FACULTY OF ENGINEERING AND TECHNOLOGY

CURRICULAM AND SYLLABUS
(REGULATION - 2015)

B.E MECHANICAL ENGINEERING
(FULLTIME) - CBCS
### CURRICULUM & SYLLABUS

#### SEMESTER I

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VINAYAKA MISSSION’S KIRUPANANDA VARIYAR ENGINEERING COLLEGE
SALEM
AND
AARUPADAI VEEDU INSTITUTE OF TECHNOLOGY, PAIYANOOR, CHENNAI

SCHOOL OF MECHANICAL SCIENCES

BOARD : MECHANICAL ENGINEERING
REGULATION : 2015
PROGRAM : B.E – MECHANICAL ENGINEERING - FULL TIME
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Aim: To impart analytical ability in solving mathematical problems as applied to the respective branches of Engineering.

Objectives:
To provide students with mathematical knowledge and skills needed to support their concurrent and subsequent engineering and science studies

- To improve their ability in solving geometrical applications of differential calculus problems
- To equip themselves familiar with the functions of several variables.
- To have knowledge in multiple calculus
- To improve their ability in Vector calculus

Outcome:
To impart analytical ability in solving Mathematical problems as applied as the respective branches of Engineering.

UNIT I  APPLICATION OF DIFFERENTIAL CALCULUS
Curvature – Cartesian and Parametric Co-ordinates – Centre and radius of curvature – Circle of curvature – Evolute

UNIT II  FUNCTIONS OF SEVERAL VARIABLES

UNIT III  INTEGRATION
Concept of integration-Integration of Rational and Trigonometric functions – Using Partial Fractions – Integration by parts.

UNIT IV  MULTIPLE INTEGRAL
Double integration – change of order of integration- Cartesian and polar coordinates – Area as a double integral – Triple integration.

UNIT V  VECTOR CALCULUS
Directional derivatives – Gradient, Divergence and Curl – Irrotational and solenoidal- vector fields – Vector integration – Green”s theorem, Gauss divergence theorem and Stoke”s theorem (excluding proof).
TEXT BOOK:
1. “Engineering Mathematics” by Department of Mathematics, VMU

REFERENCES:
Aim: To Strengthens the basic LSRW (Listening, Speaking, Reading and Writing) skills.

Objectives:
1. To enable students to develop LSRW skills in English.
2. To become effective communicators in English.
3. To ensure that learners use Electronic media materials for developing language skills.

Outcome:
Outcome of the revised English for Engineers syllabus for the first semester UG engineering students for the academic year 2015-2016.
1. By teaching this syllabus, our UG Engineering graduates will enable to enhance wide range vocabulary to use at right place in right time.
2. Students who undergo this syllabus will fulfill practice in professional writing and comprehension skill and meet the industry requirements.

Unit – I

Unit – II
Articles - Phonetics (Vowels, Consonants and Diphthongs) – Pronunciation Guidelines –Listening to Indian speakers from different regions, intrusion of mother tongue – Homophones – Homonyms, Note taking and Note making - Difference between Spoken and Written English- Use of appropriate language - Listening and Responding to Video Lectures (Green India, environment, social talks) - Extempore.

Unit – III
Tense forms- Verbal &Non verbal communication – Describing objects – Process Description- Speaking Practice – Paragraph Writing on any given topic (My favourite place, games / Hobbies / School life, etc.) – Types of paragraphs- Telephone Etiquettes.

Unit – IV

Unit – V
Sentence Pattern (SVOCA) - Statement of Comparison - Transcoding – Informal letters - SWOT analysis– Resume Writing- Difference –Bio – data, Resume and CV.

References:
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Aim: To Strengthens the fundamental knowledge in physics will improve the scientific thinking of students.

Objective: The fundamental knowledge in physics will improve the scientific thinking of students.

Outcome: To understand the elastic properties of materials.
To understand the properties of crystals.
To understand the significance of laser and its applications in technology.
To understand the basic principles of optical fibres and their applications.
To understand the Non-Destructive Testing techniques.

UNIT I – Properties of matter
Elasticity – Hooke’s law – Stress-strain diagram - Relationship between three moduli of elasticity (qualitative) - Poisson’s ratio – Young’s modulus by uniform bending and non-uniform bending – Experimental determination of rigidity modulus – I-shaped girders.

UNIT II – Crystal Physics
Unit cell – Bravais lattice – Miller indices – Calculation of number of atoms per unit cell – atomic radius – coordination number – packing factor for SC, BCC, FCC, HCP structures – Crystal imperfections – point, line, surface and volume defects.

UNIT III – Lasers

UNIT IV – Fibre Optics
Principle and propagation of light in optical fibres – numerical aperture and acceptance angle – types of optical fibres (material, refractive index, mode) – Applications: Fibre optic communication system – fibre optic displacement sensor and pressure sensor.

UNIT V - Non – Destructive Testing

Total hours : 45
TEXT BOOK
“Engineering Physics”, compiled by Department of Physics, Vinayaka Missions University, Salem.

REFERENCE BOOKS
AIM: To study the basics of Computer, Hardware, Software Applications, Algorithms and Problem solving methodologies.

OBJECTIVES:
- To provide basic knowledge on hardware and software components of computers.
- To introduce and demonstrate various software applications
- To introduce Problem solving methodologies
- To learn about Implementation of Algorithms
- To learn about HTML

OUTCOME
At the end of this course, student shall be able to:
Do Problem Solving using Programming and algorithms, Describe working of Internet based applications, Document artifacts using common quality standards, Design simple data store using DBMS concepts and implement, Develop a working website with all above learning

UNIT I - Basics of Computer and Information Technology 10

UNIT II - Software Applications (Practical Learning) 7
Office Automation: Application Packages - Word processing (MS Word) - Spread sheet (MS Excel) – Presentation (MS PowerPoint).

UNIT III - Problem Solving Methodologies 10
Problems Solving Techniques - Program Development Cycle – Algorithm Development - Flow chart generation – Programming Constructs (Sequential, Decision-Making, Iteration) - Types and generation of programming languages

UNIT IV Implementation of Algorithms 9
Implementation of Algorithms-program verification-The efficiency of algorithms-The analysis of algorithms-Fundamental Algorithms

UNIT V HTML 9
Basics of HTML – Applications of HTML – HTML Fonts – anchor tag and its attributes – Using images in HTML programs – list tag - Table tag – HTML forms

TOTAL HOURS: 45

TEXT BOOKS
1. Essentials of Computer Science and Engineering – by VMU
AIM:
To study the basics of electrical and electronics engineering

OBJECTIVE: To provide the basic knowledge about EEE
To provide an understanding of fundamentals of Electrical and Electronics Engineering

OUTCOME:
The student will be able to identify and understand the operation of electrical and electronic components and design circuits.

A) ELECTRICAL ENGINEERING

UNIT I Electrical Circuits & Meters 9
Definition of electromotive force, current, power and energy-International System of units-Ohm’s law and Kirchhoff’s laws-solution of series and parallel Circuits.
Generation of alternating voltage-average and RMS values-solution of simple R,RL,RC and RLC circuits- Calculation of power and power factor in AC circuits.

UNIT II DC Machines (Qualitative Treatment Only) 8
DC machines –parts-DC generator-EMF equation-Different types of DC generators and their applications-DC motors and their applications-different types-speed control-Starters.

UNIT III AC Machines (Qualitative Treatment Only) 6
Construction & principle of operation of transformers-Single phase & Three phase transformers-Construction and operation of AC motors-Single phase and three phase Induction motors-applications-construction, principles of operation and application of synchronous motors.

B) BASIC ELECTRONICS ENGINEERING

UNIT I: SEMICONDUCTOR DEVICES 8

UNIT II: DIGITAL FUNDAMENTALS 8
Number Systems – Binary, Octal, Decimal and Hexa-Decimal – Conversion from one to another – Logic Gates – AND, OR, NOT, XOR, Universal Gates – Adders, Multiplexer, De Multiplexer, Encoder, Decoder – Memories – PAL, PLA.

UNIT III: COMMUNICATION AND ADVANCED GADGETS 8
TEXT BOOKS
3. “Basic Electrical and Electronics Engineering”, Compiled by Department of EEE & ECE, Faculty of Engineering and Technology, VMRFDU, Anuradha agencies, 2006.
5. "Basic Electrical and Electronics Engineering", Compiled by Department of EEE & ECE, Faculty of Engineering and Technology, VMRFDU, Anuradha agencies, 2006

REFERENCES
Aim: To provide the knowledge about basics of physics

Objective: Students will have the knowledge of taking measurements precisely.

Outcome: To understand the experiments through online virtual demonstration followed by real hands-on experience.

List of Experiments

1. Young's modulus of a bar - Non-uniform bending
2. Rigidity modulus of a wire - Torsional Pendulum
3. Viscosity of a liquid - Poiseuille's method
4. Velocity of ultrasonic waves in liquids - Ultrasonic Interferometer
5. Particle size determination using Laser
6. Wavelength of spectral lines – grating - Spectrometer
7. Thickness of a wire - Air wedge Method
8. Thermal conductivity of a bad conductor - Lee's disc
9. Band gap determination of a thermistor - Post Office Box
10. Specific resistance of a wire – Potentiometer
AIM:
To provide the basic skills of EEE

OBJECTIVE:
To provide exposure to the students with hands on experience on various basic Engineering practices in Electrical and Electronics Engineering.

OUTCOME:
Development of skills in electrical and electronic devices.

LIST OF EXPERIMENTS

A) ELECTRICAL ENGINEERING LAB

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
5. Measurement of energy using single phase energy meter.

B) ELECTRONICS ENGINEERING LAB

1. Characteristics of PN junction Diode.
2. Characteristics of Zener diode.
3. Input, Output characteristics of BJT.
4. Transfer characteristics of JFET.
5. Amplitude Modulation
6. Frequency Modulation.
AIM
To practice the basics of office automation application, SQL and basic HTML coding

OBJECTIVE
To familiarize students with the basic tools of computer and their application in engineering & technology

OUTCOME
At the end of the course, the students would have develop their skills for Office automation, SQL queries and HTML

1. Implement Mail Merge in MS-Word and send letters to parents regarding the semester fee structure of the student.
2. Using MS-Word, create a leave letter addressed to your faculty advisor
3. A) Using MS-Word, create a table for a list of students with different font sizes and colours 
   B) Using MS-Word, create a flow-chart using the basic shapes available. Use page border, a watermark, header and footer
4. Using MS-PowerPoint, create a presentation about the university
5. Using MS-PowerPoint, create a story line with various animations and transition effects.
7. Using MS-Excel, create a pivot table
8. Using MS-Excel, create look-up tables
9. Using MS-Excel, create graphs for the weather condition in various cities of India
10. Create an HTML page
    a) Click on a link and go to the bottom of the page using <a href>
    b) Display an image.
11. Create an HTML page to
    a) Display ordered and unordered lists of your friends names and sports persons
    b) Display a table with 3 columns and 4 rows.
AIM
The aim of the lab to learn basic skill in fitting, Carpentry and welding techniques

OBJECTIVE
To learn the experience of practice in basic sections of the workshop namely fitting, Carpentry and welding in order to know the various methods involved in making parts of the various machines.

