theories in assembling gearbox in design soft wares (L3)

UNIT – 5 BEARINGSCLASSES :09

Sliding contact and rolling contact bearings - Hydrodynamic journal bearings, Sommerfeld Number, Raimondi & Boyd graphs - Selection of Rolling Contact bearings.

LEARNING OUTCOME:

After successful completion of the unit, students can

- Illustrate design procedures for various bearings. (L2
- Make use of those design theories in design soft wares.(L3)

TEXT BOOK:

1. Shigley. J., Mischke. C., Budynas, R., and Nisbett. K., “Mechanical Engineering Design”, 10 th Edition, Tata McGraw-Hill, 2014.
2. Prabhu. T.J., “Design of Transmission Elements”, Mani Offset, Chennai, 2003

REFERENCE BOOK:

1. Bhandari V, “Design of Machine Elements”, 15th Reprint, Tata McGraw-Hill Book Co, 2014 R2. New Technology – Bhattacharya A, The Institution of Engineers, India 1984.
2. Md. Jalaludeen , Machine Design, Volume II, Design of Transmission Systems, 4th edition, Anuradha Publications, 2014.
3. C.S.Sharma, KamleshPurohit, “Design of Machine Elements”, 1st edition, Prentice Hall of India,Pvt. Ltd., 2004.

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(AUTONOMOUS)

III Year B. Tech. MECH II – Sem

L	T	P	C
3	0	0	3

PRE-REQUESTS: Thermodynamics

COURSE OBJECTIVES:

- To develop basic knowledge of students on Rankine cycles.
- To provide sufficient knowledge on Boilers and chimneys to the students.
- To enable student knowledge on steam nozzles and steam turbines.
- To improve the knowledge of students on steam formation process.
- To provide sufficient knowledge to the students on gas turbine plant.

COURSE OUTCOMES:

- After completion of the course the student is able to
- Develop state – space diagrams based on the schematic diagrams of process flow of steam and gas turbine plants(L1)
- Apply the laws of Thermodynamics to analyze thermodynamic cycles(L4)
- Student will be able to design the blades and impeller for impulse and reacrtion turbine.
- Differentiate between vapour power cycles and gas power cycles (L3)
- Infer from property charts and tables and to apply the data for the evaluation of performance parameters of the steam and gas turbine plants(L3)
- Understand the functionality of major components of jets and rocket to do the analysis of these components(L1)

UNIT – I

Steam Power Plant: Rankine cycle - Schematic layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat addition, Methods to improve cycle performance – Regeneration & reheating.

Boilers: Classification – Working principles with sketches including H.P.Boilers – Mountings and Accessories – Working principles- Boiler horse power, Equivalent Evaporation, Efficiency and Heat balance – Draught- Classification – Height of chimney for given draught and discharge- Condition for maximum discharge- Efficiency of chimney.

LEARNING OUTCOME:

- Describe basic components of Rankine cycle (L2)
- Restate boilers and its components(L2)

UNIT – II

Steam Nozzles: Stagnation Properties- Function of nozzle – Applications and Types- Flow through nozzles- Thermodynamic analysis – Assumptions -Velocity of nozzle at exit-Ideal and actual expansion in nozzle- Velocity coefficient- Condition for maximum discharge- Critical pressure ratio- Criteria to decide nozzle shape- Super saturated flow, its effects, Degree of super saturation and Degree of under cooling - Wilson line

LEARNING OUTCOME:

- Understand the concept of nozzle and diffuser (L1).
- Summarizes the properties of steam and apply it to nozzle flow analysis (L3).

UNIT – III

Steam Turbines: Classification – Impulse turbine; Mechanical details – Velocity diagram – Effect of friction – Power developed, Axial thrust, Blade or diagram efficiency – Condition for maximum efficiency. De-Laval Turbine - its features- Methods to reduce rotor speed-Velocity compounding and Pressure compounding- Velocity and Pressure variation along the flow – Combined velocity diagram for a velocity compounded impulse turbine.

Reaction Turbines: Mechanical details – Principle of operation, Thermodynamic analysis of a stage, Degree of reaction – Velocity diagram – Parson's reaction turbine – Condition for maximum efficiency. .

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LEARNING OUTCOME:

- Principle, Classification and compounding of steam turbine (L3)
- Analyze the concepts of velocity diagram and design of impulse steam turbine by both analytical and graphical approach. (L4).

UNIT – IV

Steam Condensers: Requirements of steam condensing plant – Classification of condensers – Working principle of different types – Vacuum efficiency and Condenser efficiency – Air leakage, sources and its affects, Air pump- Cooling water requirement.

Gas Turbines: Simple gas turbine plant – Ideal cycle, essential components – Parameters of performance – Actual cycle – Regeneration, Inter cooling and Reheating –Closed and Semi-closed cycles – Merits and Demerits- Combustion chambers and turbines of Gas Turbine Plant- Brief Concepts

LEARNING OUTCOME:

- Understand the functionality of major components of steam and gas turbine plants and to do the analysis of these components (L1).
- Concept of reheat factor in turbine expansion and to understand the various governing system in steam turbine (L3).

UNIT – V

Jet Propulsion: Principle of Operation –Classification of jet propulsive engines – Working Principles with schematic diagrams and representation on T-S diagram - Thrust, Thrust Power and Propulsion Efficiency – Turbo jet engines – Needs and Demands met by Turbo jet – Schematic Diagram, Thermodynamic Cycle, Performance Evaluation Thrust Augmentation – Methods.

Rockets: Application – Working Principle – Classification – Propellant Type – Thrust, Propulsive Efficiency – Specific Impulse – Solid and Liquid propellant Rocket Engines.

LEARNING OUTCOME:

- Understand the working of various jets and rockets engines.. (L1).
- Understand the functionality of major components of Jets and rockets and to do the analysis of these components (L2)

TEXT BOOKS:

1. Thermal Engineering / Mahesh M Rathore/ Mc Graw Hill/5th Edition
2. Thermal Engineering/ Rajput/ Lakshmi Publications/ 10th Edition

REFERENCE BOOKS:

1. Gas Turbine Theory/ Saravanamuttoo, Cohen, Rogers/ Pearson/6th Edition
2. Fundamentals of Engineering Thermodynamics / Rathakrishnan/ PHI /2nd Edition
3. Gas Turbines – V. Ganesan /Mc Graw Hill/3rd Edition

Note: Steam tables Data Book R.S.Khurmi is used to analyze the various process parameters in rankine cycle.

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(AUTONOMOUS)

2260335: HEAT TRANSFER

III Year B. Tech. MECH II – Sem

L	T	P	C
3	1	-	4

PRE-REQUESTS: Mathematics & Thermodynamics

COURSE OBJECTIVES:

- To make the student understand the heat transfer through conduction.
- To make the student calculate the heat transfer rate in convection.
- To make the student determine the overall heat transfer coefficient in heat exchangers.
- To enable the student to understand the phenomena of two stage heat transfer.
- To make the student to evaluate the heat transfer by radiation.

COURSE OUTCOMES:

At the end of the Course, Student will be able to:

- Estimate the heat transfer rate through conduction in various bodies.(L5)
- Determine the convective heat transfer coefficient in various bodies.(L4)
- Analyze the heat transfer rate through free convection invarious bodies.(L4)
- Calculate the heat transfer coefficient during boiling and condensation and also the performance of heat exchanger.(L4)
- Evaluate the shape factor and heat transfer rate throughradiation.(L5)
- Design of heat exchangers using LMTD and NTE methods.(L5)

UNIT–I

Introduction: Modes and mechanisms of heat transfer – Basic laws of heat transfer –General discussion about applications of heat transfer.

Conduction Heat Transfer: Fourier rate equation – General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates – simplification and forms of the field equation – steady, unsteady and periodic heat transfer – Initial and boundary conditions

One Dimensional Steady State Conduction Heat Transfer: Homogeneous slabs, hollow cylinders and spheres- Composite systems– overall heat transfer coefficient – Electrical analogy – Critical radius of insulation

LEARNING OUTCOME:

- Understand the basic laws of heat transfer. (L2)
- Analyze problems involving steady state heat conduction in simple geometries.(L4)

UNIT – II

One Dimensional Steady State Conduction Heat Transfer: Variable Thermal conductivity – systems with heat sources or Heat generation-Extended surface (fins) Heat Transfer – Long Fin, Fin with insulated tip and Short Fin, Application to error measurement of Temperature

One Dimensional Transient Conduction Heat Transfer: Systems with negligible internal resistance – Significance of Biot and Fourier Numbers –Infinite bodies- Chart solutions of transient conduction systems- Concept of Semi infinite body.

LEARNING OUTCOME:

- Understand the fundamentals of convective heat transfer process.(L2)
- Evaluate heat transfer coefficients for forced convection inside ducts and exterior surfaces.(L5)

UNIT – III

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(AUTONOMOUS)

Convective Heat Transfer: Classification of systems based on causation of flow, condition of flow, configuration of flow and medium of flow – Dimensional analysis as a tool for experimental investigation – Buckingham Theorem and method, application for developing semi – empirical non- dimensional correlation for convection heat transfer – Significance of non-dimensional numbers .

Forced convection: External Flows: Concepts about hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat transfer -Flat plates and Cylinders.

Internal Flows: Concepts about Hydrodynamic and Thermal Entry Lengths – Division of internal flow based on this –Use of empirical relations for Horizontal Pipe Flow and annulus flow.

LEARNING OUTCOME:

- Obtain numerical solutions for thermal boundary layer.(L5)
- Evaluate heat transfer coefficients for natural convection.(L5)

UNIT – IV

Free Convection: Development of Hydrodynamic and thermal boundary layer along a vertical plate - Use of empirical relations for Vertical plates and pipes.

Heat Exchangers: Classification of heat exchangers – overall heat transfer Coefficient and fouling factor – Concepts of LMTD and NTU methods - Problems using LMTD and NTU methods.

LEARNING OUTCOME:

- Evaluation of heat transfer through pipes and plates.(L5)
- Analyze heat exchanger performance by using the method of heat exchanger effectiveness. (L4)

UNIT – V

RADIATION HEAT TRANSFER: Heat Transfer with Phase Change: Boiling: – Pool boiling – Regimes – Calculations on Nucleate boiling, Critical Heat flux and Film boiling

Condensation: Film wise and drop wise condensation –Nusselt's Theory of Condensation on a vertical plate - Film condensation on vertical and horizontal cylinders using empirical correlations.

Radiation Heat Transfer : Emission characteristics and laws of black-body radiation – Irradiation – total and monochromatic quantities – laws of Planck, Wien, Kirchoff, Lambert, Stefan and Boltzmann– heat exchange between two black bodies – concepts of shape factor – Emissivity – heat exchange between grey bodies – radiation shields – electrical analogy for radiation networks

LEARNING OUTCOME:

- Calculate radiation heat transfer between black body surfaces.(L3)
- Calculate radiation heat exchange between gray body surfaces.(L3)

TEXT BOOKS:

1. Fundamentals of Engg. Heat and Mass Transfer, R.C.Sachdeva, NewAge International Publications/5thedition.
2. Heat Transfer, P.K.Nag, TMH Publications/3rdedition.

REFERENCE BOOKS:

1. Heat Transfer, J. P. Holman, TMH Publications/ Special Indianedition.
2. Principles of Heat Transfer, Frank Kreith, R. M. Manglik& M. S. Bohn, Cengage learning publisher/ Specialedition.
3. Heat and Mass Transfer, D.S.Kumar, S.K.Kataria& Sons Publications/3rd edition.
4. Note: Heat and Mass transfer Data Book by C P Kothandaraman and Subrahmanyan is used to design and analyze various thermal processes and thermal equipment

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(AUTONOMOUS)

2280364: ROBOTICS
(OPEN ELECTIVE-II)

III Year B. Tech. MECH II – Sem

L	T	P	C
3	0	0	3

Pre-requisites: Basic principles of Kinematics and mechanics

COURSEOBJECTIVES

- To familiarize the students with the concepts and techniques in robotic engineering.
- To understand manipulator kinematics, dynamics and control, chose, and incorporate robotic technology in engineering systems.
- Make the students acquainted with the theoretical aspects of Robotics.
- EnablethestudentstoacquirepracticalexperienceinthefieldofRobotics through design projects and case studies.
- Make the students to underst and the importance of robots invarious fields of engineering.
- Expose the students to various robots and their operational details.

COURSE OUTCOMES: After completion of the course the student is able to

- Understand the basic components of robots.(L1)
- Undress and the Differentiate types of robots and robot grippers. (L2)
- Modelling off or ward and inverse kinematics of robot manipulators.(L3)
- Knowledge of working principle of wind energys ystems.(L2)
- Analyze forces in links and joints of arobot.(L4)
- ProgrammearobottoperformtasksinindustrialapplicationsandDesignintelligentrobotsusingsensors.(L3)

UNIT – 1

Introduction: Automation and Robotics –An overview of Robotics –present and future applications.
Components of the Industrial Robotics: common type so farms Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, Design of end effectors,
Precision of Movement: Resolution, Accuracy and Repeatability, Speed of Response and Load Carrying Capacity.

LEARNINGOUTCOME:

- Knowledge on Architecture, Design end effectors.(L2)

UNIT – 2

Motion Analysis: Basic Rotation Matrices, Equivalent Axis and Angle, Euler Angles, Composite Rotation Matrices. Homogeneous transformations asapplicabl autorotation and translation – problems.
ManipulatorKinematics: Hnotation-HmethodofAssignmentofframes-HTransformationMatrix,jointcoordinatesandworldcoordinates,Forwardandinversekinematics–problemsonIndustrialRoboticManipulators.

LEARNINGOUTCOME:

- Understanding the motion analysis and manipulator kinematics.(L1)

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UNIT – 3

Differentialtransformationofmanipulators,Jacobians–problems.Dynamics:Lagrange–EulerandNewton–Eulerformations – Problems
Trajectoryplanningandavoidanceofobstacles,pathplanning,Slewmotion,jointinterpolatedmotion–straightlinemotion.

LEARNINGOUTCOME:

- UnderstandingthetransformationofmanipulatorsandEulerformulations,trajectoryplanning.(L4)

UNIT – 4

RobotactuatorsandFeedbackcomponents: Actuators:Pneumatic,Hydraulicactuators,electric&steppermotors, ComparisonofActuators,Feedbackcomponents:positionsensors–potentiometers,resolvers,encoders–Velocitysensors,Tactile and Range sensors, Force and Torque sensors– End Effectors and Tools

LEARNINGOUTCOME:

- Knowledge on Robot Actuators and feedback components.(L2)

UNIT – 5

RobotApplicationinManufacturing: MaterialTransfer-Materialhandling,loadingandunloadingProcessing-spotandcontinuousarcwelding&spraypainting-AssemblyandInspection.RoboticProgrammingMethods– Languages: Lead through Programming, Textual Robotic Languages such as APT,MCL.

LEARNINGOUTCOME:

- Acquire the knowledge on application in Manufacturing.(L2)

TEXT BOOKS:

- Industrial Robotics/ Groover MP/Mc GrawHill
- Introduction to Industrial Robotics/ Ramachandran Nagarajan /Pearson.

REFERENCEBOOKS:

- Robot Dynamics and Controls/SponyandVidyasagar /JohnWiley
- Robot Analysis andcontrol/Asada,Slotine/ WileyInter-Science
- Robotics–Fuetal/TMHPublications.

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(AUTONOMOUS)

2260355: UNCONVENTIONAL MACHINING PROCESS

(Professional Elective II)

III Year B. Tech. MECH II – Sem

L	T	P	C
3	0	0	3

PRE-REQUISITES: Engineering Physics, Mathematics, Engineering chemistry, Mechanics of solids& Metallurgy and material science

COURSE OBJECTIVES:

- Understand the need and importance of non-traditional machining methods and process selection.
- Gain the knowledge to remove material by thermal evaporation, mechanical energy process.
- To teach the effects of tool geometry on machining force components and surface finish.
- To teach the machining surface finish and material removal rate.

COURSE OUTCOMES:

- Understand the basic techniques of Unconventional Machining processes modeling.
- Summarize the principle and processes of abrasive jet machining.
- Understand the principles, processes and applications of thermal metal removal processes.
- Identify the principles, processes and applications of EBM.
- Understand the principles, processes and applications of Plasma Machining.
- Knowledge of electric equipment required for effective running of EDM with the complexity of power losses and economy.

Tables/Codes: Steam Tables and Mollier Chart

UNIT – I

Introduction – Need for non-traditional machining methods-Classification of modern machining processes – considerations in process selection. Materials. Applications. Ultrasonic machining – Elements of the process, mechanics of metal removal process, parameters, economic considerations, applications and limitations, recent development. Abrasive Jet Machining, Water Jet Machining and Abrasive Water Jet Machining: Basic principles, equipment, process variable, and mechanics of metal removal, MRR, application and limitations.

LEARNING OUTCOME:

- To understand the abrasive jet machining water and water jet machining process (L2)
- Classify the modern machining process (L2)

UNIT – II

Electro – Chemical Processes: Fundamentals of electro chemical machining, electrochemical grinding, electro chemical honing and deburring processes, metal removal
rate in ECM, Tool design, Surface, Finish and accuracy, economic aspects of ECM – Simple problems for estimation of metal removal rate. Chemical machining.

LEARNING OUTCOME:

- Examine electro chemical process (L4)
- To solve the problems in metal removal rate for ECM process (L2)

UNIT – III

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(AUTONOMOUS)

Thermal Metal Removal Processes: Principles, equipments, effect of process parameters, applications, advantages and limitations of Electric discharge machining, Wire electric discharge machining, Laser beam machining, Plasma arc machining, Electron beam machining, Ion beam machining.

LEARNING OUTCOME:

- To gain knowledge on thermal metal removal process like electric discharge machining, wire electric discharge machining and laser beam machining (L3)
- Describe the process of EBM and Ion beam machining. (L1)

UNIT – IV

Principles, equipments, effect of process parameters, applications, advantages and limitations of Abrasive flow machining – Chemo mechanical polishing, Magnetic abrasive finishing, Magnetorheological is finishing, Magneto rheological abrasive flow finishing.

LEARNING OUTCOME:

- Compare the process of abrasive flow machining and magnetic abrasive finishing (L4).
- Ability to analyze Magnetorheological finishing and Magnetorheological abrasive flow finishing. (L4).

UNIT – V

Introduction - Various hybrid non-traditional machining processes, their working principles, equipments, effect of process parameters, applications, advantages and limitations. Selection and comparison of different non-traditional machining processes.

LEARNING OUTCOME:

- Study the various hybrid non-traditional machining processes its advantages and limitations (L2)
- Compare different non-traditional machining process. (L4)

TEXT BOOKS:

1. Advanced Machining Processes / VK Jain / Allied publishers / 1st Edition
2. Modern Machining Processes - P. C. Pandey, H. S. Shan/ Mc Graw Hill / 1st Edition

REFERENCE BOOKS:

1. Fundamentals of machining process/ Hassan Abdel-Gawad EI-Hofy / 2nd EditionAdvanced Methods of Machining/ J.A. McGeough/ Springer International /1st Edition
2. Non-Traditional Manufacturing Processes/ Benedict G.F./ CRC Press/1st Edition

MARRILAXMANREDDY INSTITUTEOFTECHNOLOGYANDMANAGEMENT

(AUTONOMOUS)

2260356: METAL FORMING TECHNOLOGY

(Professional Elective II)

B.Tech. III Year II SEM

L	T	P	C
3	0	0	3

PRE-REQUISITES: PRODUCTION TECHNOLOGY

COURSE OBJECTIVES

- To expose the students to fundamentals of forming process and to provide the insight into classification and advances.
- Toimpart the fundamentals of forging and rolling and the principles of their advanced processes along with their application.
- To provide the understanding of principles, classification and defects in drawing and extrusion process.
- To impart the basic knowledge on sheet metal forming processes.
- Toprovideatechnicalunderstandingofrecent advances inmetalformingprocesseslikesuper plastic forming, hydro forming, CAD and CAM in forming.

COURSE OUTCOMES:

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

- To understand the fundamental mechanics of metal forming processes
- To learn the principle, classification, equipments used and applications of Rolling and Forging Processes
- To learn the principle, classification, equipment's used and applications of Extrusion and Drawing Processes
- To understand the principle, procedure of various sheet metal forming processes
- To study about the recent advances in technology for metal forming.

UNIT – 1 **CLASSES:10**

FUNDAMENTALS OF METAL FORMING

State of stress – Components of stress, symmetry of stress tensor, principal stresses – Stress deviator – von-mises, Tresca yield criteria – Octahedral shear stress and shear strain theory – Flow stress determination – Temperature in metal forming – Hot, cold and warm working – strain rate effects – metallurgical structures – residual stresses – Spring back.

LEARNING OUTCOME:

- Understand the fundamentals of forming.(L2)
- Able to calculate the stresses in forming process.(L5)

UNIT – 2 **CLASSES:09**

FORGING AND ROLLING

Principle – classification – equipment – tooling – processes parameters and calculation of forces during forging and rolling processes – Ring compression test - Post forming heat treatment – defects (causes and remedies) – applications – Roll forming.

LEARNING OUTCOME:

- Identify the type of forging and rolling process based on the material given (L1).
- Interpret the forming defect and its cause (L6)

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UNIT – 3 **CLASSES :09**

EXTRUSION AND DRAWING PROCESSES

Classification of extrusion processes – tool, equipment and principle of these processes – influence of friction – extrusion force calculation – defects (causes and remedies) – Rod/Wire drawing – tool, equipment and principle of processes – defects – Tube drawing and sinking processes – Mannesmann process of seamless pipe manufacturing – Tube bending.

LEARNING OUTCOME:

- Understand the extrusion and drawing process(L2).
- Differentiate the types ofdrawing process and their application (L4).

UNIT – 4 **CLASSES :10**

SHEET METAL FORMING PROCESSES

Classification – conventional and HERF processes – presses – types and selection of presses – formability studies – FLD, Limiting Draw ratio - processes: Deep drawing, spinning, stretch forming, plate bending, Rubber pad forming, bulging and press brake forming – Explosion forming, electro hydraulic forming, Magnetic pulse forming.

LEARNING OUTCOME:

- Understandbasics in spinning and deep drawing(L2)
- Concludetheprocessparameterinvarioussheet metal forming methods(L3)

UNIT – 5 **CLASSES :09**

RECENT ADVANCES

Super plastic forming – Electro forming – fine blanking – Hydro forming – Peen forming – Laser Forming – Micro forming - P/M forging – Isothermal forging – high speed hot forging – near net shape forming high velocity extrusion – CAD and CAM in forming.

LEARNING OUTCOME:

- Identifythedifferenttypesofadvanced formingprocesses.(L4)
- Explain thevarioustypesofoperationscarriedout informing.(L2)

TEXT BOOK:

1. Dieter G.E., “Mechanical Metallurgy”, McGraw Hill, Co., S.I. Edition, 2001

2. Nagpal G.R. “Metal forming processes”, Khanna publishers, New Delhi, 2004

REFERENCE BOOK:

1. SeropeKalpakjian, Steven R Schmid, “Manufacturing Process for Engineering Materials”, 4th Edition, Pearson Education, 2003.
2. Rao, P.N. “Manufacturing Technology”, TMH Ltd., 2003
3. Edward M.Mielink, “Metal working Science Engineering", McGraw Hill, Inc, 2000.
4. Metal Handbook Vol.14, “Forming and Forging”, Metal Park, Ohio, USA, 1990

MARRILAXMANREDDY INSTITUTEOFTECHNOLOGYANDMANAGEMENT

(AUTONOMOUS)

2260357: PRODUCTION PLANNING AND CONTROL

(Professional Elective II)

III Year B. Tech. MECH II – Sem

B.Tech. III Year ISem

L	T	P	C
3	0	0	3

Pre-requisites: Extracting the Type of Materials Required, Machine Utilization, Numbers of Workers Required Etc.

COURSEOBJECTIVES

- To understand the problems and opportunities faced by the operations manager in manufacturing and service organizations.
- To develop an ability to apply PPC concepts in a various areas like marketing, accounting, finance, engineering, personnel management, logistics, etc.
- To integrate operations concepts with other functional areas of business
- To understand the PPC function in both manufacturing and service organizations.
- To examine several classic Operations Management planning topics including production planning and inventory control.
- To learn several important contemporary topics relevant to business managers of all functional disciplines, including quality management, lean concepts, and sustainability

COURSEOUTCOMES: After completion of the course the student is able to

1. Recognize the objectives, functions, applications of PPC and forecasting techniques.
2. Explain different Inventory control techniques.
3. Solve routing and scheduling problems
4. Summarize various aggregate production planning techniques.
5. Describe way of integrating different departments to execute PPC functions

UNIT–I CLASSES:12

Introduction: Definition – Objectives of Production Planning and Control – Functions of production planning and control– Types of production systems– Organization of production planning and control department.

Forecasting – Definition- uses of forecast- factors affecting the forecast- types of forecasting- their uses –generalprincipleofforecasting.Forecastingtechniques-quantitativeandqualitativetechniques.Measuresofforecastingerrors.

LEARNINGOUTCOME:

1. Know about production, planning and control(L1)
2. Various factors affecting PPC(L2)

UNIT-2 CLASSES:8

Inventory management – Functions of inventories – relevant inventory costs – ABC analysis – VED analysis–Basic EOQ model- Inventory control systems –continuous review systems and periodic review systems, MRP I, MRP II, ERP, JIT Systems – Basic Treatment only. Aggregate planning – Definition –aggregate-planning strategies –aggregate planning methods–transportation model.

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LEARNINGOUTCOME:

1.Varioustypesofproductionsystems(L1)_

2.Variouscharatesticsofthe production system(L2)

UNIT–III CLASSES:10

Line Balancing: Terminology, Methods of Line Balancing, RPW method , Largest Candidate method and Heuristic method.

Routing–Definition–Routingprocedure–Factorsaffectingroutingprocedure,RouteSheet.

LEARNINGOUTCOME:

1. Know about the process planning
2.Various characteristics of process planning

UNIT–IV CLASSES:10

Scheduling–Definition–SchedulingPolicies–typesofschedulingmethods –differences with loading flow shop scheduling–job shop scheduling, line of balance (LOB)– objectives– steps involved.

LEARNING OUTCOME:

1. Know about Routing(L3)
2. Understand the role of the scheduler, and how its behavior influences the performance of the system. (L1).

UNIT-V CLASSES:08

Dispatching: Definition–activitiesofdispatcher–dispatchingprocedures–variousformsusedindispatching.

Follow up: definition – types of follow up – expediting – definition – expediting procedures-Applications of computers in planning and control.

LEARNING OUTCOME:

1.Variouscharacteristicsofdispatching.(L2)

2. Becoming a public safety ***dispatcher*** means choosing ***dispatching*** not only as a career, but as a moral commitment to maintain public trust.(L1)

TEXTBOOKS:

1. Operations management–Heizer-Pearson.
2. Production and Operations Management/ AjayKGarg /McGrawHill.

REFERENCEBOOKS:

1. Production Planning and Control- Text & cases/ SK Mukhopadhyaya /PHI.ProductionPlanningandControl- Jain &Jain– Khannapublications.

MARRI LAXMAN REDDY INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(AUTONOMOUS)

2260358: FLEXIBLE MANUFACTURING SYSTEM

(Professional Elective II)

III Year B. Tech. MECH II – Sem

L	T	P	C
3	0	-	3

PRE-REQUISITES: None

COURSE OBJECTIVES

- Understanding of modern trends in design and manufacturing using CAD/CAM.
- Apply performance analysis techniques.
- Understand preventive maintenance procedures in manufacturing.
- Design models for manufacturing systems
- Apply the concept of system design procedures to different levels of production.

COURSE OUTCOMES:

- Describe the basic concepts of FMS (L2)
- Explain the FMS computer control (L2)
- Illustrate the computer control of the work center and assembly lines (L3)
- Interpret the simulation software (L3)
- Knowledge on group technology (L3)
- Applications of FMS in various fields (L3)

UNIT – 1

Introduction to FMS– development of manufacturing systems – benefits – major elements – types of flexibility – FMS application and flexibility –single product, single batch, n – batch scheduling problem – knowledge based scheduling system.

LEARNING OUTCOME:

After successful completion of the unit, students can able to understand

- Describe the developments of manufacturing systems(L2)
- Explain the importance of FMS (L2)

UNIT – 2

Introduction – composition of FMS– hierarchy of computer control –computer control of work center and assembly lines – FMS supervisory computer control – types of software specification and selection – trends.

LEARNING OUTCOME:

After successful completion of the unit, students can able to understand

- Analyze the FMS computer control (L4)
- Describe the software specifications of FMS (L2)

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UNIT – 3 Application of simulation – model of FMS– simulation software – limitation – manufacturing data systems – data flow – FMS database systems – planning for FMS database.

LEARNING OUTCOME:

After successful completion of the unit, students can able to understand

- Explain the simulation model for FMS (L2)
- Describe FMS database systems (L2)

UNIT – 4

Introduction – matrix formulation – mathematical programming formulation –graph formulation – knowledge based system for group technology – economic justification of FMS- application of possibility distributions in FMS systems justification**.**

LEARNING OUTCOME:

After successful completion of the unit, students can able to understand

- Describe the mathematical programming formulation(L2)
- knowledge on group technology (L3)

UNIT – 5

FMS application in machining, sheet metal fabrication, prismatic component production – aerospace application – FMS development towards factories of the future – artificial intelligence and expert systems in FMS – design philosophy and characteristics for future.

LEARNING OUTCOME:

After successful completion of the unit, students can able to understand

- Applications of FMS in various fields(L3)
- Assess the future of FMS(L5)

TEXT BOOK:

1. Jha, N.K. “Handbook of Flexible Manufacturing Systems”, Academic Press Inc., 1991.
2. Radhakrishnan P. And Subramanyan S., “CAD/CAM/CIM”, Wiley Eastern Ltd., New AgeInternational Ltd., 1994.

REFERENCE BOOK:

1. Raouf, A. And Ben-Daya, M., Editors, “Flexible Manufacturing Systems: Recent Development”, Elsevier Science, 1995.
2. Groover M.P., “Automation, Production Systems And Computer Integrated Manufacturing”,
3. Prentice Hall Of India Pvt., New Delhi, 1996.

MARRI LAXMAN REDDY INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(AUTONOMOUS)

2260074: ADVANCED ENGLISH LANGUAGE COMMUNICATION SKILLS LABORATORY

III Year B. Tech. MECH II – Sem

L	T	P	C
0	0	2	1

1. INTRODUCTION: The introduction of the Advanced Communication Skills Lab is considered essential at 3rd year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalized context.The proposed course should be a laboratory course to enable students to use 'good' English and perform the following:
Gathering ideas and information to organize ideas relevantly and coherently.
Engaging in debates.Participating in group discussions. Facing interviews.Writing project/research reports/technical reports.Making oral presentations.Writing formal letters.
Transferring information from non-verbal to verbal texts and vice-versa.
Taking part in social and professional communication.

2. OBJECTIVES: This Lab focuses on using multi-media instruction for language development to meet the following targets:
To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
Further, they would be required to communicate their ideas relevantly and coherently in writing.
To prepare all the students for their placements.