OUTCOME
The students would have been completely exposed to the various basic methods that are going to play in the manufacture of even very heavy machines.

FITTING
1. Square Joint
2. Dove Tail Joint

CARPENTRY
1. Half Lap Joint
2. Dove Tail Joint

WELDING
1. Arc Welding of butt Joint.
2. Arc Welding of Lap Joint

CASTING
1. Foundry – Mould Preparation using single piece pattern

DEMONSTRATION
1. Sheet Metal – Fabrication of cone
2. Black Smithy – Round to square rod

Reference:
1. “Basic Workshop Practice”, Department of Mechanical Engineering, Vinayaka Missions University
**Aim:** To provide students with mathematical knowledge and skills needed to support their concurrent and subsequent engineering and science studies

**Objectives:**

The syllabus for the Engineering Mathematics I have been framed catering to the needs of the Engineering students. It is purely applications oriented. To mention a few

- To utilize the powerful features of MATLAB one has to be an expert in Matrix theory
- The matrix theory plays a vital role in simplifying large arrays of equation and in determining their solution.
- Partial differential equation frequently occurred in the theory of elasticity and Hydraulics.
- In circuit branches the current flow can be calculated by using Laplace transform when EMF, resistance and inductions are known.

**Outcome:**

- At the end of this course the students will be in a position to apply the knowledge of Mathematics in the respective Engineering branches.

**UNIT I**

**MATRICES**

Characteristic equation – Eigen values and eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors (Without proof) – Cayley-Hamilton theorem (excluding proof) – Orthogonal transformation of a symmetric matrix to diagonal form.

**UNIT II**

**LAPLACE TRANSFORMS**


**UNIT III**

**INVERSE LAPLACE TRANSFORMS & APPLICATIONS**

Inverse Laplace transform – Convolution theorem – Initial and Final value theorem-Solution of linear ODE of second order with constant coefficients and first order simultaneous equation with constant coefficients using Laplace transforms.

**UNIT IV**

**FOURIER TRANSFORMS**

Fourier transform pairs - Fourier Sine and Cosine transforms – Properties - Transforms of simple functions - Convolution theorem - Parseval’s identity.
UNIT V
Z-TRANSFORMS

TEXT BOOKS
1. “Engineering Mathematics” by Department of Mathematics, VMU
4. A. Singaravelu, ”Transforms and Partial Differential Equations”, Meenakshi Agencies, Chennai

REFERENCE BOOKS
**Aim:** To provide the basic knowledge of business English

**Objectives:**
1. To impart and enhance corporate communication.
2. To enable learners to develop presentation skills.
3. To build confidence in learners to use English in Business contexts.

**Outcome:**
Out come of the revised Business English syllabus for the second semester UG engineering students for the academic year 2015-2016.
1. It is hoped that this syllabus will able to communicate with a range of formal and informal context.
2. This syllabus will enable the students to undergo in activities, demonstrating interaction skills and consider how own communication is adjusted in different scenario.

**Unit – I**
Subject and verb agreement (Concord) – Preposition and Relative Pronoun – Cause and effect- Phrasal Verbs – Idioms and Phrases – Listening comprehension - Listening to Audio Files and Answering Questions – Framing Questions – Negotiation skills, Persuasion Skills and Debating skills.

**Unit – II**

**Unit – III**
Reading Skills – Understanding ideas and making inferences – Group Discussion – Types of Interviews, FAQs – e- mail Netiquette, Sample e-mails – Watching Documentary Films and responding to questions.

**Unit – IV**
Corporate communication – Recommendation - Instruction – Check List- circulars- Inter office memo – Minutes of meeting and Writing agenda – Discourse Markers- Rearranging the jumbled sentences – Technical Articles – Project Proposals, Making Presentations on given topics – Preparing Power Point Presentations.

**Unit – V**

**References:**
2. Technical English-Writing, Reading and Speaking- Pickett and Lester, Harper and Row publication
AIM
To impart in basic knowledge in chemistry so that the student will understand the engineering concept and they can face the competitive examinations effectively.

OBJECTIVE
With a solid foundation in basic scientific and engineering principles, while allowing specialization in Engineering chemistry and ability to assess the impact of engineering solutions in a global and societal context.

OUTCOME
The student will come out with the ability to assess the impact of engineering solutions.

UNIT I : ELECTROCHEMISTRY, BATTERIES AND FUEL CELLS
Primary battery (Daniel and dry cell) – secondary battery (lead Acid storage battery and Nickel-Cadmium battery) – Fuel cell (H₂-O₂ fuel cell)

UNIT II : WATER TECHNOLOGY & CORROSION
Corrosion – Types – principles – corrosion control methods (Electroplating,Electroless plating, Sacrificial anode and Impressed current method).

UNIT III: CHEMISTRY OF ADVANCED MATERIALS
Organic electronic material, shape memory alloys, smart materials,polymers(PVC,Teflon, Bakelite)-fibers(optical fibre) & composites (FRP,MMC & PMC)

UNIT IV : PHASE EQUILIBRIA & NUCLEAR CHEMISTRY
Phase rule: statement and explanation of terms involved – One component system (water) – Condensed phase rule – Two component system (Lead-silver).
Nuclear Chemistry – Fission – Fusion – working of nuclear reactor – Radiations and harmful effects.

UNIT V : CHROMATOGRAPHY AND SPECTROSCOPY
TEXT BOOK: Engineering Chemistry by VMU.

References:

AIM:
The aim is to introduce C programming to the students.

OBJECTIVES:
- To introduce Basics of C
- To understand Control Structures & Arrays
- To learn about String concept, Structure and Union in C
- To introduce the concepts of Functions and Pointers
- To introduce Memory and File management concepts in C

OUTCOME
At the end of this course, student shall be able to know the concepts of C programming techniques.

UNIT I - Basics of C
Identifiers, variables, expression, keywords, data types, constants, Objective of variables. Operators: arithmetic, logical, relational, conditional and bitwise operators - Special operators: size of () & comma (,) operator - Precedence and associatively of operators - Type conversion in expressions.

UNIT II - Control Structures & Arrays
Basic input/output and library functions: Single character input/output i.e. getch(), getchar(), getche(), putchar() - Formatted input/output: printf() and scanf() – Library functions (mathematical and character functions). Decision Making and Branching – Looping statements. Arrays – Initialization – Declaration – One dimensional and two dimensional arrays.

UNIT III  String, Structure & Union
Strings: Declaration-Initialization and string handling functions. Structure and Union: structure declaration and definition – Accessing a Structure variable – Structure within a structure – Union.

UNIT IV Functions and Pointers

UNIT V Memory and File management

TOTAL HOURS: 45
TEXT BOOKS:

REFERENCE BOOKS:
AIM:
The aim is to introduce basics of solid mechanics to the students.

OBJECTIVES:
To create and understanding of statics and dynamics of bodies in rest or in motion.

OUTCOME
At the end of this course, student will be in a position to design mechanical systems independently.

UNIT 1. BASICS & STATICS OF PARTICLES

UNIT 2. EQUILIBRIUM OF RIGID BODIES
Free body diagram - Types of supports and their reactions - requirements of stable equilibrium - Moments and Couples - Moment of a force about a point and about an axis - Vectorial representation of moments and couples - Scalar components of a moment - Varignon's theorem - Equilibrium of Rigid bodies in two dimension - Equilibrium of Rigid bodies in three dimensions.

UNIT 3. PROPERTIES OF SURFACES AND SOLIDS
Determination of Areas and Volumes - First moment of area the Centroid of sections - Rectangle, circle, triangle from integration - T section, I section, Angle section, Hollow section by using standard formula - second and product moments of plane area - Rectangle, triangle, circle from integration - T section, I section, Angle section, Hollow section by using standard formula - Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia - Principle moments of inertia of plane areas - Principle axes of inertia - Mass moment of inertia.

UNIT 4. FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS
Frictional force - Laws of Coloumb friction - simple contact friction - Rolling resistance - Belt friction. Translation and Rotation of Rigid Bodies - Velocity and acceleration - General Plane motion.

UNIT 5. DYNAMICS OF PARTICLES

TOTAL: 45 PERIODS
TEXT BOOKS:

REFERENCE BOOKS:
AIM
To practice and develop applications using C Programming languages.

OBJECTIVE
To make the students to develop program in C languages.

OUTCOME
At the end of the course, the students will be able to develop applications using C Programming languages.

List of exercises:
1. Write a C Program to Implementation of Sine and cosine series
2. Write a C Program to calculate Simple Interest
3. Write a C Program to generate Fibonacci Series using for loop
4. Write a C program to calculate factorial using while loop
5. Write a C Program to
   a) Find the greatest of three numbers using if condition.
   b) Find the greatest of three numbers using conditional operator.
6. Write a C program for finding the roots of a given quadratic equation using conditional control statements
7. Write a C program to
   a) Compute matrix multiplication using the concept of arrays.
   b) Illustrate the concept of string handling functions.
8. Write a C program to
   a) Find the largest element in an array using pointers.
   b) Convert a binary number to decimal or decimal to binary using functions.
9. Write a C program to read data from keyboard, write it to a file named student again read the same data from student file and write it into data file.
10. Write a C program to store employee details using the concept of structures.
AIM:
AN INTRODUCTION OF CAD SOFTWARE AND ITS UTILITIES IN ENGINEERING FIELDS.

OBJECTIVES:
1. To improve imagination skills.
2. Increase ability to communicate with people.
3. Learn to sketch and take field dimensions.
4. Learn to take data and transform it into graphic drawings.
5. Learn basic engineering drawing formats.
6. Prepare the student for future Engineering positions.

COURSE OUTCOMES:
At the end of course the student will be able to:
1. Get acquainted with the knowledge of various lines, geometrical constructions and construction of various kinds of scales, and Ellipse.
2. Improve their imagination skills by gaining knowledge about points, lines and planes.
3. Become proficient in drawing the projections of various solids.

Concepts and conventions (Not for Examination)
Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I PLANE CURVES AND FREE HAND SKETCHING
Conics – Construction of ellipse-Free hand sketching-Representation of Three Dimensional objects – General principles of orthographic projection – Need for importance of multiple views and their placement – First angle projection – layout views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

UNIT II PROJECTION OF POINTS, LINES
Projection of points, Projection of straight lines located in the first quadrant: inclined to both planes – Determination of true lengths and true inclinations – rotating line method only.

UNIT III PROJECTION OF SOLIDS
Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

UNIT IV SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES
Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other – Obtaining true shape of section. Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones
UNIT V ISOMETRIC VIEW AND PERSPECTIVE PROJECTION

Principles of isometric View – isometric scale – isometric view of simple solids- Introduction to Perspective projection

TEXT BOOKS:


REFERENCES:

AIM
To impart in basic knowledge in chemistry so that the student will understand the engineering concept.