3. SYLLABUS: The following course content to conduct the activities is prescribed for the Advanced English Communication Skills (AECS) Lab:
Activities on Fundamentals of Inter-personal Communication and Building Vocabulary - Starting a conversation – responding appropriately and relevantly – using the right body language
– Role Play in different situations & Discourse Skills- using visuals - Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.
Activities on Reading Comprehension –General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading& effective googling.
Activities on Writing Skills – Structure and presentation of different types of writing – letter writing/Resume writing/ e-correspondence/Technical report writing/ – planning for writing – improving one's writing.
Activities on Presentation Skills– Oral presentations (individual and group) through JAM sessions/seminars/PPTs and written presentations through posters/projects/reports/e-mails/assignments etc.
Activities on Group Discussion and Interview Skills – Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conference and Mock Interviews.

4. MINIMUM REQUIREMENT:

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The Advanced English Communication Skills (AECS) Laboratory shall have the following infrastructural facilities to accommodate at least 35 students in the lab:
Spacious room with appropriate acoustics. Round Tables with movable chairs Audio-visual aids LCD Projector Public Address system P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ T. V, a digital stereo & Camcorder Headphones of High quality

5. SUGGESTED SOFTWARE:

The software consisting of the prescribed topics elaborated above should be procured and used. Oxford Advanced Learner's Compass, 7th Edition
DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice. Lingua TOEFL CBT Insider, by Dream tech
TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)

TEXT BOOKS:

1. Effective Technical Communication by M Asharaf Rizvi. McGraw Hill Education (India) Pvt. Ltd. 2nd Edition
2. Academic Writing: A Handbook for International Students by Stephen Bailey, Routledge, 5th Edition.

REFERENCE BOOKS:

1. Learn Correct English – A Book of Grammar, Usage and Composition by Shiv K. Kumar and Hemalatha Nagarajan. Pearson 2007
2. Professional Communication by Aruna Koneru, McGraw Hill Education (India) Pvt. Ltd, 2016.
3. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
4. Technical Communication by Paul V. Anderson. 2007. Cengage Learning pvt. Ltd. New Delhi.
5. English Vocabulary in Use series, Cambridge University Press 2008.
6. Handbook for Technical Communication by David A. McMurrey & Joanne Buckley. 2012. Cengage Learning.
7. Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.
8. Job Hunting by Colm Downes, Cambridge University Press 2008.
9. English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw-Hill 2009.

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(AUTONOMOUS)

2260385: HEAT TRANSFER LAB

III Year B. Tech. MECH II – Sem

L	T	P	C
0	0	3	1.5

PRE-REQUESTS: Mathematics & Thermodynamics

COURSE OBJECTIVES

- To demonstrate the concepts discussed in the Heat Transfer course
- To experimentally determine thermal conductivity and heat transfer coefficient through various materials..
- To experimentally measure effectiveness of heat exchangers.
- To experimentally measure Stefan Boltzmann constant...

COURSE OUTCOMES:

- Applications of concepts of Conduction Convection &Radiation Principles.
- Calculation of thermal conductivity Heat Transfer Coefficient of various experiments.
- Calculation of Heat Transfer Coefficient of various experiments.
- Analyzing the Performance parameters of Heat Exchanger.
- Evaluation of Emissivity of Real Surfaces.
- Assessment of Stefen Boltz's mann Constant.

LIST OF EXPERIMENTS:

1. Determination of overall heat transfer co-efficient of a composite slab
2. Determination of heat transfer rate through a lagged pipe.
3. Determination of heat transfer rate through a concentric sphere
4. Determination of thermal conductivity of a metal rod.
5. Determination of efficiency of a pin-fin
6. Determination of heat transfer coefficient in forced convection
7. Determination of heat transfer coefficient in natural convection.
8. Determination of effectiveness of parallel and counter flow heat exchangers.
9. Determination of emissivity of a given surface.
10. Determination of Stefan Boltzmann constant.
11. Determination of heat transfer rate in drop and film wise condensation.
12. Determination of critical heat flux.
13. Demonstration of heat pipe.
14. Determination of Heat transfer coefficient and instantaneous heat transfer for transient heat conduction.

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(AUTONOMOUS)

2270336: CAD & AMT

B. Tech. IV Year I Sem

L	T	P	C
3	-	-	3

PRE- REQUISITES: To learn the importance and use of computer in design and manufacture

Course Objectives

1. To study about the CAD process and concept of geometric modelling
2. To study the concepts of wireframe modelling
3. To study the concepts related to surface modelling
4. To study the concepts of solid modelling
5. To study about geometric transformations techniques, data exchange formats and mechanical tolerance

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

1. Understand the CAD process and geometric modelling concepts
2. Analyse the utility and application of wire frame modelling
3. Understand the concepts of surface modelling
4. Understand and apply the concepts of solid modelling techniques.
5. Understand graphics by using transformations and analyse the utility of data exchange formats with dimensioning and tolerances.

UNIT – 1 CLASSES:10

CAD Tools: Definition of CAD Tools, Graphics standards, Graphics software: requirements of graphics software, Functional areas of CAD, Efficient use of CAD software.

Basics of Geometric Modelling: Requirement of geometric 3D Modeling, Geometric models, Geometric construction methods, Modelling facilities desired.

Geometric Modeling: Classification of wireframe entities, Curve representation methods, Parametric representation of analytic curves: line, circle, arc, conics, Parametric representation of synthetic curves: Hermite cubic curve, Bezier curve, B-Spline curvewire, NURBS, Curve manipulations.

LEARNING OUTCOME:

After successful completion of the unit, students will be able to

- Understand importance of design concept. (L2)
- Understand the design process wireframe modeling. (L2)

UNIT –2 - ICLASSES:09

Surface Modeling: Classification of surface entities, Surface representation methods, Parametric representation of analytic surfaces: plane surface, ruled surface, surface of revolution, tabulated cylinder, Parametric representation of synthetic curves: Hermite cubic surface, Bezier surface, B-Spline surface, Blending surface, Surface manipulations.

Solid Modelling: Geometry and topology, Boundary representation, The Euler-Poincare formula, Euler operators, Constructive solid geometry: CSG primitives, Boolean operators, CSG expressions, Interior, Exterior, closure, Sweeping: linear and non-linear, Solid manipulations, feature modeling.

LEARNING OUTCOME:

After successful completion of the unit, students can

- Illustrate design procedures for various surfaces modeling method. (L2)
- Make use of those design procedures in solid modeling components.(L3)

UNIT – 3 CLASSES :09

Group Technology: Part families, Parts classification and coding. Production flow analysis, Machinecell design.

Computer aided process planning: Difficulties in traditional process planning, Computer aidedprocess planning: retrieval type and generative type, Machinability data systems.

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Computer aided manufacturing resource planning: Material resource planning, inputs to MRP, MRPoutput records, Benefits of MRP, Enterprise resource planning, Capacity requirements planning

LEARNING OUTCOME:

After successful completion of the unit, students can

- Understand the grouping in various machine parts. (L2)
- Illustrate various Computer intergrated manufacturing method.(L3)

UNIT – 4 CLASSES :08

Introduction: Prototyping fundamentals: Need for time compression in product development, Need for Additive Manufacturing, Historical development, Fundamentals of Additive Manufacturing, AM Process Chain, Advantages and Limitations of AM, Commonly used Terms, Classification of AM process, Fundamental Automated Processes: Distinction between AM and CNC, other related technologies.

Liquid-based AM Systems: Stereo lithography Apparatus (SLA): Models and specifications, Process, working principle, photopolymers, photo polymerization, Layering technology, laser and laser scanning, Applications, Advantages and Disadvantages, Case studies. Solid ground curing (SGC): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Poly jet: Process, Principle, working principle, Applications, Advantages and Disadvantages, Case studies. Micro fabrication.

LEARNING OUTCOME:

After successful completion of the unit, students can

- Identify the different types of powder based AMT (L4)
- Apply the SLS & LENS Process (L5)

UNIT – 5 CLASSES :09

Solid-based AM Systems: Laminated Object Manufacturing (LOM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Fused Deposition Modeling (FDM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Multi-Jet Modelling (MJM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

Powder Based AM Systems: Selective laser sintering (SLS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Three-dimensional Printing (3DP): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

Laser Engineered Net Shaping (LENS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies

LEARNING OUTCOME:

After successful completion of the unit, students can

- Understand other than basic AMT method (L2)
- Apply the new method in Various application (L3)

TEXT BOOKS:

1. CAD/AMT Concepts and Applications / Alavala / PHI
2. CAD/AMT Principles and Applications / P. N. Rao / Mc Graw Hill

REFERENCE BOOK:

1. CAD/AMT/ Groover M.P/ Pearson
2. CAD/AMT/CIM/ Radhakrishnan and Subramanian / New Age
3. D.T. Pham and S.S. Dimov, Rapid Manufacturing,1stedition Springer.

MARRILAXMANREDDY INSTITUTEOFTECHNOLOGYANDMANAGEMENT

(AUTONOMOUS)

2270337: INSTRUMENTATION AND CONTROL SYSTEMS

B.Tech. IV Year I Sem

L	T	P	C
3	-	-	3

PRE-REQUISITES:-Nil

COURSE OBJECTIVES

- Understanding the basic characteristics of a typical instrument. Identifying errors and their Types that would occur instrument.
- Identifying properties used for evaluating the thermal systems.
- The concept of transducer and Various types and their characters of Engineering metrology and its practice which is having increasing importance in industry

COURSE OUTCOMES: After completion of the course the student is able to

- To identify and analyze various errors that would occur in instruments (L3).
- Identify the different displacement measurement techniques and temperature measurement techniques, used in industries (L4).
- To know the working principles of various instruments to measure level (L2).
- Students will be able differentiate between mechanical electrical tachometers.(L3)
- Student will be able select appropriate device for the measurement of parameters like humidity,strain,force and torque(L4)
- Suggest control systems for speed, position and control in practical applications(L4)

UNIT – 1

Definition – Basic principles of measurement – Measurement systems, generalized configuration and functional description of measuring instruments – examples.Static and Dynamic performance characteristics – sources of errors, Classification and elimination of errors.

LEARNING OUTCOME:

- Characteristics of instruments (L2)
- Recognize various errors(L2)

UNIT – 2

Measurement of Displacement: Theory and construction of various transducers to measure displacement – Piezo electric, Inductive, capacitance.

Measurement of Temperature: Various Principles of measurement-Classification: Expansion Type: Bimetallic Strip- Liquid in glass Thermometer; Electrical Resistance Type: Thermistor, Thermocouple, RTD; Radiation Pyrometry: Optical Pyrometer;

Measurement of Pressure: Different principles used- Classification: Manometers, Dead weight pressure gauge. Tester (Piston gauge), Bourdon pressure gauges, Bulkmodulus pressure gauges; Bellows – Diaphragm gauges. Low pressure measurement – Thermal conductivity gauges, ionization pressure gauges, Mcleod pressure gauge.

LEARNING OUTCOME:

- Select appropriate instrument for measuring distance (L4)
- 2. Differentiate various working mechanisms manometers (L2)

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UNIT – 3

Measurement of Level: Direct methods – Indirect methods – Capacitive, Radioactive, Ultrasonic, Magnetic, Cryogenic Fuel level indicators – Bubbler level indicators.

Flow measurement: Rotameter, magnetic, Ultrasonic, Turbine flow meter, Hot – wire anemometer.

Measurement of Speed: Mechanical Tachometers, Electrical tachometers, Non- contact type-Stroboscope

Measurement of Acceleration and Vibration: Different simple instruments – Principles of Seismic instruments – Vibrometer and accelerometer using this principle- Piezo electric accelerometer.

LEARNING OUTCOME:

- Classify various instruments for measuring level (L2)
- Differentiate between mechanical electrical tachometers (L2)

UNIT – 4

Stress-Strain measurements: Various types of stress and strain measurements - electrical strain gauge – gauge factor – method of usage of resistance strain gauge for bending compressive and tensile strains – Use of strain gauges for measuring torque, Strain gauge Rosettes.

Measurement of Humidity: Moisture content of gases, Sling Psychomotor, Absorption Psychomotor, Dew point meter.

Measurement of Force, Torque and Power- Elastic force meters, load cells, Torsion meters, Dynamometers.

LEARNING OUTCOME:

- Will be able to identify best practice to measure stress. (L3).
- To determine humidity at a place (L2).

UNIT – 5

Elements of Control Systems: Introduction, Importance – Classification – Open and closed systems- Servomechanisms – Examples with block diagrams – Temperature, speed and position control systems

LEARNING OUTCOME:

- Classification of various control systems. (L2).
- Difference between open and closed loop systems (L2).

TEXT BOOK:

- Instrumentation mechanical measurements and control by A.k.tayal,Galogtia publications/2nd Edition
- Mechanical measurements & control byDrD.S.Kumar,metropolitan book co pvt ltd/1st Edition

REFERENCE BOOK:

- Control systems by A.nagoorkani,RBA Publications/1st Edition
- Instrumentation Measurements and Analysis by B.C. Nakra, Tata mc grawhill Publishers/3rd Edition
- Electric Measurements & Instrumentation bykK.Lalkishore,Pearson publications/1st Edition

MARRILAXMANREDDY INSTITUTEOFTECHNOLOGYANDMANAGEMENT

(AUTONOMOUS)

2270338: FINITE ELEMENT METHOD
(Professional Elective III)

IV Year B. Tech. MECH I – Sem

L	T	P	C
3	0	0	3

PRE-REQUISITES: MECHANICS OF SOLIDS

COURSE OBJECTIVES:

- The aim of the course is to provide the participants an overview on Finite Element Method, Material models, and Applications in material Engineering. At the end of the course, the participants are expected to have fair understanding of:
- Basics of Finite Element Analysis.
- Available material models for structural materials.
- Modeling of engineering systems .
- Importance of interfaces and joints on the behavior of engineering systems.
- Implementation of material model in finite element method and applications.

COURSE OUTCOMES:

- After completion of the course the student is able to
- Apply finite element method to solve problems in solid mechanics, fluid mechanics
- Formulate and solve problems in one dimensional structures including trusses, beams.
- Formulate FE characteristic equations for two dimensional elements and analyze plain stress, plain strain, and axi-symmetric problems.
- Formulate FE characteristic equations in heat transfer applications
- Formulate FE characteristic equation for dynamic analysis.
- Knowledge on FEM softwares ANSYS,NASTRAN etc

UNIT – I

Introduction: Introduction to Finite Element Methods: General Procedure – Engineering Applications –
Stress – strain relations and strain- displacement relations: Finite Elements: 1- Dimensional, 2 – Dimensional, 3-Dimensional Elements
One Dimensional Problems: 1-D Linear bar Elements - Finite element modeling, Coordinates and shape functions. Assembly of Global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions, Quadratic shape functions for bar element.

LEARNING OUTCOME:

- After successful completion of the unit, students will be able to
- Explain the shape function concept and make use of it in solving one dimensional linear elements (L2).
- Apply numerical methods on one dimensional bar elements for obtaining displacements, stresses, strains and reaction forces (L3).
- Understand the concept of FEM and its engineering applications in various areas of study.(L2)

UNIT – II

Analysis of Trusses: Derivation of Stiffness Matrix for Plane Truss, Displacement of Stress Calculations.
Analysis of Beams: Element stiffness matrix for two noded, two degrees of freedom per node beam element, simple problems on Load Vector, Deflection.

LEARNING OUTCOME:

- After successful completion of the unit, students will be able to
- Explain the shape function concepts on trusses and beams for enriching knowledge on stiffness matrixr (L2).