OBJECTIVE
To learn the relevant experience using laboratory experiments.

OUTCOME
The student will have the experience in handling the instruments relevant to his/her theory.

List of Experiments

1. Estimation of total hardness of water sample by EDTA method.
2. Estimation of dissolved oxygen by Winkler’s method.
3. Estimation of ferrous ion by Potentiometry.
4. Precipitation reaction by Conductometry.
5. Acid base reaction by pH metry.
6. Estimation of copper from its ore.
7. Estimation of iron by spectrophotometer.
8. Estimation of sodium by flame photometer.
10. Corrosion experiment by weight loss methods.
### Aim:

To provide students with mathematical knowledge and skills needed to support their concurrent and subsequent engineering and science studies

### Objective:

- To provide the students with the concept and an understanding of Differential equations.
- To orient the students to know about the application of Harmonic analysis.
- To teach the students about the solutions of wave and heat equations.
- To motivate the students to know about the applications of Fourier Series
- To equip the students with the knowledge of descriptive and inferential statistics
- To Understand the various application design of experiments

### Outcome:

- Analyze the spectral characteristics of continuous time periodic and periodic signals using Fourier series.
- Gain the knowledge in vibrations of stretched strings.
- Develop the fundamental ideas of D Alembert’s solution of the wave equation
- Understand the concepts of Steady state conditions
- Use the applications of statistics in practical life
- Apply Probability Distributions logics to solve the problems
- Understand in collection, presentation and drawing conclusion about biological data
- Apply the subject knowledge in their engineering subjects

### UNIT-I PARTIAL DIFFERENTIAL EQUATIONS 12

Formation - Solutions of standard types \( f(p,q)=0 \), clairauts form, \( f(z,p,q)=0, f(p,x)=g(q,y) \) of first order equations - Lagrange's Linear equation - Linear partial differential equations of second and higher order with constant coefficients.

### UNIT-II FOURIER SERIES 12

Dirichlet's conditions - General Fourier series - Half-range Sine and Cosine series - Parseval's identity – Harmonic Analysis.

### UNIT-III BOUNDARY VALUE PROBLEMS 12

Classification of second order linear partial differential equations - Solutions of one - dimensional wave equation, one-dimensional heat equation - Steady state solution of two-dimensional heat equation - Fourier series solutions in Cartesian coordinates.

### UNIT-IV STANDARD DISTRIBUTIONS 12

UNIT-V STATISTICS

Measures of central tendency. Curve fitting-Straight line and Parabola by least square method, Correlation, Rankcorrelation and Regression.

Lecture Hours: 45; Tutorial Hours: 15; Total hours : 60

TEXT BOOKS:

REFERENCES
Aim  The aim of the subject is to provide a fundamental knowledge of thermodynamics.

Objective  1. To achieve an understanding of fundamentals of thermodynamic systems and first law of thermodynamics.
2. To provide an in-depth study of availability and second law of thermodynamics.
3. To understand the concept of working fluid and its properties.
4. To provide in-depth study of power cycles applying the different working fluids studied in the previous chapter.
5. To understand the Thermodynamic Relations and also to understand combustion equations.

Outcome  The students would understand the basic fundamentals in thermodynamics and its applications.

UNIT –I  BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS  9
Definition of Thermodynamics, macroscopic and microscopic approach, thermodynamic systems and surroundings, thermodynamic properties, thermodynamic equilibrium, state, path, process and cycle, reversible and irreversible processes, work, energy, and heat, state postulate and Zeroth law of thermodynamics, thermometer and thermometric property, temperature Scales.
Internal energy, First law of thermodynamics, perpetual motion machine of the first kind PMM I, application of first law to non-flow processes or closed system and related problems, application of first law to steady flow process, steady flow energy equation. Problems

UNIT –II  SECOND LAW OF THERMODYNAMICS  9

UNIT 3  PURE SUBSTANCES AND THERMODYNAMIC RELATIONS  9
Definition of pure substance, phase change of a pure substance, p-T diagram, p-V-T Surface, phase change terminology, property diagram in common use. Formation of steam, sensible heat, latent heat, dryness fraction, enthalpy, superheated steam, thermodynamic properties of steam and steam table, work, internal energy, entropy calculation, Mollier diagram, calorimeters for determination of dryness fraction. Problems determining thermodynamic properties of steam.
Thermodynamic relations: Thermodynamic potentials, thermodynamic gradients, general thermodynamics relations, entropy (Tds) equations, equations for internal energy and enthalpy, equation of state, coefficient of expansion and compressibility, specific heats, Joule Thomson coefficient, Clausius –Clapeyron equation, Maxwell’s relations.
UNIT 4: GASES AND VAPOUR MIXTURES

Ideal gas, equation of state for a perfect gas, Joules law, internal energy, enthalpy & specific heat capacities of an ideal gas, real gases, Van der waals equation – Amagats experiment, the cooling effect. Law of corresponding states, reduced properties, compressibility chart. Problem on calculation of properties ideal and real gases. Daltons law, Gibbs – Daltons law, volumetric analysis of a gas mixture, apparent molecular weight and gas constant, specific heats of a gas mixture, adiabatic mixing of perfect gases. Problems on gas mixture property values.

UNIT 5: FUELS AND COMBUSTION

Characteristics of an ideal fuel, properties of fuel, flash point, fire point, cloud point, pour point, viscosity, combustion reaction and combustion analysis, theoretical air and excess air, stoichiometric air fuel ratio, analysis of combustion products, internal energy and enthalpy of formation, calorific value, determination of calorific value of fuels, Junkers gas calorimeter, Orsat apparatus, exhaust gas analyser, problem on calculation of air fuel ratio.

TUTORIAL : 15 PERIODS
TOTAL HOURS : 60 PERIODS

TEXTBOOKS:
Aim | The aim of the subject is to provide a fundamental knowledge in manufacturing sector.
---|---
Objective | 1. To acquire the knowledge about mould making, metal melting and casting process.
 | 2. To acquire the knowledge about various metal joining processes.
 | 3. To acquire the knowledge about various hot and cold working processes.
 | 4. To acquire the knowledge about various sheet metal forming processes.
 | 5. To acquire the knowledge about various plastic processing.
Outcome | The students would understand the basic working principle of joining and cutting operations and can perform casting and welding process.

UNIT – I METAL CASTING PROCESSES

UNIT – II METAL JOINING PROCESS

UNIT – III BULK DEFORMATION PROCESSES
Hot and Cold working of materials - Forging: hot and cold forging, open and close forging, types forging machines, types of forging operations. Extrusion: hot and cold extrusion, forward and backward extrusion, types operations. Rolling: hot and cold rolling, types and operations, wire drawing and tube piercing. Drawing: Hot and cold drawing – sheet metal drawing, deep drawing, bar drawing, tube drawing, tube piercing, wire drawing, plastic drawing.

UNIT – IV SHEET METAL FORMING PROCESSES

UNIT – V PROCESSING OF PLASTICS

TOTAL HOURS : 45 PERIODS
39
TEXT BOOKS

REFERENCES

Contents beyond the syllabus:
1. Introduction about Friction stir process.
2. Stir casting process.
Aim
The aim of the subject is to provide a fundamental knowledge in fluid mechanics and machinery.

Objective
1. To learn the fundamentals in Fluid Mechanics
2. To understand the kinematics of the fluid flow.
3. To understand the fluid flow concepts
4. To learn the working principle, applications & design of various hydraulic turbines.
5. To learn the working principle, applications & design of various hydraulic pumps.

Outcome
The students would be able to understand the basic fluid properties and could understand the working principle of pumps.

UNIT –I - BASIC CONCEPTS AND PROPERTIES
Fluid – Definition - solid and fluid - Units and dimensions - Properties of fluids – Temperature - Viscosity - Compressibility - Vapour pressure - Capillary and surface tension - Fluid statics: concept of fluid static pressure - Pressure measurements by manometers and pressure gauges. Introduction to CFD, geophysical fluid dynamics. Velocity and density measurement methods.

UNIT –II - FLUID KINEMATICS AND SIMILARITIES
Fluid Kinematics - Flow visualization - Lines of flow - Types of flow - Velocity field and acceleration - Continuity equation (one and three dimensional differential forms)- Equation of streamline - Stream function - Velocity potential function - Circulation - Flow net – Fluid dynamics - Equations of motion - Euler's equation along a streamline - Bernoulli's equation – Applications - Venturi meter - Orifice meter - Pitot tube - Dimensional analysis - Buckingham's $\pi$ theorem- Applications - Similarity laws and models.

UNIT –III - INCOMPRESSIBLE FLUID FLOW

UNIT –IV - HYDRAULIC TURBINES

UNIT –V - HYDRAULIC PUMPS
TOTAL HOURS : 45 PERIODS

TEXT BOOKS

REFERENCES
Aim | The aim of the subject is to provide a fundamental knowledge in strength of materials
---|---
Objective | 1. To understand basic mechanical forces acting on rigid and deformable bodies.
2. To learn to draw shear force and bending moment diagram for various types of beams.
3. To learn the torsional effects on circular bars, shafts, helical spring.
4. To learn the deflection equations of beams and columns for different end conditions.
5. To learn the two dimensional stresses and deformation of cylinders and spherical shells.
Outcome | The students would understand the basic properties of materials and their testing methodologies.

UNIT –I -STRESS– STRAIN AND DEFORMATION OF SOLIDS 9

UNIT –II -BEAMS - LOADS AND STRESSES 9
Types of beams: Supports and Loads – Shear force and Bending Moment in beams – Cantilever- Simply supported and Overhanging beams – Stresses in beams – Theory of simple bending – Stress variation along the length and in the beam section – Shear stresses in beams.

UNIT –III –TORSION 9

UNIT –IV -DEFLECTION OF BEAMS 9

UNIT –V -ANALYSIS OF STRESSES IN TWO DIMENSIONS 9
Biaxial state of stresses – Thin cylindrical and spherical shells – Deformation in thin cylindrical and spherical shells – Biaxial stresses at a point – Stresses on inclined plane – Principal planes and stresses – Mohr’s circle for biaxial stresses – Maximum shear stress - Strain energy in bending and torsion.

TUTORIAL : 15
TOTAL HOURS : 60
TEXT BOOKS
REFERENCES
Aim

The aim of the subject is to provide a fundamental knowledge in kinematics of machines

Objective

1. To learn the basic mechanisms of kinematics.
2. To learn to calculate the velocity and acceleration of links using graphical and vectorial approach.
3. To study about Cams and to draw their profiles.
4. To learn about Gear terminology and types of gear trains.
5. To study about effect of friction in Transmission devices.

Outcome

The students would understand the basic link mechanisms and would draw cam profiles.

UNIT –I - BASICS OF MECHANISMS


UNIT –II - KINEMATICS OF LINKS


UNIT –III - KINEMATICS OF CAM

Classifications - Displacement diagrams-parabolic- Simple harmonic and Cycloidal motions - Layout of plate cam profiles - Derivatives of Follower motion - High speed cams - circular arc and tangent cams - Standard cam motion - Pressure angle and undercutting.

UNIT –IV - GEARS


UNIT –V – FRICTION

Surface contacts-Sliding and Rolling friction - Friction drives – Friction in screw threads - Friction clutches - Belt and rope drives- Friction aspects in Brakes – Friction in vehicle propulsion and braking.

TOTAL HOURS: 45 PERIODS
TEXT BOOKS

REFERENCES

STANDARDS
Aim | The aim of the subject is to provide a fundamental knowledge in Drawing Softwares
---|---
Objective | • To study about fits and tolerances and enable students apply them in assembly of components.
| • To make students assemble simple machine components, measure and create assembly drawings on A2 Sheets using Mini Drafter or using Computer Aided Drafting software.
---|---
Outcome | The students would be enable to learn the basic drafting procedures, allowances, 2D and 3D drawings.

INTRODUCTION TO MACHINE DRAWING


Fits - Terminology, classification, basic systems, selection of fits, Methods of indicating fits on drawing. Geometrical Tolerances.

1. Assembly Drawing using Mini Drafter – Universal Coupling
2. Assembly Drawing using Mini Drafter – Footstep Bearing
3. Assembly Drawing using Mini Drafter – Plummer Block

INTRODUCTION TO CAD SOFTWARE


4. 2D Drawing by using CAD software - Knuckle Joint
5. 2D Drawing by using CAD software – Gib and Cotter Joint
6. 2D Drawing by using CAD software - Screw Jack

INTRODUCTION TO 3D MODELING


7. 3D Modeling by using CAD software – Press tool Assembly
8. 3D Modeling by using CAD software – Bushed Bearing
9. 3D Modeling by using CAD software – Machine Vice
10. 3D Modeling by using CAD software – Piston and Connecting Rod

TOTAL HOURS: 45

TEXT BOOKS

REFERENCES
Aim  The aim of the subject is to provide make the students to understand the basic operations of lathe machine and drilling machine

Objective  To practice the various operations in lathe and drilling machine

Outcome  The students can perform operations in lathe and drilling machine.

LIST OF EXPERIMENTS

1. Exercise on plain turning and facing of given cylindrical MS specimen.
2. Exercise on step turning and chamfering.
3. Exercise on taper turning of given specification on a cylindrical specimen.
4. Manufacture of external or internal threads of given specification on a cylindrical Specimen.
5. Exercise on step turning with knurling of given specification on a cylindrical specimen
6. Exercise on drilling, boring and reaming on the given MS plate.
7. Exercise on eccentric turning in lathe on a given specimen.
8. Exercise on drilling with internal thread on a given specimen.

TOTAL  : 30
Aim | The aim of the subject is to provide make the students to understand the basic mechanism in hydraulics and strength of materials.

Objective | i) To understand the concepts of fluid mechanics and performances of various pumps
              ii) To get hands on experience to conduct testing of materials.

Outcome | The students can perform operations in hydraulic machineries and test various materials.

LIST OF EXPERIMENTS:
2. Determination of pipe loses (major & minor).
3. Conducting experiments and draw the characteristic curves of centrifugal pump/submersible pump/jet pump/reciprocating pump/Gear pump (any 3 pump experiments must be done).
4. Study about the performance characteristics of Pelton wheel and Francis turbine.
5. Determination of Tensile strength and Compression strength on a given specimen.
6. Determination of shear strength of Mild steel and Aluminium rods
7. Determination of Torsional strength of mild steel rod
8. Determination of Impact strength
9. Conduct of Hardness test on metals - Brinell and Rockwell Hardness.
10. Conduct of Deflection test on beams
### AIM
- To provide students with mathematical knowledge and skills needed to support their concurrent and subsequent engineering and science studies.

### Objective:
- To provide the knowledge in solving different types of equations.
- To apply appropriate numerical methods to solve a linear system of equations.
- To equip the students with interpolation, numerical differentiation and numerical integration techniques.

### Outcome:
The students will be able to
- Relate their subject knowledge with their experiments during their course of study.
- Understand the use of numerical methods in modern scientific computing with finite precision computation.
- Solve an algebraic or transcendental equation using an appropriate numerical method.
- Solve their engineering problems using interpolation techniques.
- Understand the calculation and interpretation of errors in numerical methods.
- Identify the numerical techniques for their engineering problem.

### UNIT-I

#### SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS


### UNIT-II

#### INTERPOLATION AND APPROXIMATION

Interpolation with Newton's divided differences, Lagrange's polynomial, Newton forward and backward differences, central difference Formula (Stirling’s and Bessel’s).

### UNIT-III

#### NUMERICAL DIFFERENTIATION AND INTEGRATION

Numerical differentiation with interpolation polynomials, Numerical integration by Trapezoidal and Simpson's (both 1/3rd and 3/8th) rules, Rombergs rule, Two and Three point Gaussian quadrature formula. Double integrals using Trapezoidal and Simpson's rule.
UNIT-IV
INITIAL VALUE PROBLEMS OF ODE

Solution of equations related to simple harmonic motion, Oscillations of a spring mass system, Simple pendulum, Oscillatory electrical circuit and Deflection of beams with initial conditions - using Taylor series. Euler, Modified Euler and Runge-Kutta methods.

UNIT-V
BOUNDARY VALUE PROBLEMS FOR ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS

Finite difference solution for the second order ordinary differential equations, Finite difference solution for one dimensional heat equation (both implicit and explicit). One dimensional wave equation and two dimensional Laplace and Poisson equations.

Lecture Hours: 45
Tutorial Hours: 15
Total hours : 60

TEXT BOOK

1. N.Subramanian, Numerical Methods, SCM Publishers, Erode.

REFERENCES

Aim  The aim of the subject is to provide knowledge in various mechanisms, vibrations and balancing of masses

Objective  
1. To study about forces acting on various parts of mechanisms.  
2. To learn static and dynamic balancing of masses.  
3. To study the characteristics of free and forced vibrations.  
4. To study and analyze various types of Governors and effect of gyroscopic forces.  
5. To learn about Cam Dynamics - velocity and displacement and acceleration.

Outcome  The students would be able to understand the operations of governors, cam dynamics and vibrations.

UNIT 1 Force Analysis  

UNIT –II BALANCING  
Static and dynamic balancing - Balancing of rotating masses - Balancing a single cylinder Engine - Balancing Multi-cylinder Engines - Partial balancing in locomotive Engines - Balancing linkages - balancing machines.

UNIT -III FREE VIBRATIONS  
Basic features of vibratory systems - idealized models - Basic elements and lumping of parameters - Degrees of freedom - Single degree of freedom - Free vibration - Equations of motion - natural frequency - Types of Damping - Damped vibration- critical speeds of simple shaft - Torsional vibration - Natural frequency of two and three rotor systems.

UNIT –IV FORCED VIBRATIONS  

UNIT – V MECHANISMS FOR CONTROL  
Gyroscopic Forces: Gyroscopic couple, Effect of Gyroscopic couple on vehicle; Applicatons of Gyroscopic forces. - Ships and airplanes

TUTORIAL :15  TOTAL HOURS :60
TEXT BOOKS

REFERENCES
Aim: The aim of the subject is to provide knowledge in cutting process of manufacturing sector.

Objective:
1. To understand the metal cutting processes.
2. To understand the types, construction and operations of lathes.
3. To gain the knowledge of different operations on special machines.
4. To understand the types and operations of sawing, broaching and gear cutting machines.
5. To learn the various machining processes that uses abrasives.

Outcome: The students would be able to operate lathe machines and special machines perform operations.

UNIT – I THEORY OF METAL CUTTING

UNIT – II CENTRE LATHE AND SPECIAL PURPOSE LATHES
Centre lathe- constructional features and various operations- taper turning methods- thread cutting methods-special attachments- machining time and power estimation.
Capstan and turret lathes - automats – Swiss type–automatic screw type.

UNIT – III SHAPER, PLANNER, MILLING AND DRILLING MACHINES

UNIT – IV SAWING - BROACHING AND GEAR CUTTING

UNIT – V ABRASIVE PROCESSES

TOTAL HOURS :45
TEXT BOOKS

REFERENCES
4. B.L.Juneja G.S.Sekhon nithsethan ”Fundamentals of metal cutting and machine tools”
SEMESTER | SUBJECT | L | T | P | C
---|---|---|---|---|---
IV | DISASTER MITIGATION AND MANAGEMENT | 3 | 0 | 0 | 3

**Aim**
To impart awareness on disasters and preparedness during disasters

**Objective**
1. To Understand basic concepts in Disaster Management
2. To Understand Definitions and Terminologies used in Disaster Management
3. To Understand the Challenges posed by Disasters
4. To understand Impacts of Disasters

**Outcome**
The students would be able to understand the various aspects of disasters and trained to face its challenges.

**UNIT 1 INTRODUCTION**
9
Concept of disaster; Different approaches; Concept of Risk; Levels of disasters; Disaster phenomena and events (*Global, national and regional*); Natural and man-made hazards

**UNIT 2 RISK ASSESSMENT AND VULNERABILITY ANALYSIS**
9
Response time, frequency and forewarning levels of different hazards; Characteristics and damage potential of natural hazards; hazard assessment; Dimensions of vulnerability factors; vulnerability assessment; Vulnerability and disaster risk; Vulnerabilities to flood and earthquake hazards

**UNIT 3 DISASTER MANAGEMENT MECHANISM**
9
Concepts of risk management and crisis management - Disaster management cycle; Response and Recovery; Development, Prevention, Mitigation and Preparedness-Planning for relief

**UNIT 4 DISASTER RESPONSE**
9
Mass media and disaster management-Disaster Response Plan; Communication, Participation, and Activation of Emergency Preparedness Plan-Logistics Management-Psychological Response-Trauma and Stress Management-Rumour and Panic Management-Minimum Standards of Relief-Managing Relief-Funding

**UNIT 5 DISASTER MANAGEMENT IN INDIA**
9
Strategies for disaster management planning; Steps for formulating a disaster risk reduction plan; Disaster management Act and Policy in India; Organisational structure for disaster management in India; Preparation of state and district disaster management plans
Text books


References

**Aim**
To integrate the basic laws of thermodynamics into thermal systems towards applications.

**Objective**
1. To provide thorough knowledge on internal combustion engines.
2. To inculcate advanced topics of internal combustion engines.
3. To understand the function and applications of air compressors and steam turbines.
4. To provide an in-depth knowledge of refrigeration systems functioning and applications.
5. To provide details of air conditioning methodologies available for domestic and industrial applications.

**Outcome**
The students would be able to understand the working principle of IC Engines, refrigeration systems.

**UNIT 1 : VAPOUR POWER CYCLES, STEAM NOZZLES, STEAM TURBINES**
Rankine cycles, effect of operating conditions on Rankine cycle efficiency, Modified Rankine cycle, regenerative cycle, reheat cycle, Binary Vapour cycle. Problems on Rankine cycle with reheat and regeneration conditions.
Steam nozzles, property calculation of steam flow through nozzles, metastable expansion of steam in a nozzle, steam injector. Problems for velocity and discharge calculation of steam.
Steam turbines, classifications, impulse and reaction turbine, compounding of steam turbines, bleeding, governing & control.