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- Apply numerical methods on truss and beam elements for obtaining displacements, stresses, strains. (L3).
- Make use of shape functions for obtaining stiffness matrix and load vector on truss and beam elements.(L3)

UNIT – III

Finite element modeling of two-dimensional stress analysis with constant strain triangles and treatment of boundary conditions, Estimation of Load Vector, Stresses

Finite element modeling of Axi-symmetric solids subjected to Axi-symmetric loading with triangular elements and two dimensional four noded isoparametric elements.

LEARNING OUTCOME:

- After successful completion of the unit, students will be able to
- Recall the fundamental structural concepts of stress-strain relations and strain displacements for solving 2D and 3D elastic problems. (L1)
- Illustrate finite element modelling of triangular, axi-symmetric and four noded elements for obtaining shape functions of two dimensional elements. (L2)
- Male use of shape functions for developing stiffness matrix of triangular, axisymmetric and four noded elements (L3)

UNIT – IV

Steady State Heat Transfer Analysis: one dimensional analysis of Slab, fin and two-dimensional heat conduction analysis of thin plate.

LEARNING OUTCOME :

- After successful completion of the unit, students will be able to
- Explain the basics of heat transfer for 1D, fin and thin plate for developing mathematical models.(L2) Apply numerical methods on heat transfer problems for developing thermal stiffness matrix and thermal load vector.(L3)

UNIT – V

Dynamic Analysis: Formulation of finite element model, lumped and consistent mass matrices, evaluation of Eigen values and Eigen vectors for a stepped bar.

Finite element – formulation to 3 D problems in stress analysis, convergence requirements, Mesh generation and its techniques, introduction to softwares such as ANSYS, ABAQUS, NASTRAN

LEARNING OUTCOME:

- After successful completion of the unit, students will be able to
- Illustrate the concepts of stepped bar for obtaining the Eigen values and Eigen vectors of various structural problems. (L2)
- Make use of modern tools such as ANSYS, NASTRAN for solving 3D structural and heat transfer problems (L3).
- Understand the concept of mesh generation and its importance. (L2)

TEXT BOOKS:

1. Finite Element Methods: Basic Concepts and applications/Alavala/PHI/3rd Edition
2. Introduction to Finite Elements in Engineering,/ Chandrupatla, Ashok and Belegundu /Pearson/4th Edition

REFERENCE BOOKS:

1. An Introduction to the Finite Element Method / Edition-4/J. N. Reddy/ Mc Graw Hill/4th Edition
2. Finite Element Analysis / SS Bhavikatti / New Age/3rd Edition
3. Finite Element Method/Dixit/Cengage/4th Edition
4. The Finite Element method in Engineering/Singiresu S.Rao/5th Edition

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2270303: ELEMENTS OF ELECTRIC AND HYBRID VEHICLES
(Open Elective III)

B.Tech. IV Year I Sem

L	T	P	C
3	0	0	3

PRE-REQUISITES: Basic knowledge of electrical engineering

COURSE OBJECTIVES
The main learning objective of this course is to prepare the students for:
1. To understand the basic performance of conventional Vehicles
2. Describe the hybrid vehicles and their performance.
3. To understand the concept of electric traction
4. To understand the different possible ways of energy storage.
5. To understand the different strategies related to hybrid vehicle operation & energy management.

COURSE OUTCOMES:
The main learning objective of this course is to prepare the students for:
1. Study the models to describe hybrid vehicles and their performance.
2. Understand the importance of hybrid vehicles
3. Analyse the design of electric trains
4. Implement the different possible ways of energy storage.
5. Adopt the different strategies related to hybrid vehicle operation & energy management.

UNIT – 1 INTRODUCTION

Conventional Vehicles: Basics of vehicle performance, vehicle power Source characterization, transmission characteristics, and mathematical models to describe vehicle performance.

LEARNING OUTCOME:
After successful completion of the unit, students will be able to
1. Understand the performance of conventional Vehicles. (L2)
2. Understand the mathematical models to describe vehicle performance.(L2)

UNIT 2: INTRODUCTION TO HYBRID ELECTRIC VEHICLES:

History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

LEARNING OUTCOME:
After successful completion of the unit, students can
1. Understand theimportance of hybrid and electric vehicles. (L2)

Analyse the fuel efficiency.(L2)

UNIT 3: ELECTRIC TRAINS:

Electric Drive Trains: Basic concept of electric traction. Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

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LEARNING OUTCOME:

After successful completion of the unit, students will be able to

1. Understand the importance of hybrid and electric vehicles. (L2)
2. Analyse the fuel efficiency.(L2)

UNIT 4: ENERGY STORAGE:

Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems.

LEARNING OUTCOME:

After successful completion of the unit, students will be able to

1. Understand the importance of hybridisation. (L2)
2. Understand the different energy storage devices.(L2)

UNIT 5: ENERGY MANAGEMENT STRATEGIES:

Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies and implementation issues of energy management strategies.

LEARNING OUTCOME:

After successful completion of the unit, students will be able to

1. Understand energy management strategies. (L2)
2. Understand the implementation issues of energy management.(L2)

TEXT BOOK:

1. C. Mi, M. A. Masrur and D. W. Gao, “Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives”, John Wiley & Sons, 2011.
2. S. Onori, L. Serrao and G. Rizzoni, “Hybrid Electric Vehicles: Energy Management Strategies”, Springer, 2015.

REFERENCE BOOK:

1. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design”, CRC Press, 2004.

2. T. Denton, “Electric and Hybrid Vehicles”, Routledge, 2016

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2270359: REFRIGERATION AND AIRCONDITIONING
(Professional Elective-III)

B.Tech. IV Year I Sem

L	T	P	C
3	0	0	3

PRE-REQUISITE: THERMODYNAMICS

COURSE OBJECTIVES:

- To know the various methods of refrigeration and to introduce vapour compression.
- Refrigeration cycle, analysis and methods for improving performance.
- To know the operation of vapour absorption system.
- To know the various components of refrigeration system and their working principles.
- To design air conditioning systems by cooling load calculations.
- To know the various applications of refrigeration and air conditioning systems.

COURSE OUTCOMES:

- The students will get the knowledge about the principle of refrigeration, different methods of refrigeration. (L2)
- Able to know the various components of refrigeration system and their working principles.(L1)
- Able to understand what is meant by air conditioning and various psychrometric properties and processes and know the usage of Psychrometric chart.(L1)
- Know how to provide required environment to suit various needs of day to day requirements like comfort air conditioning, water cooling , storage of perishable food etc.,(L4)
- Able to understand cooling and heating loads in an air conditioning system.(L5)
- Enable them to do simple design calculations and analysis of these systems.(L6)

UNIT – 1

Introduction to refrigeration: Necessity and applications, UNIT ofrefrigeration and C.O.P, Mechanical refrigeration, types Reversed Carnot cycle ofrefrigeration.

Air Refrigeration: Bell Coleman cycle, Open and Dense air systems, Actualrefrigeration system. Necessity of aircraft refrigeration, Aircraft refrigeration systems-Types.

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LEARNING OUTCOME:

At the end of this unit, the students will be able to

- Familiarize with the terminology associated withRefrigeration and Air conditioning.(L4)
- Illustration of bell coleman cycle and its working.(L3)

UNIT – 2

Refrigerants: Refrigerants Classification, desirable properties, commonly usedrefrigerants, nomenclature, Alternate refrigerant.

Vapour Compression Refrigeration: Working principle, essential components of plant,simplevapor compression refrigeration cycle, modifications, Use of P - h charts.

LEARNING OUTCOME:

At the end of this unit, the students will be able to

- Choose various types of refrigerants and its applications, global warming, Ozone depletion potential.(L4)
- Describe the analysis of sub cooled, super heat, sensible, latent heat and COP calculations, different types of refrigeration systems.(L2)

UNIT – 3

System Components: Compressors-types, Condensers - classification, working,Evaporators - classification, working, Expansion devices - types, working.

Vapour Absorption System: Calculation of max COP, description and Workingof NH3-water system, Li-Br,H2O system, principle of operation of three fluidabsorption system and salient features.

LEARNING OUTCOME :

At the end of this unit, the students will be able to

- Design and understand the function of each of the major refrigeration system components: evaporator, compressor, condenser, and metering device.(L5)
- Study the working principles of vapor absorption systems.(L2)

UNIT – 4

Steam Jet Refrigeration System: Principle of working, application merits anddemerits.

Non-Conventional Refrigeration Methods: Principle and operation ofthermoelectric refrigerator and Vortex tube or Hirsch tube.

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Psychrometry: Introduction, Psychrometric properties and relations, Pcyhrometricchart. Psychrometric processes, Sensible, Latent and Total heat, Sensible Heat Factor (SHF), Bypass factor.

LEARNING OUTCOME:

At the end of this unit, the students will be able to

- Identify different types of air properties (DBT, WBT, DPT, and Humidity) and predict relative cooling load calculations in Air conditioning system.(L4)
- Analyze the air conditioning processes using principles of Psychrometry

UNIT – 5 AIR CONDITIONING SYSTEMS

Introduction to Air Conditioning: Need for ventilation, infiltration, concepts of RSHF, ASHF, and ESHF&ADP, concept of human comfort and effective temperature, comfort air conditioning, industrial air conditioning requirements, air conditioning load calculations.

Air Conditioning Systems: Introduction, components of Air conditioning system, Classification of Air conditioning systems, Central and Unitary, summer, winter and Year round systems.

LEARNING OUTCOME:

At the end of this unit, the students will be able to

- Identify different types of air properties (DBT, WBT, DPT, and Humidity) and predict relative cooling load calculations in Air conditioning system.(L4)
- Study the working principles of Air conditioning systems.(L2)

TEXT BOOK:

1. Refrigeration and air conditioning – R.S. Khurmi& Gupta, 3rd edition.
2. Refrigeration and air conditioning – C.P Arora, 4th edition.
3. Refrigeration and air conditioning- Manohar Prasad. 2nd edition.
4. A Course in refrigeration and air conditioning a– S.C Arora &Domkundwar. 3rdedition..

REFERENCE BOOK :

1. Principles of Refrigeration -- Dossat, 5th edition
2. Refrigeration and air conditioning –Stoecker, 2ndedition.

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WEB REFERENCES:

1. http://www.refrigerationbasics.com/index.htm
2. http://www.howstuffworks.com/ac.htm
3. http://www.ashrae.org
4. http://www.taftan.com/thermodynamics/AIRCOND.HTM
5. http://www.wisegeek.com/how-does-air-conditioning-work.htm

MARRILAXMANREDDY INSTITUTEOFTECHNOLOGYANDMANAGEMENT

(AUTONOMOUS)

2070360: AUTOMOBILE ENGINEERING
(Professional Elective-III)

B. Tech. IV Year I Sem

L	T	P	C
3	0	0	3

COURSEOBJECTIVES: The main learning objective of this course is to prepare the students for

- Classifyingthetypesofchassisandidentifydifferentclassofautomobiles
- Outline the engine systems and their emission control.
- Illustrating the functions of various transmission systems.
- Imparting the working of different braking and steering systems.
- Understanding the working of electrical and electronic components.

COURSEOUTCOMES: Uponcompletionofthiscourse,thestudentswillbeableto:

- Distinguish the different types of automobiles and chassis.
- Interpret the various types of engines and their emission control.
- Select the appropriate transmission systems.
- Compare the braking and steering systems.
- Infer the functions of different electrical and electronic components.

UNIT–1

INTRODUCTON TO AUTOMOBILE AND TYPES: An overview of different types of automobiles and their power sources. Specifications, Performance Parameters, Types of power delivery, Safety standards, Trends in automobile design. Two and Types, Regulations, Car body construction. Bus Body Details, General consideration relating to chassis layout. Introduction to MV Act, Pollution Norms.

LEARNINGOUTCOME:

- Describe the types Of Automobile Engines.(L2)
- Show the details of bus body and body construction of automobile engineering.(L3)

UNIT–2

POWERTRAINANDFUELMANAGEMENTSYSTEMS: ReciprocatingEnginesystems,Hybridsystems.Pollutantemissions and their control; Catalytic converter systems, Electronic Engine Management systems for SI and CIengines.Liquidandgaseousalternatefuels-Alcohol,LPG,CNG,andHydrogen.

LEARNINGOUTCOME:

- Explainelectricenginemanagementsystemforsparkignitionandcompressionignitionengine.(L2)
- Discussthetypesofpollutantemissionandtherecontrolinautomobilesystem.(L2)

UNIT–3

CLUTCH AND TRANSMISSION SYSTEMS: Clutch system and types, Gear box and types - manual, automatic, andAMT,propellershafting,Differential,Axles-function,andtypes,Wheels,Tyres-types,constructionandspecification,suspensionsystem-typesandfunctioning.

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LEARNINGOUTCOME:

- Identify the working principle in different types of clutch.(L1)
- Outline the suspension system and its function in automobile engine.(L1)

UNIT–4

BRAKING SUSPENSION AND ELECTRONIC SYSTEMS: Braking system - requirements and types, Steering system -working, type sand steering geometry parameters. Wheel balancing & Alignment, Introduction to Battery, Alternator, and Starter Motor systems, working principle, and circuitry, Safety systems - seat belts, air-bag, Modern electronic features in vehicles like tyre pressure monitoring, Electronic Stability Program, Electronic Brakeforce Distribution, Automatic head lamp ON,Rain sensing wipers, speed sensing auto locking, OBD. HVAC system.

LEARNINGOUTCOME:

- Identify different types of brakes and its working conditions.(L4)
- Compare Ackers an steering mechanism and Davis steering mechanism.(L4)

UNIT–5

ELECTRICALVEHICAL: Electric Vehicle–Need-Types–Cost and Emissions– End of life. Electric Vehicle Technology –Layouts, cables, components, Controls. Batteries –overview and its types. Battery plug-in and life.Ultra-capacitor,Charging–MethodsandStandards.Alternatechargingsources–Wireless & Solar.

LEARNINGOUTCOME:

- Demonstrate electric vehicle technology and its layout.(L3)
- Study the different types of alternative charging ounce like wireless and solar.(L2)

TEXTBOOK:

1. Jack Erjavek, “Automotive Technology–A Systems Approach”, ThomsonLearning,3rdEdition, 1999.
2. WilliamH.CrouseandDonaldL.Anglin,“AutomotiveMechanics”,TataMcGrawHill,10thEdition,2004.

REFERENCE BOOK:

1. GillP.S.,“ATextbookofAutomobileEngineering–Vol.I,IIandIII”,S.K.KatariaandSons,2ndEdition,2012.
2. Giri,N.K.,“AutomotiveTechnology”,KhannaPublishers,2ndEdition,2002.
3. KirpalSingh,AutomobileEngineeringVolumeIandII,StandardPublishers&Distributors,14th Edition,2017.
4. KumarD.S.,“AutomobileEngineering”,S.K.KatariaandSons,2ndEdition,2017.
5. RobertBoschGmbH,“AutomotiveHandbook”,RobertBosch,2004.

MARRILAXMANREDDY INSTITUTEOFTECHNOLOGYANDMANAGEMENT

(AUTONOMOUS)

2270361: COMPUTATIONAL FLUID DYNAMICS

(Professional Elective III)

IV Year B .Tech. MECH I– Sem. **L T P C**

3 0 0 3

Pre-requisites: Basic principles of Kinematics and mechanics

COURSE OBJECTIVES

- To apply the principles of Heat Transfer and Fluid Mechanics to formulate governing equations for physical problems and to solve those using different numerical techniques

COURSE OUTCOMES: After completion of the course the student is able to

- Differentiate between different types of Partial Differential Equations and to know and understand appropriate numerical techniques. (L1)
- Solve the simple heat transfer and fluid flow problems using different numerical techniques, viz., FDM. (L3)
- Understand and to appreciate the need for validation of numerical solution. (L3)

UNIT – 1 Basic Aspects of the Governing Equations – Physical Boundary Conditions – Methods of solutions of Physical Problems – Need for Computational Fluid Dynamics – Different numerical/CFD techniques – FDM, FEM, FVM etc., - Main working principle - CFD as a research and design tool – Applications in various branches of Engineering Mathematical behavior of Partial Differential Equations (Governing Equations): Classification of linear/ quasi linear PDE – Examples - Physical Processes: Wave Equations and Equations of Heat Transfer and Fluid Flow – Mathematical Behavior - General characteristics – Its significance in understanding the physical and numerical aspects of the PDE – One way and Two Way variables – Well posed problems – Initial and Boundary Conditions Solution of Simultaneous Algebraic Equations: Direct Method – Gauss Elimination – LU Decomposition – Pivoting – Treatment of Banded Matrices – Thomas Algorithm Iterative Method: Gauss Seidel and Jordan Methods - Stability Criterion.