**UNIT 2 : GAS POWER CYCLES AND INTERNAL COMBUSTION ENGINES**
Air standard cycles, Carnot cycle, Otto cycle, Diesel cycle, Dual cycle, problems on determination of efficiency, mean effective pressure and work. Comparison of air standard cycles. Atkinson cycle, Ericsson cycle, Stirling cycle.

**UNIT 3 BRAYTON CYCLE, GAS TURBINES AND AIR COMPRESSORS**
Brayton cycle, gas turbines, classification, open cycle and closed cycle, Gas turbine fuels, Calculation of work output and efficiency on Brayton cycle, Application of gas turbine, problems on Brayton cycle.
Air compressors- classification, reciprocating air compressor, staging, calculation of work and efficiency, clearance in compressors, intercooler, applications. Rotary compressor, classification, centrifugal compressor, axial flow compressor, compressor characteristics – surging, choking and stalling. Problems on air compressor – single stage and multi stage.

**UNIT 4 : REFRIGERATION**
Refrigeration – refrigeration systems, methods of refrigeration, Air refrigeration system, Reversed carnot cycle, reversed brayton cycle, vapour compression refrigeration cycle, components and functions, factors affecting the performance, vapour absorption systems – components and functions, COP calculations, refrigerant- classifications, properties of an ideal refrigerant, common refrigerants and its applications.

**UNIT 5 : PSYCHROMETRICS AND AIRCONDITIONING**
Psychrometry - terms and psychometric relations, psychrometers, psychrometric charts, processes, mixing of air stream, sensible heating, sensible cooling, cooling and dehumidification, cooling and humidification, heating and humidification. Problems using psychrometric charts.


**TEXTBOOKS:**

**REFERENCES**
1. ARORA.C.P."Refrigeration and Air-conditioning,” Tata McGraw Hill,
5. MANOHAR PRASAD, Refrigeration and Air-conditioning – New Age International (P) Ltd, 1995

Content beyond the syllabus
- Six stroke engine
- Liquefaction of gases
AIM: To learn about the effect of environmental pollution due to industrialization and emergence of social issues and remedial measures

Objective:

- Understanding and appreciation of cultural aspects of society
- Understanding of professional and ethical responsibility of engineering practice
- Knowledge of contemporary issues

Outcome:
The student will come out with ethical responsibility in his/her profession

UNIT - I - ENVIRONMENT AND NATURAL RESOURCES  
Environment - Definition, Objective & importance - Public awareness- Forest resources, mineral resources, water resources, food resources, energy resources (uses, over-exploitation & adverse effects in each case) - Objective & role of environmental engineers in conservation of natural resources - Sustainability development.

UNIT - II - ECOSYSTEMS AND BIO – DIVERSITY  
Ecosystem - Definition, structure and function - Energy flow - Ecological succession - food chain, food web, ecological pyramids- Introduction, types, characteristics, structure and function of forest, grassland, desert and Aquatic ecosystems - Bio - Diversity: values and uses, hotspots, threats and conservation.

UNIT - III - ENVIRONMENTAL POLLUTION  

UNIT - IV - SOCIAL ISSUES AND ENVIRONMENT  
Urban problems related to energy - Water conservation – Resettlement and rehabilitation of people - Environmental ethics - Climate change - Global warming - Acid rain - Ozone depletion- Waste land reclamation, Environment Protection Act for air, water, wild life and forests - Pollution Control Board.

UNIT - V - HUMAN POPULATION AND ENVIRONMENT  

TEXT BOOKS:

REFERENCES:
2. Bharucha Erach "The Biodiversity of India" Mapin Publishing Pvt Ltd, Ahmedabad, India
**Aim**

The aim of the subject is to provide knowledge in mechanisms related to machine dynamics.

**Objective**

To understand about governors, GyroObjective, Speed measurement, spring mass system and compound pendulum

**Outcome**

The students would be able to understand the working principle of vibrations, balancing of masses.

1. To perform an experiment on Watt and Porter Governor to prepare performance characteristic curves and to find stability and sensitivity.
2. To determine the position of sleeve against controlling force and speed of a Hartnell governor and to plot the characteristic curve of radius of rotation.
3. To analyse the motion of a motorized gyroObjective when the couple is applied along its spin axis and determine gyroscopic couple.
4. Determine the Moment of Inertia by compound pendulum and tri-filar suspension.
5. To determine the frequency of undamped free vibration and damped forced vibration of an equivalent spring mass system.
6. To determine whirling speed of shaft theoretically and experimentally.
7. To analyse forced vibrations of a cantilever beam.
8. To determine the natural frequency of undamped torsional vibration of a single rotor shaft system.
9. To perform an experiment for static balancing on a static balancing machine.
10. To perform an experiment for dynamic balancing on a dynamic balancing machine.

**TOTAL HOURS** : 30
Aim | The aim of the subject is to provide knowledge in special machines.
---|---
Objective | To understand about operating principle of various special machines.
Outcome | The students would be able to get hands on training of the operations in shaper, grinder, milling machine, etc.

LIST OF EXPERIMENTS
1. Study of different machineries of special machines lab.
2. To shape a square rod from a round bar.
3. To manufacture a V-Groove in a given specimen.
4. To manufacture a hexagonal block from a given round stock.
5. To mill plain surfaces on the given specimen.
6. To manufacture a spur gear from the given blank in a Universal Milling Machine.
7. To manufacture a groove in a given rectangular bar stock and also do letter sink on it in a vertical milling machine.
8. To manufacture a keyway on a given specimen in a vertical slotting machine.
9. To grind a machined surface to the given specification in a universal cylindrical grinder.
10. To drill holes as per given dimensions and locations on the given specimen in a radial drilling machine and tap the hole for given thread dimension.

TOTAL HOURS : 30
### Aim
The aim of the subject is to provide knowledge in performance characteristics of internal combustion engine.

### Objective
To understand about characteristics of conventional and alternative fuels.

### Outcome
The students would be able to understand the importance of alternate fuels and their capability as alternate to fossil fuels.

| 1. Determination of Viscosity of the given specimen oil by using Red Wood Viscometer. |
| 2. Determination of Flash Point and Fire Point of the given fuel sample. |
| 3. Construction of actual valve timing diagram of a four stroke engine and comparison with Theoretical valve timing diagram. |
| 4. Construction of actual port timing diagram of a two stroke engine and comparison with Theoretical port timing diagram. |
| 5. Performance test on a four stroke single/twin cylinder diesel engine. |
| 6. Determination of frictional power of a four cylinder petrol engine by conducting a Morse test. |
| 7. Conduct a retardation test and determine frictional power in a diesel engine. |
| 8. Determination of the COP of a LPG refrigerator test rig. |

**TOTAL HOURS**: 30
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<td>V</td>
<td>DESIGN OF MACHINE ELEMENTS</td>
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(Use of approved Design Data Book is permitted in the University examination)

<table>
<thead>
<tr>
<th>Aim</th>
<th>The aim of the subject is to provide basic knowledge in designing various machine elements.</th>
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<tbody>
<tr>
<td>Objective 1. To understand basic design procedures, steady and variable stresses, failure Theories.</td>
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<td>2. To study the design concepts of shafts and couplings.</td>
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<td>3. To study the design parameters of fasteners and welded joints.</td>
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<td>4. To learn the design parameters of different types of springs and levers.</td>
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<td>5. To understand the design concepts of bearings and flywheel.</td>
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<tr>
<td>Outcome</td>
<td>The students would be able to design any machine elements with standard procedures and formulae.</td>
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</table>

UNIT 1: STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS 9
Introduction to the design process - factor influencing machine design- Direct- Bending and torsional stress equations -Calculation of principal stresses for various load combinations- Factor of safety - theories of failure – stress concentration – design for variable loading – Soderberg- Goodman and Gerber relations

UNIT 2: DESIGN OF SHAFTS AND COUPLINGS 9
Design of solid and hollow shafts based on strength- rigidity and critical speed – Design of rigid and flexible couplings

UNIT 3: DESIGN OF FASTENERS AND WELDED JOINTS 9

UNIT 4: DESIGN OF SPRINGS 9
Design of helical- leaf- disc and torsional springs under constant loads and varying loads – Concentric torsion springs

UNIT 5: DESIGN OF BEARINGS AND FLYWHEELS 9
Design of bearings – sliding contact and rolling contact types– Design of journal bearings calculation of bearing dimensions – Design of flywheels involving stresses in rim and arm.

TUTORIAL :15 TOTAL HOURS :60
TEXT BOOKS

REFERENCES
### Aim
The aim of the subject is to provide basic knowledge in materials behavior and metallurgy.

### Objective
1. To understand the classification, properties and application of various engineering materials.
2. To learn the heat treatment methodologies and mechanical treatment methodologies.
3. To understand the various deformation mechanisms, failure modes and phase diagram.
4. To understand the various forms of corrosion, protection methods.
5. To understand the basic concepts in powder metallurgy, composite materials and working of SEM.

### Outcome
The students would be able to understand the behavior of materials, their heat and mechanical treatment.

### UNIT I METALLIC & NON-METALLIC MATERIALS

### UNIT II BEHAVIOR OF MATERIALS

### UNIT III MATERIAL TREATMENT
Heat treatment- annealing, Normalizing- hardening and Tempering, Case hardening, Hardenability - Jominy end quench test. Mechanical Treatment-strengthening mechanisms-strain hardening, solid solution hardening, grain size reduction

### UNIT IV CORROSION
Introduction- forms of corrosion-pitting, intergranular, stress corrosion, corrosion fatigue, dezincification, erosion-corrosion, Crevice Corrosion, Fretting-Protection methods-PVD, CVD.

### UNIT V ADVANCED MATERIALS & CHARACTERIZATION
Powder metallurgy –powder production, blending, compaction, sintering-applications. Composites-Types-MMC, PMC, CMC-properties & applications. SEM-working principle, set-up, sample preparation method-evaluation mode-EDAX

### TOTAL HOURS
45
TEXT BOOKS

REFERENCE BOOKS
2. George E.Dieter, “Mechanical Metallurgy”
Aim
The aim of the subject is to provide basic knowledge in instrumentation and measurements.

Objective
1. To understand the basic measurement system.
2. To understand the various instruments used for linear and angular measurement.
3. To understand the various instruments used for form measurement and surface finish.
4. To understand the principle, applications and advancements of laser.
5. To understand the various instruments to acquire the data and store in computer.

Outcome
The students would be able to understand the working principle of various measuring instruments.