LEARNING OUTCOME:

- Understanding of governing equations. (L1)
- Knowledge on Mathematical behavior of Partial Differential Equations. (L2)

UNIT – 2

Finite Difference Method: Basic aspects of Discretization – Finite Difference formulae for first order and second order terms – Solution of physical problems with Elliptic type of Governing Equations for different boundary conditions - Numerical treatment of 1D and 2D problems in heat conduction, beams etc., - Solutions –Treatment of Curvelinear coordinates – Singularities – Finite Difference Discretization – Solution of 1D heat conduction problems in Heat conduction in curve linear coordinates.

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LEARNING OUTCOME:

- Understanding of Finite Difference Method. (L1)
- Ability to analyze different boundary conditions. (L2)

UNIT – 3

FDM: Solution of physical problems with Parabolic type of Governing Equations – Initial Condition – Explicit, implicit and semi implicit methods – Types of errors – Stability and Consistency – Von Neumann Stability criterion– Solution of simple physical problems in 1D and 2D – Transient Heat conduction problems- ADI scheme - Simple Hyperbolic type PDE - First order and Second order wave equations – Discretization using Explicit method - Stability criterion – Courant Number – CFL Condition - Its significance - Treatment of simple problems

LEARNING OUTCOME:

- Ability to analyze the 1D and 2D problems. (L2)
- Capability to apply different techniques to solve 1D and 2D problems (L3)

UNIT – 4

Finite Difference Solution of Unsteady Inviscid Flows: Lax – Wendroff Technique – Disadvantages – McCormack's Technique

Fluid Flow Equations – Finite Difference Solutions of 2D Viscous Incompressible flow problems – Vorticity and Stream Function Formulation – Finite Difference treatment of Lid Driven Cavity Problem - Application to Cylindrical Coordinates with example of flow over infinitely long cylinder and sphere – Obtaining Elliptic Equations

LEARNING OUTCOME:

Knowledge on different techniques to apply unsteady Inviscid flows. (L3)

UNIT – 5

Finite Difference Applications in Fluid flow problems: Fundamentals of fluid Flow modeling using Burger's Equation – Discretization using FTCS method with respect to Upwind Scheme and Transport Property – Upwind Scheme and Artificial Viscosity

Solutions of Navier Stokes Equations for Incompressible Fluid Flows: Staggered Grid – Marker and Cell (MAC) Formulation – Numerical Stability Considerations – Pressure correction method - SIMPLE Algorithm

LEARNING OUTCOME:

Acquire the knowledge on FDA methods to fluid flow problems. (L2)

TEXT BOOKS:

1. Computational Fluid Dynamics: The basics with applications/ John D Anderson/McGraw Hill Publications
2. Numerical Heat Transfer and Fluid Flow/ S.V. Patankar/ McGraw Hill

REFERENCE BOOKS:

1. Computational Fluid Flow and Heat Transfer / K Muralidharan and T Sudarajan/ Narosa Publishers
2. Computational Methods for Fluid Dynamics / Firziger&Peric/ Springer
3. Computational Fluid Dynamics/Chung T. J./Cambridge/Second Edition.

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(AUTONOMOUS)

2270362: HYDRAULIC AND PNEUMATICS

(Professional Elective III)

B. Tech. IV Year

L	T	P	C
3	0	0	3

Pre-requisites: Fluid Mechanics and Hydraulics Machinery

COURSE OBJECTIVES

1. To know the concepts of hydraulics & pneumatics.
2. To learn the applications of hydraulics and pneumatics in automobiles.
3. To know the advantages and applications of Fluid Power Engineering and Power Transmission System.
4. Know the components of hydraulic and pneumatic circuits.
5. To learn the Applications of Fluid Power System in automation of Machine Tools and others Equipment's.

COURSE OUTCOMES: After completion of the course the student is able to

1. Understand the Properties of fluids, Fluids for hydraulic systems and distribution of fluid power. (L1)
2. Design and analysis of typical hydraulic circuits. (L4)
3. Identify the accessories used in fluid power system. (L2)
4. Filtration systems and maintenance of system. (L4)
5. Explain safe handling of hydraulic fluids, cylinders, control valves and hoses. (L3)

UNIT – 1: BASIC COMPONENTS OF HYDRAULICS CLASSES:12

Introduction to oil hydraulics and pneumatics, their structure, advantages and limitations. ISO symbols, energy losses in hydraulic systems. Applications, Basic types and constructions of Hydraulic pumps and motors. Pump and motor analysis. Performance curves and parameters.

LEARNING OUTCOME:

1. To list the basic components required in hydraulic and pneumatic power systems. (L1)
2. Describe the basic working principle of hydraulic and pneumatic power systems. (L2)

UNIT – 2: ACTUATORS AND VALVES CLASSES:12

Hydraulic actuators, types and constructional details, lever systems, control elements – direction, pressure and flow control valves. Valve configurations, General valve analysis, valve lap, flow forces and lateral forces on spool valves. Series and parallel pressure compensation flow control valves. Flapper valve Analysis and Design.

LEARNING OUTCOME:

1. Distinguish between a single-acting and a double- acting hydraulic cylinders. (L2)
2. Understand and explain the construction, operation, and application of various pressure, control and flow control valves. (L1)

UNIT – 3: HYDRAULIC CIRCUITS CLASSES :12

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Proportional control valves and servo valves. Nonlinearities in control systems (backlash, hysteresis, dead band and friction nonlinearities). Design and analysis of typical hydraulic circuits. Regenerative circuits, high low circuits, Synchronization circuits, and accumulator sizing.

LEARNING OUTCOME:

1. To understand and appreciate the functions and applications of accumulators. (L2)
2. Describe the construction and operation of various accumulator circuits. (L4)

UNIT – 4: BASIC COMPONENTS OF PNEUMATIC CLASSES :09

Intensifier circuits Meter-in, Meter-out and Bleed-off circuits; Fail Safe and Counter balancing circuits, accessories used in fluid power system, Filtration systems and maintenance of system. Components of pneumatic systems; Direction, flow and pressure control valves in pneumatic systems. Development of single and multiple actuator circuits. Valves for logic functions; Time delay valve; Exhaust and supply air throttling;

LEARNING OUTCOME:

1. To understand and appreciate the functions and applications of pressure intensifier. (L1)
2. Understand and explain the construction, operation, and application of air pressure regulator and flow control valve. (L5)

UNIT – 5: CONTROL SYSTEMS AND APLLICATINS CLASSES :09

Examples of typical circuits using Displacement – Time and Travel-Step diagrams. Will-dependent control, Travel-dependent control and Time dependent control, combined control, Program Control, Electro pneumatic control and air-hydraulic control, Ladder diagrams. Applications in Assembly, Feeding, Metal working, materials handling and plastics working.

LEARNING OUTCOME:

1. Understand the technology of fluidics and how fluidics is used to control fluid power systems. (L1)
2. Apply and design fluidic logic circuits for various fluid power systems. (L3)

TEXT BOOKS:

1. Fluid Power Control systems/ Pippenger, J.J., and R. M. Koff/ New York: McGraw Hill.
2. “Fluid Power Systems: modeling, simulation and microcomputer control”/ John Watton/ Prentice Hall International.

REFERENCE BOOKS:

1. Fundamentals of Fluid Power Control. / John Watton/ 1st Ed. Cambridge University Press, 2009
2. “Fluid Power with applications”/ Anthony Esposito / Pearson Education.

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2270386: CAD & AMT LAB

B. Tech. IV Year I Sem

L	T	P	C
0	0	2	1

Pre-requisites: To give the exposure to usage of software tools for design and manufacturing to acquire the skills needed to analyze and simulate engineering systems.

COURSE OBJECTIVES

- To impart the students with necessary computer aided design skills.
- To impart the students with necessary computer aided analysis skills.
- To analyze the various mechanical components.
- Simulation of mechanical components.
- To impart the knowledge on CNC programming

COURSE OUT COMES: After completion of the course the student is able to

- Able to solve simple problems using FEA software
- Generate freeform shapes in part mode to visualize components
- Create complex engineering assemblies using appropriate assembly constraints.
- Develop G and M codes for turning and milling components.
- Generate automated tool paths for a given engineering component

LIST OF EXPERIMENTS:

1. Sketching: Development of part drawings for various components in the form of orthographic. Representation of dimensioning and tolerances.
2. Part Modelling: Generation of various 3D Models through Protrusion, revolve, sweep. Creation of various features. Study of parent child relation. Feature based and Boolean based modelling. Study of various standard Translators. Design of simple components.
3. Determination of deflection and stresses in 2D and 3D trusses and beams.
4. Determination of deflections, principal and Von-mises stresses in plane stress, plane strain and Axi-symmetric components.
5. Determination of stresses in 3D and shell structures (at least one example in each case)
6. Estimation of natural frequencies and mode shapes, Harmonic response of 2D beam.
7. Study state heat transfer analysis of plane and axi-symmetric components.
8. Review of CAD Modeling Techniques and Introduction to RP
9. Generating STL files from the CAD Models & Working on STL files
10. Modeling Creative Designs in CAD Software
11. Simulation in Catalyst Software.
12. Sending the tool path data to FDM RP machine .

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(AUTONOMOUS)

2270387: INSTRUMENTION AND CONTROL SYSTEMS LAB

B.Tech. IV Year I Sem

L	T	P	C
0	0	2	1

PRE-REQUISITES: -

COURSE OBJECTIVES

- Impart an adequate knowledge and expertise to calibrate instruments available in an Industry.
- Impart knowledge on various working principles and design of Instruments.
- Understand calibration of measuring instruments for temperature.
- Understand the functioning of strain gauges for measuring pressure, load and vibrations.
- Apply calibration of measuring instruments of flow and speed measurement.

COURSE OUTCOMES : After completion of the course the student is able to

- Analyse errors, integrate and interpret different types of measurements (L3
- Understand how physical quantities are measured and how they are converted to electrical or other forms.(L2)
- Evaluate the measurement of speed in engineering applications and importance of speed measurement in instrumentation (L4).
- Visualize the areas affected with pressure in equipment and calibrate the pressure measuring devices (L3).
- Comprehend the level of liquid in any container and the various applications of measurement of flow (L4)
- Able to analyse Instrumentation and Control systems and their applications of various industries(L4)

LIST OF EXPERIMENTS (A minimum of 10 experiments to be conducted)

1. . Calibration of pressure gauges
2. Calibration of transducer for temperature measurements
3. Study and calibration of LVDT transducer for displacement measurements
4. Calibration of strain gauge
5. .Calibration of thermocouple for temperaturemeasurements
6. . Calibration of capacitive transducer for angular displacement
7. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
8. Calibration of resistance temperature detector for temperature measurements
9. Study and calibration of Rota meter for flow measurement
10. Study and use of a Seismic pick up for the measurement of vibration
11. Study and calibration of McLeod gauge for low pressure
12. . Measurement And Control Of **Temperature Loop** Of A Process Using Resistance Temperature Detector With SCADA

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PRODUCTION DRAWING LAB

UNIT-I

Conventional representation of Materials - conventional representation of parts-screw joints, welded joints, springs, gears, electrical, hydraulic and pneumatic circuit's methods of indicating notes on drawings.

UNIT-II

Limits and Fits: Types of fits, exercises involving selection/interpretation of fits and estimation of limits from tables.

UNIT-III

Form and Positional Tolerances: Introduction and indication of the tolerances of from and position on drawings, deformation of runout and total runout and their indication.

UNIT-IV

Surface roughness and its indication: Definitions - finishes obtainable from various manufacturing processes, recommended surface roughness on mechanical components.

UNIT-V

Heat treatment and surface treatment symbols used on drawings. UNIT-VI

Detailed and Part drawings: Drawing of parts from assembly drawings with indications of size, tolerances, roughness, form and position errors

etc.

UNIT-VII

Part Drawing using computer aided drafting by CAD software

TEXT BOOKS:

1. Froduction and Drawing - K.L. Narayana & P. Kannsiah! New Age Machine Drawing with Auto CAD- Pohit and Ghosh, PE

REFERENCES:

1. Geometric dimensioning and tolerancing James D. Meadows! B.S Publications intuworldupdates.org

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(AUTONOMOUS)

2270361: COMPUTATIONAL FLUID DYNAMICS
(Professional Elective-IV)

B. Tech. IV Year I Sem

L	T	P	C
3	0	0	3

Pre-requisites: Basic principles of Kinematics and mechanics

COURSE OBJECTIVES

6. To apply the principles of Heat Transfer and Fluid Mechanics to formulate governing equations fo physical problems and to solve those using different numerical techniques.

COURSE OUTCOMES: After completion of the course the student is able to

6. Differentiate between different types of Partial Differential Equations and to know and understand appropriate numerical techniques. (L1)
7. Solve the simple heat transfer and fluid flow problems using different numerical techniques, viz., FDM. (L3)
8. Understand and to appreciate the need for validation of numerical solution. (L3)

UNIT – 1 CLASSES:12

Basic Aspects of the Governing Equations – Physical Boundary Conditions – Methods of solutions of Physical Problems – Need for Computational Fluid Dynamics – Different numerical/CFD techniques – FDM, FEM, FVM etc., - Main working principle - CFD as a research and design tool – Applications in various branches of Engineering Mathematical behavior of Partial Differential Equations (Governing Equations): Classification of linear/ quasi linear PDE – Examples - Physical Processes: Wave Equations and Equations of Heat Transfer and Fluid Flow – Mathematical Behavior - General characteristics – Its significance in understanding the physical and numerical aspects of the PDE – One way and Two Way variables – Well posed problems – Initial and Boundary Conditions Solution of Simultaneous Algebraic Equations: Direct Method – Gauss Elimination – LU Decomposition – Pivoting – Treatment of Banded Matrices – Thomas Algorithm Iterative Method: Gauss Seidel and Jordan Methods - Stability Criterion.

LEARNING OUTCOME:

3. Understanding of governing equations. (L1)
4. Knowledge on Mathematical behavior of Partial Differential Equations. (L2)

UNIT – 2 CLASSES:8

Finite Difference Method: Basic aspects of Discretization – Finite Difference formulae for first order and second order terms – Solution of physical problems with Elliptic type of Governing Equations for different boundary conditions - Numerical treatment of 1D and 2D problems in heat conduction, beams etc., - Solutions –Treatment of Curvelinear coordinates – Singularities – Finite Difference Discretization – Solution of 1D heat conduction problems in Heat conduction in curve linear coordinates.

LEARNING OUTCOME:

3. Understanding of Finite Difference Method. (L1)
4. Ability to analyze different boundary conditions. (L2)

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FDM: Solution of physical problems with Parabolic type of Governing Equations – Initial Condition – Explicit, implicit and semi implicit methods – Types of errors – Stability and Consistency – Von Neumann Stability criterion– Solution of simple physical problems in 1D and 2D – Transient Heat conduction problems- ADI scheme - Simple Hyperbolic type PDE - First order and Second order wave equations – Discretization using Explicit method - Stability criterion – Courant Number – CFL Condition - Its significance - Treatment of simple problems

LEARNING OUTCOME:

3. Ability to analyze the 1D and 2D problems. (L2)
4. Capability to apply different techniques to solve 1D and 2D problems (L3)

UNIT – 4 **CLASSES :10**

Finite Difference Solution of Unsteady Inviscid Flows: Lax – Wendroff Technique – Disadvantages – Maccormack's Technique

Fluid Flow Equations – Finite Difference Solutions of 2D Viscous Incompressible flow problems – Vorticity and Stream Function Formulation – Finite Difference treatment of Lid Driven Cavity Problem - Application to Cylindrical Coordinates with example of flow over infinitely long cylinder and sphere – Obtaining Elliptic Equations

LEARNING OUTCOME:

3. Knowledge on different techniques to apply unsteady Inviscid flows. (L3)

UNIT – 5 **CLASSES :08**

Finite Difference Applications in Fluid flow problems: Fundamentals of fluid Flow modeling using Burger's Equation – Discretization using FTCS method with respect to Upwind Scheme and Transport Property – Upwind Scheme and Artificial Viscosity

Solutions of Navier Stokes Equations for Incompressible Fluid Flows: Staggered Grid – Marker and Cell (MAC) Formulation – Numerical Stability Considerations – Pressure correction method - SIMPLE Algorithm

LEARNING OUTCOME:

3. Acquire the knowledge on FDA methods to fluid flow problems. (L2)

TEXT BOOKS:

3. Computational Fluid Dynamics: The basics with applications/ John D Anderson/McGraw Hill Publications
4. Numerical Heat Transfer and Fluid Flow/ S.V. Patankar/ Mc Graw Hill

REFERENCE BOOKS:

3. Computational Fluid Flow and Heat Transfer / K Muralidharan and T Sudarajan/ Narosa Publishers
4. Computational Methods for Fluid Dynamics / Firziger & Peric/ Springer
5. Computational Fluid Dynamics/ Chung T. J./Cambridge/Second Edition.

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(AUTONOMOUS)

280364: ROBOTICS

(Professional Elective IV)

IV Year B. Tech. MECH I– Sem. **L T P C**

3 0 0 3

Pre-requisites: Basicprinciples of Kinematics and mechanics

COURSE OBJECTIVES

1. To familiarize the students with the concepts and techniques in robotic engineering.
2. To understand manipulator kinematics, dynamics and control, chose, and incorporaterobotic technology in engineering systems.
3. Make the students acquainted with the theoretical aspects of Robotics .
4. Enable the students to acquire practical experience in the field of Robotics through design projectsand case studies.
5. Make the students to understand the importance of robots in various fields of engineering.
6. Expose the students to various robots and their operational details.

COURSE OUTCOMES: After completion of the course the student is able to

1. Understand the basic components of robots. (L1)
2. Understand the Differentiate types of robots and robot grippers. (L2)
3. Modeling of forward and inverse kinematics of robot manipulators. (L3)
4. Knowledge of working principle of wind energy systems. (L2)
5. Analyze forces in links and joints of a robot. (L4)
6. Programme a robot to perform tasks in industrial applications and Design intelligent robots using sensors.(L3)

UNIT – 1

CLA

SSES:08

Introduction: Automation and Robotics – An over view of Robotics – present and future applications.
Components of the Industrial Robotics: common types of arms. Components, Architecture, number of degrees offreedom – Requirements and challenges of end effectors, Design of end effectors,
Precision of Movement: Resolution, Accuracy and Repeatability, Speed of Response and Load Carrying Capacity.

LEARNING OUTCOME:

1. Knowledge on Architecture, Design end effectors. (L2)

UNIT – 2

CL

ASSES:12

Motion Analysis: Basic Rotation Matrices, Equivalent Axis and Angle, Euler Angles, Composite Rotation Matrices.Homogeneous transformations as applicable to rotation and translation –

problems.

Manipulator Kinematics: H notation-H method of Assignment of frames-H Transformation Matrix, joint coordinates
and world coordinates, Forward and inverse kinematics – problems on Industrial Robotic Manipulators.

LEARNING OUTCOME:

1. Understanding the motion analysis and manipulator kinematics. (L1)

Differential transformation of manipulators, Jacobians – problems. Dynamics: Lagrange – Euler and Newton – Eulerformations – Problems
Trajectory planning and avoidance of obstacles, path planning, Slew motion, joint interpolated motion – straight linemotion.

LEARNING OUTCOME:

1. Understanding the transformation of manipulators and Euler formulations, trajectory planning. (L4)

UNIT – 4

CLA

SSES :10

Robot actuators and Feedback components: Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors,
comparison of Actuators, Feedback components: position sensors – potentiometers, resolvers, encoders – Velocitysensors, Tactile and Range sensors, Force and Torque sensors – End Effectors and Tools

LEARNING OUTCOME:

1. Knowledge on Robot Actuators and feedback components. (L2)

UNIT – 5

CL

ASSES :08

Robot Application in Manufacturing: Material Transfer - Material handling, loading and unloading Processing -spot and continuous arc welding & spray painting - Assembly and Inspection. Robotic Programming Methods –
Languages: Lead Through Programming, Textual Robotic Languages such as APT, MCL.

LEARNING OUTCOME:

1. Acquire the knowledge on application in Manufacturing. (L2)

TEXT BOOKS:

1. Industrial Robotics / Groover M P /Mc Graw Hill
2. Introduction to Industrial Robotics / Ramachandran Nagarajan / Pearson.

REFERENCE BOOKS:

1. Robot Dynamics and Controls / Spony and Vidyasagar / John Wiley
2. Robot Analysis and control / Asada, Slotine / Wiley Inter-Science
3. Robotics – Fu et al / TMH Publications.

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(AUTONOMOUS)

2280365: MECHATRONICS

(Professional Elective IV)

III Year B. Tech. MECH II – Sem

L	T	P	C
3	0	0	3

PRE-REQUISITES: Basic Electronics Engineering

COURSE OBJECTIVES:

- To explain the concept of Mechatronics
- Understand & Elements of sensors, transducers & displacement of characteristics.
- To analyse the PN junction diode, BIT, FET, DIA and TRIAC and its significance.
- To gain the Knowledge about Hydraulic and Pneumatic acting system in industrial application.
- Understand the concept of PLC system and significance of PLC control
- Detailed study of system and in its facing data.

COURSE OUTCOMES :

After completion of the course the student is able to

- Develop a simulation model for simple physical systems and explain mechatronics design process.(L4)
- Knowledge of working principle of various energy systems Outline appropriate sensors and actuators for an engineering application.(L1)
- Time and Frequency domain analysis of system model (for control application).(L4)
- Implement Mechatronic System/Process which is Environment Friendly with appropriate Consideration for Public Health and Safety.(L3)
- Explain linearization of nonlinear systems and elements of data acquisition.(L2)
- Development of PLC ladder programming and implementation of real life system.(L5)

UNIT – I

Mechatronics systems, elements, levels of mechatronics system, Mechatronics design process, system, measurement systems, control systems, microprocessor-based controllers, advantages and disadvantages of mechatronics systems. Sensors and transducers, types, displacement, position, proximity, velocity, motion , acceleration, torque, fluid pressure, liquid flow, liquid level, temperature and light sensors.

LEARNING OUTCOME:

- Identification of key elements of mechatronics system and its representation in terms of block diagram.(L2)
- Develop a simulation model for simple physical systems and explain mechatronics design process.(L5)

UNIT – II

Solid state electronic devices, PN junction diode, BJT, FET, DIA and TRIAC. Analog signal conditioning, amplifiers, filtering. Introduction to MEMS & typical applications.

LEARNING OUTCOME:

- Describe the principle and analyze the operation of p-n diodes, BJTs. (L2)
- Interfacing of Sensors, Actuators using appropriate DAQ micro-controller.(L1)

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UNIT – III

Hydraulic and pneumatic actuating systems, Fluid systems, Hydraulic and pneumatic systems, components, control valves, electro-pneumatic, hydrop neumatic, electro-hydraulic servo systems: Mechanical actuating systems and electrical actuating systems.

LEARNING OUTCOME:

- Outline appropriate sensors and actuators for an engineering application.(L3)
- Development of PLC ladder programming and implementation of real life system.(L4)

UNIT – IV

Digital electronics and systems, digital logic control, microprocessors and micro controllers, programming, process controllers, programmable logic controllers, PLCs versus computers, application of PLCs for control

LEARNING OUTCOME:

- PLC implementation on real time systems.(L4)
- Explain various applications of design of mechatronic systems.(L2)

UNIT – V

System and interfacing and data acquisition, DAQS, SCADA, A to D and D to A conversions; Dynamic models and analogies, System response. Design of mechatronics systems & future trends.

LEARNING OUTCOME:

- Exhibit Effective Project Management Skills to Conceive and Develop a Project Plan. (L4)
- Apply Knowledge of Math, Science, and Mechatronic Engineering disciplines to Solve Real Life Industrial Problems.(L5)

TEXT BOOKS:

1. MECHATRONICS Integrated Mechanical Electronics Systems/KP Ramachandran & GK Vijaya Raghavan/WILEY India Ist Edition/2008
2. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering? W Bolton/ Pearson Education Press/3rd edition, 2005.

REFERENCE BOOKS: Mechatronics Source Book by Newton C Braga, Thomson Publications, Chennai. 3rd edition

1. Mechatronics N. Shanmugani /Anuradha Agencies Publishers. 1st edition
2. Mechatronics System Design I Devdas shey/RichardIThomson, 2nd edition

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(AUTONOMOUS)

2280366: MECHANICAL VIBRATIONS

(Professional Elective IV)

III Year B. Tech. MECH II – Sem **L T P C**

3 0 0 3

PRE-REQUISITES: Engineering Mechanics

COURSE OBJECTIVES:

- To impart the knowledge of vibration on various levels.
- To understand remedies for vibrations at various levels.
- To impart the knowledge on single degree of freedom systems.
- To impart the knowledge on two degree of freedom systems
- To understand the working and use of vibration measuring instruments.

COURSE OUTCOMES:

After completion of the course the student is able to

- Understand the causes and effects of vibration in mechanical systems (L2)
- Outline various schematic models for physical systems and formulate governing equations of motion. (L2)
- Analyze rotating and reciprocating systems and compute critical speeds .(L3)
- Analyze and design machine supporting structures, vibration isolators and absorbers. .(L3)
- Understand the role of damping, stiffness and inertia in mechanical systems (L2)
- Demonstrate various vibration measuring instruments. (L2)

UNIT – I

Introduction: Introduction to vibrations & basic concepts, Damped Single Degree Freedom System: Damping Models- Viscous Damping, Structural Damping, Coulomb Damping Single Degree Freedom System with Damping- Over Damped, Under Damped, Critically Damped, Logarithmic Decrement.

LEARNING OUTCOME:

- Discuss basic concepts on vibration. (L2).
- Calculate natural frequency and damped frequency for the single-degree-of freedom system.(L3).

UNIT – II

Single Degree Freedom System – Forced Vibrations: Response to harmonic excitations, solution of differential equation of motion, Vector approach, Magnification factor Resonance, Rotating/reciprocating unbalances, Force Transmissibility, Motion Transmissibility, Critical Speed of shaft.

LEARNING OUTCOME: Discuss the equation of motion of a single-degree-of-freedom system using different methods such as Newton's second law, D'Alembert's principle, and the principle of conservation of energy. (L2)

- Calculate the equation of motion for the different types of initial conditions. (L3)

UNIT – III

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Two-degree freedom systems: Principal modes- undamped and damped free and forced vibrations; undamped vibration absorbers; Multi degree freedom systems: Matrix formulation, stiffness and flexibility influence coefficients; Eigen value problem; normal modes and their properties; Free and forced vibration by Modal analysis; Method of matrix inversion; Torsional vibrations of multi- rotor systems and geared systems; Discrete- Time systems.

LEARNING OUTCOME:

- Discuss linear vibratory models of dynamic systems with changing complexities(L2)
- calculate the differential equations of motion of vibratory systems (L3)

UNIT – IV

Continuous system: Free vibration of strings – longitudinal oscillations of bars- traverse vibrations of beams- Torsional vibrations of shafts.

Critical speeds of shafts: Critical speeds without and with damping, secondary critical speed.

LEARNING OUTCOME:

- Able to calculate critical speeds with and without damping. (L3).
- Understand the concept of free vibration in continous systems. (L2).

UNIT – V

Vibration measurements: Vibrometers, velocity meters & accelerometers, seismic instruments

Numerical Methods: Rayleigh's stodola's, Matrix iteration, Rayleigh- Ritz Method and Holzer's methods

Acoustics and Noise Control: Acoustic wave equation, Acoustic energy and sound intensity. Propagation of sound, Concept of Acoustic impedance. Sound power transmission, Transmission Loss. Human Response and ratings, Sound measuring instruments

LEARNING OUTCOME:

- To formulate numerical methods for multi degree freedom of systems(L3).
- To understand various instruments used to measure vibration.(L2).

TEXTBOOKS:

1. Elements of Vibration Analysis / Meirovitch/ Mc Graw Hill / 2nd Edition
2. Principles of Vibration / Benson H. Tongue/Oxford / 2nd Edition

REFERENCE BOOKS:

1. Mechanical Vibrations by G.K. Groover./8 th Edition
2. Mechanical Vibrations / SS Rao / Pearson/4th Edition.

Mechanical Vibration /Rao V. Dukkipati, J Srinivas/ PHI/ / 2nd Edition

MARRILAXMANREDDY INSTITUTEOFTECHNOLOGYANDMANAGEMENT

(AUTONOMOUS)

2280367: TOTAL QUALITY MANAGEMENT

(Professional Elective V)

III Year B. Tech. MECH I – Sem

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To explain the concept of Total Quality Management (TQM).
- To analyse the customer focus and satisfaction.
- To outline the organizing for Total Quality Management related to system approach, quality implementation.
- To understand the cost of quality, accounting system and quality management.
- To gain knowledge on the universal standards of quality.
- To outline the management of process quality.

COURSE OUTCOMES: After completion of the course the student is able to

- Understanding of product Inspection vs Process control. (L2)
- Knowledge on role of marketing and sales. (L1)
- Capability to understanding the evolution of bench marking. (L3)
- Knowledge to make the transition from a traditional to a TQM organization. (L2)
- Knowledge of quality pertaining to documentation, services and the cost of certification. (L3)
- Students are expected to have a good command over Total Quality Management.(L2)

UNIT – I

Introduction: The concept of TQM, Quality and Business Performance, Attitude and Involvement of Top Management, Communication, Culture and Management Systems. Management of Process Quality: Definition of Quality, Quality Control, a Brief History, Product Inspection Vs Process Control, Statistical Quality Control, Control Charts and Acceptance Sampling.

LEARNING OUTCOME:

- Evaluate the quality management and the whole process of quality control. (L4)
- Understand the history of total quality management to have an excellent business performance. (L2)

UNIT – II

Customer Focus and Satisfaction: Process Vs Customer, Internal Customer Conflict, Quality Focus, Customer Satisfaction, Role of Marketing and Sales, Buyer – Supplier Relationships.
Bench Marking: Evolution of Bench Marking, Meaning of Bench Marking, Benefits of Bench Marketing, the Bench Marking Procedure, Pitfalls of Bench Marketing.

LEARNING OUTCOME:

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- Identify the buyer – supplier relationships. (L1)
- Importance of bench marketing. (L2)

UNIT - III

Organizing for TQM: The Systems Approach, Organizing for Quality Implementation, Making the Transition from a Traditional to a TQM Organization, Quality Circles, Seven Tools of TQM: Stratification, Check Sheet.