UNIT 1. BASIC PRINCIPLES & LINEAR / ANGULAR MEASUREMENT

UNIT 2 : DISPLACEMENT, SPEED & ACCELERATION / VIBRATION MEASUREMENT

UNIT 3 : TEMPERATURE, PRESSURE AND FLOW MEASUREMENT

UNIT 4 : FORCE, TORQUE, & STRAIN MEASUREMENTS

UNIT 5 : FORM MEASUREMENTS AND OPTICAL MEASUREMENTS


TOTAL HOURS 45

TEXTBOOKS:

REFERENCES;
Aim | The aim of the subject is to provide knowledge in gas dynamics and jet propulsion.
---|---
Objective | 1. To understand the basics of compressible flow and its significance.
2. To understand flow through variable areas ducts and the significance of flow through nozzles and diffusers.
3. To understand flow through constant area ducts and its significance.
4. To provide a basic understanding of normal shock behavior.
5. To provide an overview of jet propulsion technology and its basics.
Outcome | The students would be able to understand the gas dynamics and various propulsion systems.

1. **COMPRESSIBLE FLOW – FUNDAMENTALS** | 8

2. **FLOW THROUGH VARIABLE AREA DUCTS** | 8
Isentropic flow through variable area ducts - T-s and h-s diagrams for nozzle and diffuser flows - Area ratio as a function of Mach number - Mass flow rate through nozzles and diffusers - Effect of friction in flow through nozzles.

3. **FLOW THROUGH CONSTANT AREA DUCTS** | 9
Flow in constant area ducts with friction (Fanno flow) – Fanno curves and Fanno flow equation - variation of flow properties - variation of Mach number with duct length.
Isothermal flow with friction in constant area ducts. Flow in constant area ducts with heat transfer (Rayleigh flow) - Rayleigh line and Rayleigh flow equation - variation of flow properties - Maximum heat transfer.

4. **NORMAL SHOCK** | 10
Governing equations - Variation of flow parameters like static pressure, static temperature, static density, stagnation pressure and entropy across the normal shock - Prandtl-Meyer equation - impossibility of shock in subsonic flows - flow in convergent and divergent nozzle with shock - normal shock in Fanno and Rayleigh flows, flow with oblique shocks.

5. **PROPULSION** | 10
Jet Propulsion: Aircraft propulsion – types of jet engines – energy flow through jet engines - performance of turbo jet engines – thrust - thrust power - propulsive and overall efficiencies - thrust augmentation in turbo jet engine - ram jet and pulse jet engines
Space Propulsion: Types of rocket engines - Propellants - Ignition and combustion - Theory of rocket propulsion –Terminal and characteristic velocity - Applications - Space flights.

**TOTAL HOURS**: 45
TEXTBOOKS

REFERENCES
3. RATHAKRISHNAN.E- “Gas Dynamics”- Prentice Hall of India- New Delhi- 2001
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<td>ELECTRICAL MACHINES AND DRIVES</td>
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**Aim**  
The aim of the subject is to provide basic knowledge in electrical machines and drives.

**Objective**  
- To study the basic concept of D.C. and A.C. circuits and to learn the concept of transformers and do simple problems.
- To study the performance characteristics of D.C. motors, three phase induction motor and single phase induction motor.
- To study the methods of speed control of D.C. and A.C. motors and methods of starting of D.C. and A.C. motors.
- To study the basics of selection of drive for a given application.
- To study the concept of controlling the speed of D.C. and A.C. motors using solid state devices.

**Outcome**  
The students would be able to understand the working principle of various drives.

**UNIT I CIRCUITS AND TRANSFORMERS**  

**UNIT II ELECTRICAL MOTORS**  
Constructional details, principle of operation and performance characteristics of D.C. motors, single phase induction motor, three phase induction motor, synchronous motors, universal motors, stepper motors and reluctance motor.

**UNIT III SPEED CONTROL AND STARTING**  

**UNIT IV ELECTRICAL DRIVES**  
Type of Electrical Drives – Selection & factors influencing the selection – heating and cooling curves – loading condition and classes of duty – determination of power rating – simple problems.

**UNIT V SOLID STATE DRIVES (QUALITATIVE TREATMENT ONLY)**  

**TOTAL: 45 PERIODS**
TEXT BOOK

REFERENCES
Aim | The aim of the subject is to provide basic knowledge in working principles of various measuring instruments.
---|---
Objective | To expose the students the measurement systems and its procedures.
Outcome | The students would be able to understand the working principle of various equipments and their applications.

1. Temperature measurement using a Thermocouple.
2. Displacement measurement using a Linear Variable Differential Transformer (LVDT).
3. Speed measurement using Stroboscope.
6. Angular Measurements using Bevel Protactor and Sine Bar.
8. Straightness measurement using an autocollimator.
10. Fundamental dimension measurement of a gear using a contour projector.
Aim
The aim of the subject is to provide basic knowledge in physical metallurgy - metallography.

Objectives
1. To get a basic understanding of microstructures of specimens of different materials
2. To understand the process of heat treatment.

Outcome
The students would be able to understand the characteristics, applications of various metals and also about the heat treatment processes.

LIST OF EXPERIMENTS

1. Introduction to Metallography
2. Preparation of Metallographic specimen
3. Identification of Ferrous specimens (minimum 4)
4. Identification of Non-Ferrous specimens (minimum 2)
5. Heat treatment – Annealing- comparison between annealed and un heat treated specimen
6. Heat treatment – Normalizing- comparison between normalized and un heat treated specimen
7. Heat treatment – Hardening- comparison between hardened and un heat treated specimen
8. Heat treatment -Tempering- comparison between hardened and un heat treated specimen
   (For heat treatment experiments low carbon steel could be used)
Aim  The aim of the subject is to provide basic knowledge in working principles of electrical drives.

Objective  To expose the students the operation of electric drives and give them hands on experience.

Outcome  The students would be able to understand the working principle of various electrical drives, their performance characteristics.

LIST OF EXPERIMENTS

1. Load test on D.C. shunt motor
2. Speed control of D.C. shunt motor
3. Swinburne’s test
4. Load test on three phase induction motor
5. Load test on single phase induction motor
6. Performance characteristics of single phase transformer
7. AC to DC half and fully controlled converter
8. IGBT based choppers
9. IGBT based PWM inverter
10. Converter - DC motor drive
11. Inverter fed induction motor drive
**Aim**  
The aim of the subject is to provide an overview of a complete automobile engineering.

**Objective**  
1. To study construction and working of different engine components.  
2. To study about the different auxiliary systems of an automobile.  
3. To study about the transmission system of an automobile.  
4. To understand the different types of steering, brakes and suspension systems of an automobile.  
5. To study the various modern alternate technologies of automobiles.

**Outcome**  
The students would be able to understand the various parts of automobiles and mechanisms.

**UNIT I VEHICLE STRUCTURE AND ENGINES**  
9  
Types of automobiles, vehicle construction and different layouts, chassis, frame and body, resistances to vehicle motion and need for a gearbox, components of engine-their forms, functions and materials

**UNIT II ENGINE AUXILIARY SYSTEMS**  
9  
Electrically controlled gasoline injection system for SI engines. Electrically controlled diesel injection system (Unit injector system, Rotary distributor type and common rail direct injection system), Electronic ignition system, Turbo chargers, Engine emission control by three way catalytic converter system.

**UNIT III TRANSMISSION SYSTEMS**  
9  
Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, over drive, transfer box, fluid flywheel –torque converter, propeller shaft, slip joints, universal joints, Differential, and rear axle, Hotchkiss Drive and Torque Tube Drive.

**UNIT IV STEERING, BRAKES AND SUSPENSION SYSTEMS**  
9  
Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, Anti lock. Braking System and Traction Control

**UNIT V ALTERNATIVE TECHNOLOGIES**  
9  

**TOTAL HOURS**  
: 45
TEXT BOOKS

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<td>VI</td>
<td>HEAT AND MASS TRANSFER</td>
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<tr>
<th>Aim</th>
<th>The aim of the subject is to provide knowledge in heat and mass transfer</th>
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<tbody>
<tr>
<td>Objective</td>
<td>1. To study about conduction mode of heat transfer.</td>
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<td>2. To study about transient mode of heat transfer.</td>
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<td>3. To study about convection mode of heat transfer</td>
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<td>4. To study about radiation mode of heat transfer and heat exchanger</td>
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<td>5. To study heat transfer with mass transfer</td>
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<td>Outcome</td>
<td>The students would be able to understand the basic concepts in heat power systems, integration of thermodynamics in heat power systems.</td>
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UNIT –I  CONDUCTION - I
Fourier law of conduction, General equation in Cartesian, Cylindrical and Spherical coordinates one dimensional steady state conduction across plane wall - composite wall – Composite cylinder – Composite sphere with convection boundaries, overall heat transfer coefficients, and critical thickness of insulation, conduction with generation, thermal contact resistance, and variable conductivity.

UNIT –II  CONDUCTION - II
Fins or extended surfaces- Pin fins, annular fins, longitudinal fins.Unsteady state conduction – lumped capacity system, semi – infinite solids and multi dimensional systems, numerical solutions of two-dimensional steady and unsteady conduction.

UNIT –III CONVECTION

UNIT –IV  RADIATION AND HEAT EXCHANGERS

UNIT –V  MASS TRANSFER AND HEAT PIPES
Fick’s law, Equimolar diffusion, Stefan’s law, mass transfer coefficient, non-dimensional number used in mass transfer, atmospheric evaporation. Problems.
Heat pipes – Introduction, Types and applications.

TUTORIAL HOURS: 15; TOTAL HOURS: 60
TEXT BOOKS
1. KOTHANDARAMAN C.P “Fundamentals of Heat and Mass Transfer” New Age International-
2. SACHDEVA R C- “Fundamentals of Engineering Heat and Mass Transfer” New Age International

REFERENCES
**Aim**
The aim of the subject is to provide knowledge in various transmission system design principle.

**Objective**
1. To study the design procedure for power transmission by belt, ropes and pulleys.
2. To study the design procedure for spur and helical gears.
3. To study the design procedure for bevel, worm and cross helical gears.
4. To study the design procedure for various types of gear box.
5. To study the design procedure for clutches and brakes.

**Outcome**
The students would be able to understand the design of belts, gears and gear boxes.

**UNIT – I - DESIGN OF TRANSMISSION SYSTEMS FOR FLEXIBLE ELEMENTS**  
Selection of Flat belts and pulleys-Selection of V belts and pulleys – Wire ropes and pulleys – Selection of Transmission chains.

**UNIT – II -SPUR GEARS AND HELICAL GEARS**  
Gear Terminology-Gear materials -power rating calculations based on strength and wear considerations - Parallel axis Helical Gears. Simple gear design procedure.

**UNIT – III –BEVEL GEARS AND WORM GEARS**  
Straight bevel gear-. Estimating the dimensions of pair of straight bevel gears. Simple gear design procedure.  
Worm Gear- terminology. -Forces and stresses- efficiency- estimating the dimensions of the worm gear pair. Simple gear design procedure.

**UNIT – IV -DESIGN OF GEAR BOXES**  
Geometric progression - Standard step ratio - Ray diagram- kinematics layout — Design of multi speed gear box, simple gear box design problems (No. of speeds not more than 14).