- **LEARNING OUTCOME:**
- Develop the system approach. (L4)
- Categorize the quality circles and seven tools of TQM. (L5)

UNIT – IV

The Cost of Quality: Definition of the Cost of Quality, Quality Costs, Measuring Quality Costs, use of Quality Cost Information, Accounting Systems and Quality Management.

LEARNING OUTCOME:

- Analyze the quality costs and measuring quality costs. (L4)
- Knowledge of the cost of quality. (L1)

UNIT – V

ISO9000: Universal Standards of Quality: ISO Around the World, The ISO9000 ANSI/ASQC Q-90, Series Standards, Benefits of ISO9000 Certification the Third Party Audit, Documentation ISO9000 and Services, the Cost of Certification Implementing the System.

LEARNING OUTCOME:

- Comparsion of universal standards of quality in terms of ISO around the world. (L2)
- Importance of ISO 9000 certification. (L2)

TEXT BOOKS:

1. Total Quality Management/Joel E.Ross/Taylor AND Franscis Limited 3rd Edition
2. Total Quality Management/P.N.Mukharjee/PHI 3rd Edition

REFERENCE BOOKS:

1. Beyond TQM/Robert L.Flood, 1st Edition
2. Statistical Quality Control / E.L. Grant, 12th Edition
3. Total Quality Management: A Practical Approach/H.Lal, 1st Edition

MARRILAXMANREDDY INSTITUTEOFTECHNOLOGYANDMANAGEMENT

(AUTONOMOUS)

2280368: QUALITY RELIABILITY

(Professional Elective V)

B.Tech. IV Year II Sem

L	T	P	C
3	-	-	3

PRE-REQUISITES: Total Quality Management

COURSE OBJECTIVES:

- The main learning objective of this course is to prepare the students for:
- Applying the 7 QC tools in problem solving for continuous improvement.
- Designing online sampling plan for quality control using control charts and perform process capability studies.
- Applying the strategies of acceptance sampling plan to perform quality audit in the customer site.
- Evaluating the different reliability measurements applying the reliability concepts
- Selecting the suitable method of improving the reliability and integrate reliability concepts in new product design and development.

COURSE OUTCOMES:

- Upon completion of this course, the students will be able to:
- Understand the principles and concepts of the seven quality control tools and their role in identifying and addressing process issues.
- Utilize control charts to monitor processes in real-time, detect deviations, and make data-driven decisions for process adjustments.
- Understand the principles and objectives of acceptance sampling and its application in quality audits.
- Students will be able to calculate and interpret reliability indices such as MTBF (Mean Time Between Failures) and MTTR (Mean Time to Repair).
- Students will learn to balance reliability objectives with cost considerations in product development.

UNIT – 1 NTRODUCTION AND STATISTICAL PROCESS CONTROL CLASSES:09

Introduction: -definitions of quality, Evolution of Quality: Inspection, Quality Control, Quality assurance Customer-Orientation: Internal & External Customer Concept, Life cycle approach to quality costs-Prevention; Appraisal and Failure costs. Seven SPC tools -Histogram, Check sheets, Ishikawa diagrams, Pareto, Scatter diagrams, Control charts and flow chart.

LEARNING OUTCOME:

After successful completion of the unit, students can

- Understand how quality management has evolved over time, from basic inspection to more advanced quality control and assurance methods. (L2)
- Apply these tools to analyze processes and make improvements that reduce defects and enhance the overall quality of products or services. (L3)

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UNIT – 2 ONLINE QUALITY CONTROL

CLASSES:09

Control chart for attributes –control chart for non-conforming– p chart and np chart – control chart for nonconformities– C and U charts, Control chart for variables – X chart, R chart and σ chart -State of control and process out of control identification in charts, pattern study and process capability studies.

LEARNING OUTCOME:

After successful completion of the unit, students can

- Develop the ability to analyze control charts to detect patterns and trends that may indicate process issues. (L3)
- Understand how these charts help monitor processes, spot control states, identify deviations, and evaluate process capability. (L2)

UNIT OFFLINE QUALITY CONTROL CLASSES :09

Lot by lot sampling – types – probability of acceptance in single, double, multiple sampling techniques – O.C. curves – producers Risk and consumers Risk. AQL, LTPD, AOQL concepts standard sampling plans for AQL and LTPD- uses of standard sampling plans.

LEARNING OUTCOME:

After successful completion of the unit, students can

- Understand different ways to sample products in lots (single, double, multiple sampling). (L2)
- Apply these plans to decide whether to accept or reject product lots, ensuring quality in various industries. (L3)

UNIT – 4 RELIABILITY CONCEPTS

CLASSES :09

Reliability engineering - fundamentals – failure data analysis, Mean failure rate, Mortality curves concept of burn –in period, useful life and wear out phase of a system, mean time to failure, meantime between failure, hazard rate – failure density and conditional reliability- Maintainability and availability – simple problems.

LEARNING OUTCOME:

After successful completion of the unit, students can

- Apply the concepts of maintainability and availability in practical problem-solving scenarios. (L3)
- Solve simple problems related to maintainability and availability to assess and improve the reliability of systems and components. (L2)

UNIT – 5 RELIABLITY ESTIMATION

CLASSES :09

System reliability: Series, Parallel and Mixed configurations, Reliability improvement techniques, use of Pareto analysis – design for reliability – redundancy unit and standby redundancy- fault tree analysis – Optimization in reliability – Product design – Product analysis – Product development – Product life cycles.

LEARNING OUTCOME:

After successful completion of the unit, students can

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- Understand the various configurations of system reliability, including Series, Parallel, and Mixed configurations. (L2)
- Apply the principles of reliability engineering in real-world scenarios, particularly in product design and development. (L3)

TEXT BOOK:

1. Douglas.C. Montgomery, “Introduction to Statistical quality control”, 7th edition, John Wiley2012.
2. Srinath. L.S., “Reliability Engineering”, 4th edition Affiliated East west press, 2011

REFERENCES BOOKS:

1. Besterfield D.H., “Quality Control”, 8th edition, Prentice Hall, 2009.
2. Connor, P.D.T.O., “Practical Reliability Engineering”, 5 theditionWiley India, 2012
3. Grant, Eugene .L “Statistical Quality Control”, TMH, 2005

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(AUTONOMOUS)

2280369: NON-DESTRUCTIVE EVALUATION

(Professional Elective V)

IV Year B. Tech. MECH I – Sem

L	T	P	C
3	0	0	3

PRE-REQUISITES: None

COURSE OBJECTIVES:

- To make the students to understand the importance of NDT in quality assurance
- To imbibe the students the basic principles of various NDT techniques, its applications,
- limitations, codes and standards.
- To equip the students with proper competencies to locate a flaw in various materials,
- products.
- To make the students to be ready to use NDT techniques for in-situ applications too.
- To inculcate the knowledge of selection of the right NDT technique for a given
- application

COURSE OUTCOMES:

The students will be able

- To compare the differences between the various visual inspection techniques and apply the same to the components to be inspected.
- To recognise the importance of Penetrant testing in NDT with the understanding of the procedures involved in the Penetration methods
- To interpret the images and the results obtained from the Thermographic technique and the Eddy current testing
- To evaluate and interpret the results obtained in the Ultrasonic inspection and Acoustic Emission technique
- To explain the techniques involved in the Radiographic testing and the various advancements in Radiography.

UNIT – I

INTRODUCTION & VISUAL INSPECTION METHODS: NDT versus Mechanical testing, Need for NDT, Relative merits and limitations, various physical characteristics of materials and their applications in NDT. Visual Inspection -Unaided, Aided- Borescopes -Videoscopes, Special features in Borescopes, Selection of borescopes, Optical sensors, Microscopes & replication Microscopy Technique and applications.

LEARNING OUTCOME:

After successful completion of the unit, students can able to

- Understand the importance of NDT inspection methods. (L2)
- Develop the testing procedures of visual inspection.(L3)

UNIT – II

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(AUTONOMOUS)

LIQUID PENETRANT TESTING& MAGNETIC PARTICLE TESTING: LPT - Principle, types, Procedures, Penetrants and their characteristics, Emulsifiers, Solvent Cleaners / Removers, Developers-properties and their forms, Equipments, Advantages and limitations, Inspection and Interpretation, Applications and case study. MPT-Principle, Theory of Magnetism, Magnetising current, Magnetisation methods, Magnetic particles, Procedure, Interpretation, Relevant and Non-relevant indications, Residual magnetism, Demagnetisation – need, methods, Advantages and Limitations, Applications, Magnetic Rubber Inspection, Magnetic Printing, Magnetic Painting.

LEARNING OUTCOME:

After successful completion of the unit, students can able to

- Understand the importance of NDT inspection methods. (L2)
- Develop the testing procedures of NDT inspection method. (L3)

UNIT – III

THERMOGRAPHY & EDDY CURRENT TESTING: Thermography – Introduction, Principle, Contact & Non-Contact inspection methods, Active & Passive methods, Liquid Crystal – Concept, example, advantages & limitations. Eddy current Testing – Principle, properties of eddy currents, Eddy current sensing elements, probes, Instrumentation, Types of arrangement, Advantages & Limitations, Interpretation of Results& applications.

LEARNING OUTCOME:

After successful completion of the unit, students can able to

- Understand the importance of NDT inspection methods. (L2)
- Develop the testing procedures of NDT inspection method. (L3)

UNIT – IV

ULTRASONIC TESTING & ACOUSTIC EMISSION TESTING: Ultrasonic Testing-Principle, Basic Equipment, Transducers, couplants, Ultrasonic wave, Variables in UT, Transmission and Pulse-echo method, Straight beam and angle beam, A-Scan, B-Scan & C-Scan, Phased Array Ultrasound& Time of Flight Diffraction, Advantages & Limitations, Interpretation of Results& Applications.

Acoustic Emission Technique – Introduction, Types of AE signal, AE wave propagation, Source location, Kaiser effect, AE transducers, Principle, AE parameters, AE instrumentation, Advantages & Limitations, Interpretation of Results, Applications.

LEARNING OUTCOME:

After successful completion of the unit, students can able to

- Understand the importance of Ultrasonic inspection method. (L2)
- Develop the testing procedures of Ultrasonic inspection method. (L3)

UNIT – V

RADIOGRAPHY: Introduction, Principle, X-ray Production, Gamma ray sources, tubing materials, X-ray tubing characteristics, Interaction of X-ray with matter, Imaging, Film techniques, Filmless techniques, Types and uses of filters and screens, Real time radiography, geometric factors, inverse

square law, characteristics of film, graininess, density, speed, contrast, characteristic curves, Penetrameters, Exposure charts, Radiographic equivalence. Fluoroscopy- Xero-Radiography, Digital Radiography – Film Digitisation, Direct Radiography &Computed Radiography, Computed Tomography, Gamma ray Radiography, Safety in X- ray and Gamma Ray radiography.

LEARNING OUTCOME:

After successful completion of the unit, students can able to

- Understand the importance of radiography inspection method. (L2)
- Develop the testing procedure of radiography inspection method. (L3)

TEXT BOOKS:

1. Paul E Mix, "Introduction to Non-destructive testing: a training guide", Wiley/2nd edition New Jersey, 2005
2. Baldev Raj, T.Jayakumar, M.Thavasimuthu "Practical Non-Destructive Testing", Narosa Publishing House, 2009.

REFERENCE BOOKS:

1. Ravi Prakash, "Non-Destructive Testing Techniques", New Age International Publishers/1st revised edition,2010.
2. ASM Metals Handbook, "Non-Destructive Evaluation and Quality Control", American Society of Metals, Metals Park, Ohio, USA, 200/Volume-17.
3. ASNT, American Society for Non Destructive Testing, Columbus, Ohio, NDT Handbook,Vol. 1, Leak Testing, Vol. 2, Liquid Penetrant Testing, Vol. 3, Infrared and Thermal Testing Vol. 4, Radiographic Testing, Vol. 5, Electromagnetic Testing, Vol. 6, Acoustic Emission Testing, Vol. 7, Ultrasonic Testing

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(AUTONOMOUS)

2280370: SURFACE ENGINEERING AND TRIBOLOGY

(Professional Elective V)

B.Tech. IV Year II SEM	**L**	**T**	**P**	**C**
	3	**0**	**-**	**3**

PRE-REQUISITES: Manufacturing Process

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for:

1. Describe the fundamentals of surface features and different types of friction associated with metals and non metals. (L2)
2. Analyze the different types of wear mechanism and its standard measurement. (L4)
3. Understand the different types of corrosion and its preventive measures. (L1)
4. Describe the different types of surface properties and surface modification techniques. (L2)
5. Analyze the various types of materials used in the friction and wear applications. (L4)

COURSE OUTCOMES:

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

1. Describe the fundamentals of surface features and different types of friction associated with metals and non metals. (L2)
2. Analyze the different types of wear mechanism and its standard measurement. (L4)
3. Understand the different types of corrosion and its preventive measures. (L1)
4. Analyze the different types of surface properties and surface modification techniques. (L4)
5. Describe the various types of materials used in the friction and wear applications. (L2)

UNIT – 1 UNITI SURFACES AND FRICTION

Basics of surfaces features – Roughness parameters – surface measurement - Cause of frictionLaws of friction – Static friction – Rolling Friction – Stick-slip Phenomenon - Friction properties of metal and nonmetals – Friction in extreme conditions – Thermal considerations in sliding contact.

LEARNING OUTCOME:

After successful completion of the unit, students will be able to

3. Understand the surface features. (L2)
4. Understand the Friction properties of metal and nonmetals. (L2)

UNIT – 2 WEAR

Laws of Wear - Types of Wear mechanism – wear debris analysis - Theoretical wear models - Wear of metals and nonmetals – International standards in friction and wear measurements.

LEARNING OUTCOME:

After successful completion of the unit, students will be able to

1. Analyse the wear mechanisms. (L4)
2. Understand International standards in friction and wear measurements. (L2)

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UNIT – 3 CORROSION

Introduction – Types of corrosion – Factors influencing corrosion – Testing of corrosion – In-service monitoring, Simulated service, Laboratory testing – Prevention of Corrosion – Material selection, Alteration of environment, Design, Cathodic and Anodic Protection, Corrosion inhibitors.

LEARNING OUTCOME:

After successful completion of the unit, students will be able to

1. Understand the impartance of corrosion. (L2)
2. Analyse how to prevent corrosion. (L4)

UNIT – 4 SURFACE TREATMENTS

Surface properties – Hydrophobic – Super hydrophobic – Hydrophilic - surface metallurgy –Surface coating Techniques – PVD – CVD – Physical CVD – Ion implantation – Surface welding – Thermal spraying – Laser surface hardening and alloying - New trends in coating technology – DLC – CNC – Thick coatings – Nano-engineered coatings – Other coatings, Corrosion resistant coatings.

LEARNING OUTCOME:

After successful completion of the unit, students will be able to

1. Understand the surface properties. (L2)
2. Analyse the various surface coating techniques. (L4)

UNIT – 5 ENGINEERING MATERIALS

Introduction – High and low friction materials - Advanced alloys – Super alloys, Titanium alloys, Magnesium alloys, Aluminium alloys, and Nickel based alloys – Ceramics – Polymers – Biomaterials – Bio Tribology - Nano Tribology.

LEARNING OUTCOME:

After successful completion of the unit, students will be able to

1. Understand the importance of engineering materials. (L2)
2. Analyse the importance of nano tribology. (L4)

TEXT BOOK:

1. G.W.Stachowiak andA.W.Batchelor, “Engineering Tribology”, Butterworth-Heinemann, 2005.
2. S.K.Basu, S.N.Sengupta and B.B.Ahuja ,”Fundamentals of Tribology”, Prentice Hall of India, 2005.