**UNIT – V -DESIGN OF CLUTCHES AND BRAKES**  
Design of plate clutches –axial clutches-cone clutches- internal and external shoe brakes-simple problems.

**TUTORIAL : 15**

**TOTAL HOURS : 60**

**TEXT BOOKS**

**REFERENCES**
Aim | The aim of the subject is to provide knowledge in computer integrated manufacturing

Objective | 1. To understand the importance of CIM and business aspects  
3. To gain knowledge about GT and CAPP  
4. To enable student to learn about FMS and SFC  
5. To understand about architecture and network concepts

Outcome | The students would be able to understand the various concepts viz. group technology, CAPP, FMS.

UNIT I INTRODUCTION TO CAD/CAM | 9
The design process Morphology of design, Product cycle Computer Aided Design, Benefits of CAD. Role of computers - principles of computer graphics - Current trends in manufacturing engineering - Design for Manufacturing and Assembly - Sequential and concurrent engineering, Rapid prototyping

UNIT II SOLID MODELING | 9
Graphic software: coordinate representation- graphic functions, software standards. Graphical Kernel system (GKS) - Initial graphics exchange system (IGES) - Graphic packages. Geometric Modeling - Wire frame, Surface and Solid models - Constructive Solid Geometry (CSG) and Boundary Representation (B-REP) Techniques - Features of Solid Modeling Packages.

UNIT III FUNDAMENTALS OF CNC MACHINES | 9

UNIT IV GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING | 10

UNIT V SHOP FLOOR CONTROL AND INTRODUCTION OF FMS | 9
Shop floor control-phases -factory data collection system -automatic identification methods- Bar code technology-automated data collection system. MS-components of FMS - types -FMS workstation -material handling and storage systems- FMS layout -computer control systems-application and benefits.

Total Hours | 45
TEXT BOOKS


REFERENCES

Aim | The aim of the subject is to create ethics and inculcate right virtues.
---|---
Objective | To create an awareness on Ethics and Human Values in engineering professions and to inspire moral and social values and Loyalty to appreciate the rights of others.
Outcome | The students would be able to understand the responsibility of every citizen and right virtues.

Unit – I: HUMAN VALUES

Unit – II: ENGINEERING ETHICS

Unit – III: ENGINEERING AS SOCIAL EXPERIMENTATION
Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - the challenger case study.

Unit – IV: SAFETY, RESPONSIBILITIES AND RIGHTS

Unit – V: GLOBAL ISSUES
Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of electronics and telecommunication engineers (IETE),India, etc.

Total Hours 45
TEXT BOOK

REFERENCES
Aim: The aim of the subject is to provide basic knowledge in working of CNC machines.

Objective:
1. To gain knowledge about CNC programming
2. To get the hands on training in CNC trainer machines
3. To simulate various CNC machining and generate codes using CAM software

Outcome: The students would be able to operate CNC machine using part programming.

Introduction:

1. Study of G and M codes
3. Machining practice on Trainer Type CNC Machines-
4. Simulation of tool path using any CAM Software

Part programming in CNC Milling:

1. Point to point motions
2. Linear motions
3. Circular interpolations
4. Contour motions
5. Rectangular pocketing
6. Mirroring
7. Circular Pocketing
8. Fixed /canned cycles
9. Subroutines

Part programming for CNC Turning:

1. Turning and facing
2. Step turning, Taper Turning
3. Grooving
4. Fixed/Canned Cycles :
5. Thread cutting Cycles
6. Peek Drilling Cycles
Aim | The aim of the subject is to provide basic knowledge in heat transfer systems.
---|---
Objective | To gain knowledge in various heat transmissions systems and modes viz, conduction, convection and radiation.
Outcome | The students would be able to understand the modes of heat transfer with hands on training.

1. To determine the thermal conductivity of a lagged pipe.
2. To determine the thermal conductivity of a solid by the guarded hot plate method.
3. To determine the heat transfer through composite wall apparatus.
4. To find the effectiveness of a pin fin in a rectangular duct under natural convective & forced convective condition and plot temperature distribution along its length.
5. To determine the surface heat transfer coefficient for a heated vertical tube under natural convection and plot the variation of local heat transfer coefficient along the length of the tube. Also compare the results with those of the correlation.
6. To determine average heat transfer coefficient for an externally heated horizontal pipe under forced convection & plot Reynolds and Nusselt numbers along the length of pipe. Also compare the results with those of the correlations.
7. To measure the emissivity of the gray body (plate) at different temperature and plot the variation of emissivity with surface temperature.
8. To find overall heat transfer coefficient and effectiveness of a heat exchange under parallel & counter flow conditions. Also plot the temperature distribution in both the cases along the length of heat exchanger.
9. To verify the Stefan-Boltzmann constant for thermal radiation.
10. Study and demonstration of boiler.
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**Aim**  
The aim of the subject is to provide overall knowledge about automobile engineering.

**Objective**  
To study about the various parts of an automobile.

**Outcome**  
The students would be able to understand the assembly and disassembly of various automobile Parts and also about other mechanisms.

**List of Experiments:**

1. Dismantling and assembling of Compression Ignition diesel engine.
2. Dismantling and assembling of Petrol engine.
3. Dismantling and assembling of Mesh Type gear box.
4. Dismantling and assembling of Rear Axle assembly with Differential.
5. Study of simple Carburetor by dismantling and assembling.
6. Dismantling and assembling of S.U.Carburetor
7. Study of engine Self Starting system.
10. Study of Differential Gear.
11. Study of diesel fuel supply system
Aim | The aim of the subject is to provide knowledge about various fluid power systems
---|---
Objective | 1. To study about basics of fluid power systems  
2. To gain knowledge about components used in hydraulic and pneumatic systems  
3. To learn various valves and actuators  
4. To learn about different hydraulic circuits  
5. To learn about different pneumatic circuits
Outcome | The students would be able to understand the applications of hydraulics and pneumatic systems.

UNIT I FLUID POWER SYSTEMS AND FUNDAMENTALS 9

Introduction to fluid power, Advantages and Applications of fluid power system. Types of fluid power systems, Properties of fluids – General types of fluids – Fluid power symbols. Basic Laws in Fluid power system. Low cost automation.

UNIT II HYDRAULIC SYSTEM & PNEUMATIC SYSTEMS 9

Pump classification – Gear pump, Vane Pump, piston pump, construction and working of pumps – Variable displacement pumps.  
Pneumatic Components: Compressors-types. Filter, Regulator, Lubricator Unit, Muffler – Air control valves, Quick exhaust valves.

UNIT III VALVES AND ACTUATORS 9


UNIT IV DESIGN OF HYDRAULIC CIRCUITS 9


UNIT V DESIGN OF PNEUMATIC CIRCUITS 9


TOTAL HOURS : 45
TEXT BOOKS:
1. Hydraulicas And Pneumatic Controls, Srinivasan, TMH

REFERENCES:
Aim | The aim of the subject is to provide knowledge in finite element analysis.
---|---
Objective | 1. To understand the basics of Finite element techniques and 1D element equation formulation  
2. To gain knowledge about 2D problems in structural and Thermal  
3. To enable student to learn about Natural coordinates and Iso-Parametric Elements  
4. To understand about Elasticity concepts and Virtual work  
5. To study about dynamic analysis
---|---
Outcome | The students would be able to understand the basic concepts in mathematical problem analysis.
---|---

UNIT I: INTRODUCTION TO FINITE ELEMENT METHODS (12)


UNIT II: ONE-DIMENSION PROBLEMS (12)

Finite element modeling-coordinates and shape functions-potential energy approach-Galerkin method-Element matrices and vectors-Assembly for global equations- Boundary conditions-Higher order elements-Shapes function-Application to axial loadings of rods-Extension to plane trusses-Bending of beams-Finite element formulation of stiffness matrix and load vectors-Assembly to global equations-Boundary conditions-Solutions and post processing –Example problems

UNIT III: TWO DIMENSION SCALAR VARIABLE PROBLEMS (12)

Finite element modeling-Element equations-Load vectors and boundary condition-Assembly-Applications to scalar variable problems such as torsion, heat transfer, etc.,-Examples

UNIT IV: TWO DIMENSION VECTOR VARIABLE PROBLEMS (12)

Vector variable problems-Elasticity equations-Plane stress, Plane strain and Axissymmetric problems-CST and LST Elements-Formulation-Element matrices-Assembly-Boundary conditions and solutions-Examples

UNIT V: ISOPARAMETRIC ELEMENT FORMUALTIONS (12)

Natural coordinates-Isoparametric elements-Elements shapes functions-Element equations-Gaussian quadrature-Examples
Text Books:

REFERENCE BOOKS:
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<tr>
<td>VII</td>
<td>RENEWABLE SOURCES OF ENERGY</td>
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**Aim**
The aim of the subject is to provide an overview of availability of renewable energy.

**Objective**
1. To impart the importance of solar energy.
2. To inculcate the importance of wind energy.
3. To know the importance of bio energy.
4. To know various renewable energy power plants.
5. To impart the necessity of latest and modern energy sources.

**Outcome**
The students would be able to understand the availability, utilization and conservation of renewable energy sources.

**UNIT I SOLAR ENERGY**

**UNIT II WIND ENERGY**
Fundamentals of wind resource-site selection criteria-instruments-data analysis, frequency distribution
Wind energy conversion principles; General introduction- Aerodynamic principle-types and classification of wind electric conversion system-water pumping wind mill performance characteristics-small wind turbine design and performance characteristics study.

**UNIT III BIO–ENERGY**

**UNIT IV OTEC, TIDAL, GEOTHERMAL AND HYDEL ENERGY**

**UNIT V NEW ENERGY SOURCES**

**TOTAL:** 45 hours
TEXT BOOKS:

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<tr>
<td>VII</td>
<td>MECHATRONICS</td>
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**Aim**
The aim of the subject is to provide knowledge about mechatronics system - an integration.

**Objective**
1. To study about basic electronic components and to design circuits for mechanical applications.
2. To study about sensors and transducers and their significant applications in mechanical engineering applications.
3. To study about the microprocessor and microcontroller architecture and its important applications in machineries and automotives.
4. To study about programmable logic controller and to develop applications for mechanical systems.
5. To study designing of Mechatronic systems for automotive, electronic appliances etc.

**Outcome**
The students would be able to understand the automation principle, sensors, relays and their applications.

**UNIT – I - INTRODUCTION**

**UNIT – II - SENSORS AND TRANSDUCERS**
Transducers – Classification, selection, resistive, capacitive and inductive transducers, piezo-electric transducers, optical and digital transducers. Transducers for Measurement - displacement, temperature, level, flow, pressure, velocity, torque, speed.

**UNIT – III - MICROPROCESSOR AND MICROCONTROLLERS**
8051 Microcontroller – Signals, Operational features, Memory and I/O addressing, Interrupts, serial communication, and instruction set. Applications in cutting machinery and automotives.

**UNIT – IV - PROGRAMMABLE LOGIC CONTROLLERS**
Introduction-Basic structure-Input/Output Processing-Programming-Mnemonics-Timers- Internal relays and counters-Data handling-Analog Input/Output-Selection of a PLC. SCADA, Industrial applications of PLC in conveyor systems, product line automations etc.