REFERENCE BOOK:

1. Fontana G., “Corrosion Engineering”, McGraw Hill, 1985.
2. Halling, J. (Editor), “Principles of Tribology “, MacMillian, 1984

MARRILAXMANREDDY INSTITUTEOFTECHNOLOGYANDMANAGEMENT

(AUTONOMOUS)

2280371: FUZZY LOGIC & ARTIFICIAL NEURAL NETWORKS

(Professional Elective VI)

B.Tech. IV Year II Sem

L	T	P	C
3	0	-	3

PRE-REQUISITES: Set Theory, Logic, and Engineering Mathematics, Programming Skills.

COURSE OBJECTIVES

The course is intended to

- Understand the fuzzy relations and functional diagram.
- Familiarize fuzzy logic controller and design of fuzzy logic controller.
- Understand the architecture of neural networks.
- Understand the different schemes of neural networks to fuzzy logic.
- Implement the neuro-fuzzy control to different systems.

COURSE OUTCOMES:

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

- Demonstrate the fuzzy relations and functional diagram.
- Apply the fuzzy logic to different cases.
- Apply kohenen self-organising maps to different neural networks.
- Develop neural networks to fuzzy logic for different schemes.
- Apply neuro-fuzzy control to case studies.

UNIT – 1 - Introduction to Fuzzy Logic **CLASSES:12**

Fuzzy sets – Fuzzy relations – Fuzzy conditional statements – Fuzzy rules – Fuzzy algorithm – functional diagram.

LEARNING OUTCOME:

1. Understand the fuzzy relations. (L2)
2. Understand the fuzzy algorithm. (L2)

UNIT – 2 – Fuzzy Logic Control Systems **CLASSES:10**

Fuzzy logic controller – Fuzzification interface – Knowledge hase – Decision making logic –Defuzzification interface – Design of Fuzzy logic controller – Case study.

LEARNING OUTCOME:

1.Demonstrate fuzzification interface. (L2)

2. Understand the design of fuzzy logic controller. (L2)

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UNIT – 3 – Introduction and different Architectures of Neural Networks **CLASSES:10**

Artificial Neuron – MLP – Backpropagation – Hopfield Networks – Kohenen self-organising maps – Adaptive Resonance.

LEARNING OUTCOME:

1. Understand the concept of Artificial Neuron(L2)
2.Understand Architecture of Neural Networks. (L2)

UNIT – 4 – Neural Networks to Fuzzy Logic **CLASSES :08**

Schemes of Neuro-control-Identification & control of dynamical systems – case study.

LEARNING OUTCOME:

1.Understand the Schemes of Neural Networks (L2).
2. Apply NN Schemes to different Sector (L3).

UNIT – 5 – Neuro-Fuzzy Control **CLASSES :08**

Adaptive fuzzy systems – optimization of membership function and rule base of fuzzy logic controller using neural networks – fuzzy neuron – case study.

LEARNING OUTCOME:

1. Understand the adaptive fuzzy systems (L2).
2. Apply fuzzy logic controller to case study (L3).

TEXT BOOK :

1. Klir G.J., and T.A., Fuzzy Sets, uncertainty and information, Prentice Hall of India, New Delhi,2020.
2. Nie & Linkers : Fuzzy Neural Control : Principles, Algorithms and Applications, PHI,2021

REFERENCE BOOK :

1. Simon Hayking, Neural Network,ISA, Research triangle Parke, 2018.
2. Kosco b., Neural Networks and Fuzzy systems : A Dynamical approach to machine Intelligence, Prentice Hall, USA, 2019.
3. Hertz j., Korgh A., and Palmer R.G. Introduction to the Theory of Neural Computation Addison – Wesley Publishing Co., California, 2021.

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2280372: INDUSTRIAL 4.0

(Professional Elective VI)

B.Tech. IV Year II Sem

L	T	P	C
3	0	-	3

PRE-REQUISITES: Basic knowledge of computer and internet

COURSE OBJECTIVES

The course is intended to

- Industry 4.0 components such as: automation, data exchanges, cloud, cyber-physical systems, robots.
- Convergence between consumer and industrial applications, evolution of connectivity technologies and data processing.
- Study how technology applications in Industry 4.0 will change industrial production
- Study how Industry 4.0 contributes to competitive advantages from a management perspective
- Strategize how businesses in different industries can benefit from Industry 4.0, in line with their needs and opportunities

COURSE OUTCOMES:

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

- Understand the basics of Industrial Revolution.
- Understand the basic concepts of Industry 4.0.
- Understand the Concepts of Industrial IOT in various sectors.
- Understand the applications of Industrial IOT.
- Understand the Business issues in Industry 4.0.

UNIT – 1 - Introduction to Industry 4.0 CLASSES:09

The Various Industrial Revolutions - Digitalisation and the Networked Economy - Drivers, Enablers, Compelling Forces and Challenges for Industry 4.0 - The Journey so far: Developments in USA, Europe, China and other countries - Comparison of Industry 4.0 Factory and Today's Factory - Trends of Industrial Big Data and Predictive Analytics for Smart Business Transformation.

LEARNING OUTCOME:

1. Understand the basics of Industrial Revolution. (L2)
2. Understand the basic concepts of Industry 4.0. (L2)

UNIT – 2 - ROAD TO INDUSTRY 4.0

CLASSES:09

Internet of Things (IoT) & Industrial Internet of Things (IIoT) & Internet of Services - Smart Manufacturing - Smart Devices and Products - Smart Logistics - Smart Cities - Predictive Analytics

LEARNING OUTCOME:

1.Understand the Concept of IOT (L2)

2. Demonstrate fundamentals of IOT (L2)

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UNIT – 3 – IIOT
CLASSES:09

Fourth Revolution – Sustainability assessment of Manufacturing Industry – Lean Production system – Smart and connected business perspective – smart factories – cyber-physical systems – collaboration platform and PLM.

LEARNING OUTCOME:

1. Understand the concept of Fourth Revolution (L2)
2. Apply IOT Techniques to various Industry. (L3)

UNIT – 4 - Applications **CLASSES :09**

Inventory Management and Quality Control – Plant security and safety – Facility management – oil, chemical and Pharmaceutical Industry – Milk processing and packaging industries.

LEARNING OUTCOME:

1.Understand the Applications of IOT (L2).
2. Apply IOT Applications to Industrial Sector (L3).

UNIT – 5 – BUSINESS ISSUES IN INDUSTRY 4.0 **CLASSES :09**

Opportunities and Challenges - Future of Works and Skills for Workers in the Industry 4.0 Era - Strategies for competing in an Industry 4.0 world.

LEARNING OUTCOME:

1. Understand the business issues of industry 4.0 (L2).
2. Understand the future scope of industry 4.0 (L2).

TEXT BOOK :

3. Christoph Jan Bartodziej, “The Concept Industry 4.0 – An Empirical Analysis of Technologies and Application in Production Logistics”, Spinger Gabler, 2015.
4. Alasdair Gilchrist, “Industry 4.0 – The Industrial Internet of Thigs”, Springer Link, 2016.

REFERENCE BOOK :

1. The Fourth Industrial Revolution by Klaus Schwab, World Economic Forum
2. Internet of Things: A Hands-On Approach by Arsheep Bahga and Vijay Madisetti, University Press.
3.Daniel Minoli, “Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications”, ISBN: 978-1-118-47347-4, Willy Publications.

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(AUTONOMOUS)

2280373: AUTOMATIONIN MANUFACTURING
(Professional Elective VI)

B. Tech. IV Year II SEM

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PRE-REQUISITES:None

COURSE OBJECTIVES:

- Lower Cost and Improve Time-to-Market
- Automation investment life-cycle analysis
- Empowered teams of talented employees
- Partnering with automation suppliers
- On-line process analysis
- Procedural process control
- Information integration and data warehousing

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

- Illustrate the basic concepts of automation systems (L3)
- Analyze the production Concepts and Mathematical Models (L4)
- Describe the importance of automated material handling and storage systems (L1)
- Analyze various automated flow lines, Explain assembly systems and line balancing methods(L4)
- Analyze the transfer lines and their applications (L4)
- Interpret the importance of Automated Assembly Systems (L3)

UNIT – 1 **CLASSES:10**

Numerical control, Elements of NC system, NC part programming:
Methods of NC part programming, manual part programming, Computer assisted part programming, Computerized part program, CNC, DNC and Adaptive Control Systems.

LEARNING OUTCOME:

After successful completion of the unit, students can able to

- Understand the NC programming (L1)
- Post processing of CNC, DNC and ACS (L3)

UNIT – 2 **CLASSES:09**

Introduction to Automation: Automation in Production Systems-Automated Manufacturing Systems, Computerized Manufacturing Support Systems, Reasons for Automation, Automation Principles and Strategies.

Introduction to Material Handling: Overview of Material Handling Equipment, Considerations in Material Handling System Design, the 10 Principles of Material Handling. Material Transport Systems, Automated Guided Vehicle Systems, Monorails and other Rail Guided Vehicles, Conveyor Systems, Analysis of Material Transport Systems. Storage Systems, Storage System Performance, Storage Location Strategies, Conventional Storage Methods and Equipment, Automated Storage Systems, Engineering Analysis of Storage Systems.

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LEARNING OUTCOME:

After successful completion of the unit, students can able to understand

- Design the Material Handling and storage systems (L5)
- Analysis the Material Transport Systems (L4)

UNIT – 3 CLASSES :09

Manual Assembly Lines: Fundamentals of Manual Assembly Lines, Alternative Assembly Systems, Design for Assembly, Analysis of Single Model Assembly Lines, Line balancing problem, largest candidate rule, Kilbridge and Wester method, and Ranked Positional Weights Method, Mixed Model Assembly Lines, Considerations in assembly line design.

LEARNING OUTCOME:

After successful completion of the unit, students can able to understand

- Design of material handling systems (L5)
- Describe automated storage and retrieval systems (L3)

UNIT – 4 CLASSES :08

Transfer lines: Fundamentals of Automated Production Lines, Storage Buffers, and Applications of Automated Production Lines. Analysis of Transfer Lines with no Internal Storage, Analysis of Transfer lines with Storage Buffers.

LEARNING OUTCOME:

After successful completion of the unit, students can able to understand

- Demonstrate the automated production lines (L3)
- Analysis of transfer lines (L4).

UNIT – 5 CLASSES :09

Automated Assembly Systems: Fundamentals of Automated Assembly Systems, Design for Automated Assembly, and Quantitative Analysis of Assembly Systems - Parts Delivery System at Work Stations, Multi- Station Assembly Machines, Single Station Assembly Machines, Partial Automation.

LEARNING OUTCOME:

After successful completion of the unit, students can able to understand

- Describe Assembly Systems (L1)
- Design of assembly systems (L5)

TEXT BOOK:

1. Automation, Production systems and computer integrated manufacturing, Mikel P. Groover/ Pearson Eduction. 1st Edition.

2. CAD CAM: Principles, Practice and Manufacturing Management / Chris Mc Mohan, Jimmie Browne / Pearson edu. (LPE) 1st Edition.

REFERENCE BOOK:

1. Automation, Buckinghsm W, Haper& Row Publishers, New York, 1961

2. Automation for Productivity, Luke H.D, John Wiley & Sons, New York, 1972.

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(AUTONOMOUS)

2280374: MECHANICAL WITH AI & ML
(Professional Elective VI)

B.Tech. IV Year II Sem

L	T	P	C
3	0	-	3

PRE-REQUISITES: Linear Algebra, Probability, Statistics, Logical Reasoning.

COURSE OBJECTIVES

The course is intended to

- ACQUAINT with fundamentals of artificial intelligence and machine learning.
- LEARN feature extraction and selection techniques for processing data set.
- UNDERSTAND basic algorithms used in classification and regression problems.
- OUTLINE steps involved in development of machine learning model.
- FAMILIARIZE with concepts of reinforced and deep learning
- IMPLEMENT AND ANALYZE machine learning model in mechanical engineering problems

COURSE OUTCOMES:

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

- DEMONSTRATE fundamentals of artificial intelligence and machine learning.
- APPLY feature extraction and selection techniques.
- APPLY machine learning algorithms for classification and regression problems.
- DEVISE AND DEVELOP a machine learning model using various steps.
- EXPLAIN concepts of reinforced and deep learning.
- SIMULATE machine learning model in mechanical engineering problem.

UNIT – 1 - Introduction to Artificial Intelligence **CLASSES:12**

Introduction to Al, Problem formulation, Problem Definition, Production systems, Control strategies, Search strategies, Problem characteristics, Production system characteristics, Specialized production systems, Problem solving methods, Problem graphs, Matching, Indexing and Heuristic functions, Hill Climbing, Depth first and Breath first, Constraints satisfaction — Related algorithms, Measure of performance and analysis of search algorithms.

LEARNING OUTCOME:

1. Understand the basics of problem AI. (L2)
2. Understand the basic Algorithms of AI. (L2)

UNIT – 2 - Introduction to Machine Learning **CLASSES:10**

Introduction and basic concepts – Need for machine learning – Types of machine learning – Supervised Unsupervised learning – Reinforced learning – Deep learning Versus Machine learning – Relation between - Machine Learning and Statistics-Machine learning methods based on time-Static learning-Dynamic learning - - Function Approximation.

LEARNING OUTCOME:

1.Demonstrate fundamentals of artificial intelligence and machine learning. (L2)

2. Understand the basic algorithms of ML (L2)

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(AUTONOMOUS)

UNIT – 3 – Artificial Intelligence in Robotics **CLASSES:10**

Reinforcement Learning- planning and search, localization, tracking, mapping and control- A* search algorithms- path smoothing algorithms - SLAM algorithm- Precision agriculture- Assistance robots-Robot Performance optimization-Case studies.

LEARNING OUTCOME:

1. Understand the concept of AI Algorithm (L2)
2. Apply AI Techniques to Robotics. (L3)

UNIT – 4 - Applications of Machine Learning in Industrial Sectors **CLASSES :08**

Applications of machine learning in Industrial sectors - Energy sector: oil and gas - Basic materials sector: Chemicals and Basic resources - Industrials sector - Industrial manufacturing - Industry 4.0: Introduction - Industry smartization - Industry smartization; Component level case study - Industry smartization: Machine level case study - Industry smartization; Production level case study - Industry smartization: Distribution level case study - Machine Learning Challenges and Opportunities within Smart Industries

LEARNING OUTCOME:

1.Understand the Applications of ML (L2).
2. Apply ML Algorithms to Industrial Sector (L3).

UNIT – 5 - Application of Artificial Intelligence in Mechanical Manufacturing Industries **CLASSES :08**

Fault diagnosis- Quality inspection- Improving the safety of working places- Material modeling and smart materials-Automobile engineering- building self-driving cars and autonomous vehicles, Auto parking-Machine learning in Machine Tools and Manufacturing Industries.

LEARNING OUTCOME:

1. Understand the Applications of AI (L2).
2. Apply AI Algorithms to Manufacturing Industries (L3).

TEXT BOOK :

5. Kaushik Kumar, Divya Zindani, Paulo Davim, Artificial Intelligence in Mechanical and Industrial Engineering , ISBN 9781003011248, CRC Press, 2021.
6. B Joshi, Machine Learning and Artificial Intelligence, Springer, 2020.

REFERENCE BOOK :

1. Solanki, Kumar, Nayyar, Emerging Trends and Applications of Machine Learning, IGI Global, 2018.
2.Gebrail Bekda,Sinan Melih Nigdeli,Melda Yücel, “Artificial Intelligence and Machine Learning Applications in Civil, Mechanical, and Industrial Engineering (Advances in Computational Intelligence and Robotics)”, 2019.
3. Mangey Ram, J. Paulo Davim, Soft Computing Techniques and Applications in Mechanical Engineering, IGI Global, USA, DOI: 10.4018/978-1-5225-3035- 0,2022.ISBN13: 9781522530350