**UNIT – V - DESIGN OF MECHATRONICS SYSTEMS**
Stages in designing mechatronic systems, traditional and mechatronic design, possible design solutions. Design of following mechatronic systems - Pick and place robot, automatic car park system, engine management system, machinery automation.

**TOTAL HOURS : 45 PERIODS**
TEXT BOOK:

REFERENCES:
SEMESTER | SUBJECT | L | T | P | C
---|---|---|---|---|---
VII | FINITE ELEMENT ANALYSIS LAB | 0 | 0 | 4 | 2

**Aim**  
The aim of the subject is to provide hands on experience in finite element analysis software.

**Objective**  
To gain knowledge in various procedures in drafting and analysing a component using FEA software.

**Outcome**  
The students would be able to understand and analyse any component using software.

**LIST OF EXPERIMENTS:**

1. Study of analysis and its benefits
2. Application of distributed loads
3. Nonlinear analysis of a cantilever beam
4. Buckling analysis
5. Stress analysis of cantilever beam
6. Stress analysis of axi-symmetry vessels
7. Stress analysis of two dimensional truss
8. Transient thermal conduction
9. Simple conduction
10. Plane stress bracket
11. Modal analysis of a cantilever beam
12. Harmonic analysis of a cantilever beam
Aim | The aim of the subject is to provide overall knowledge about automation sector.

Objective | To train the students with hands-on experience in fluid power systems and automation.

Outcome | The students would be able to understand the operation of various logical sequence with software.

LIST OF EXPERIMENTS:

1. Design and testing of fluid power circuits to control
   (i) Velocity (ii) direction and
   (iii) force of single and double acting actuators
2. Design of circuits with logic sequence using Electro pneumatic trainer kits.
3. Simulation of basic Hydraulic, Pneumatic and Electric circuits using software
4. Design and Testing of Circuits with multiple cylinder sequences in Electro pneumatic using PLC.
AIM: To translate the theoretical concept into practical output at small level

OBJECTIVE

- The objective of the mini project work is to enable the students to form the groups of not more than 4 members on a project involving the activity based learning concept and to design a model/mechanism related to the branch of study.

OUTCOME: To learn the concept of design, manufacture and assembly

- Formation of Group as follows
  - Category A: 8.5CGPA and above
  - Category B: 7 to 8.49 CGPA
  - Category C: 5 to 6.9 CGPA
    A group will be formed with at least one student from each category.

- Every mini project work shall have a guide who is the member of the faculty of the institution. Three periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the mini project.
AIM : To translate the theoretical concept into practical output

OBJECTIVE

- The objective of the project work is to enable the students to form the groups of not more than 4 members on a project involving theoretical and experimental studies related to the branch of study.

OUTCOME:

- The outcome of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer or management project or a design problem.

- This final report shall be typewritten form as specified in the guidelines.

- Every project work shall have a guide who is the member of the faculty of the institution. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.

- Formation of Group as follows
  - Category A : 8.5CGPA and above
  - Category B : 7 to 8.49 CGPA
  - Category C : 5 to 6.9 CGPA
    A group will be formed with atleast one student from each category.

- The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department.

- Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion.

- The continuous assessment shall be made as prescribed in the regulations
ELECTIVE SUBJECTS
Objectives:

- Linear Programming is useful in finding either maximum or minimum of an expression subject to given constraints
- To minimize the cost of transporting items from various sources to different destinations
- When number of activities are to be carried out most economical way with less time consumptions can be found
- Inventory is essential to provide flexibility in operating a system or organization.
- Decision making is an integral part of any business organization. It uses to select the best among several decisions through a proper evaluation of the parameters of each decision environment

1. Linear programming

2. Transportation model
   Transportation problem – Assignment problem – Under Assignment - Traveling salesman problem

3. Network model

4. Inventory Models
   Inventory Model – Economic Order Quantity Model – Purchasing Model (with and without shortages) – Manufacturing Model (with and without shortages) - Stochastic Inventory Model (Stock in discrete and continuous units).

5. Decision Model

   Tutorial : 15
   Total Hours : 60

TEXT BOOK

REFERENCES:
Objectives:
1. To understand the importance of refrigeration cycle.
2. To know about various refrigerants.
3. To explain the principles of psychrometry.
4. To understand various AC systems.
5. To understand various new and unconventional refrigeration systems.

UNIT I REFRIGERATION CYCLE

UNIT II REFRIGERANTS AND SYSTEM COMPONENTS

UNIT III PSYCHROMETRY

UNIT IV AIR CONDITIONING SYSTEMS
Cooling load calculation - working principles of centralized air conditioning systems, split, ductable split, packaged air conditioning, VAV & VRV Systems. Duct Design by equal friction method, Indoor Air quality concepts.

UNIT V UNCONVENTIONAL REFRIGERATION CYCLES
Vapor Absorption system – Ejector jet, Steam jet refrigeration, and Thermo electric refrigeration - applications. Ice plant – food storage plants – milk – chilling plants.

TOTAL HOURS :45

TEXT BOOKS:

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<tr>
<td>UNCONVENTIONAL MANUFACTURING PROCESSES</td>
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**Objectives:**
1. To gain knowledge and understanding of basic concepts of unconventional machining processes
2. To impart the knowledge and understanding of various mechanical methods
3. To impart the knowledge and understanding of electrical energy based processes
4. To impart the knowledge and understanding of chemical and hybrid processes
5. To impart the knowledge and understanding of thermal energy based processes

**UNIT I ** INTRODUCTION

**UNIT II MECHANICAL ENERGY BASED PROCESSES**
9

**UNIT III ELECTRICAL ENERGY BASED PROCESSES**
10

**UNIT IV CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES**
10
Chemical machining and Electro-Chemical Machining- Electro Chemical Grinding and Electro chemical Honing- working principle and applications- Process Parameters - Surface finish and MRR - Etchants – Maskants.

**UNIT V THERMAL ENERGY BASED PROCESSES**
10
Laser Beam Machining and drilling, Plasma Arc Machining and Electron Beam Machining Working principles & Applications – Equipment – Types - Beam control techniques. Micromachining and Nanofabrication Techniques

**TOTAL HOURS** 45

**TEXT BOOKS:**

**REFERENCES:**
Objectives:
1. To learn the basics about Robotics and Robot manipulation in space.
2. To understand the controlling of Robots and devices system.
3. To learn the Sensor technology
4. To learn the knowledge of Robot programming and Expert system.
5. To understand about Robot cell design, applications and economics

UNIT I  FUNDAMENTALS OF ROBOT  7

UNIT II  ROBOT DRIVE SYSTEMS AND END EFFECTORS  10

UNIT III  ROBOT SENSORS  9

UNIT IV  ROBOT KINEMATICS AND ROBOT PROGRAMMING  10
Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional), Four Degrees of Freedom (In 3 Dimensional) – Deviations and Problems. Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End Effectors commands and simple programs.

UNIT V  CELL DESIGN APPLICATIONS AND ECONOMICS OF ROBOTICS  9
Economic Analysis of Robots – Pay back Method, EUAC Method, and Rate of Return Method.

TOTAL HOURS  :  45
Text Books:
2. Fu.K.S., Cgonzalez R. Lee C.S.G., “Robotics Control, Sensing, Vision and Intelligence” Mc Graw hill,
Reference Books:
Objectives:
1. To learn about SI engines.
2. To learn about CI engines.
3. To learn to control various pollutants.
4. To know about various alternative fuels.
5. To know various latest trends in automobiles.

1. SPARK IGNITION ENGINES

2. COMPRESSION IGNITION ENGINES

3. POLLUTANT FORMATION CONTROL

4. ALTERNATIVE FUELS

5. RECENT TRENDS

TOTAL HOURS : 45

TEXT BOOK:

REFERENCES:
1. R.B.Mathur and R.P.Sharmal- “Internal Combustion Engines ".
Objectives:
1. To introduce the importance of cryogenic engineering.
2. To study the low temperature refrigeration system.
3. To study the gas separation systems.
4. To know the vacuum technology.
5. To understand about cryogenic storage.

UNIT 1 CONSTRUCTION DETAILS AND HEAT TRANSFER


UNIT II LIQUEFACTION AND LOW TEMPERATURE REFRIGERATION


UNIT III SEPARATION AND PURIFICATION SYSTEMS

General characteristics of mixtures-composition diagrams. Gas separation-principles of rectification-flash calculations - Rectification column analysis- Flash calculations.

UNIT IV INSULATION AND VACUUM TECHNOLOGY

Thermal insulation and their performance at cryogenic temperatures- Super Insulations- Vacuum insulation- Powder insulation- Cryo pumping Applications.

UNIT V STORAGE AND INSTRUMENTATION

Cryogenic Storage vessels and Transportation- Transfer devices. Pressure flow-level and temperature measurements.

TOTAL HOURS: 45

TEXT BOOK:

REFERENCES:
Objectives:

1. To understand Rapid prototyping history and its development.
2. To gain knowledge about liquid and powder based RP process
3. To enable student to learn about solid based RP process
4. To inherit knowledge about Rapid Tooling
5. To elaborate about principles of reverse engineering

UNIT I  INTRODUCTION

UNIT II  LIQUID AND POWDER BASED RP PROCESSES
Liquid based process: Principles of STL and typical processes such as the SLA process, solid ground curing and others - Powder based process: Principles and typical processes such as selective laser sintering and some 3D printing processes.

UNIT III  SOLID BASED RP PROCESSES
Principles and typical processes such as fused deposition modeling laminated object modeling and others.

UNIT IV  RAPID TOOLING
Principles and typical processes for quick batch production of plastic and metal parts though quick tooling.

UNIT V  REVERSE ENGINEERING
3D scanning, 3D digitizing and Data fitting, high speed machining- Hardware and software - Applications: Evaluation, bench marking and various case studies.

TOTAL HOURS: 45
Text Books:

REFERENCES:
UNIT I
**Introduction:** Energy resources and their availability, types of power plants, selection of the plants, review of basic thermodynamic cycles used in power plants.

**Hydro Electric Power Plants:** Rainfall and run-off measurements and plotting of various curves for estimating stream flow and size of reservoir, power plants design, construction and operation of different components of hydro-electric power plants, site selection, comparison with other types of power plants.

Unit II
**Steam Power Plants:** Layout and working of modern-thermal power plants, super critical pressure steam stations, site selection, coal storage, preparation, coal handling systems, feeding and burning of pulverized fuel, ash handling systems, dust collection-mechanical dust collector and electrostatic precipitator.

**Gas Turbine and Combined Cycle Power Plants:** Constant pressure gas turbine power plants, Arrangements of combined plants (steam & gas turbine power plants), re-powering systems with gas production from coal using PFBC systems, with organic fluids, parameters affecting thermodynamic efficiency of combined cycles.

Unit III
**Nuclear Power Plants:** Principles of nuclear energy, basic nuclear reactions, nuclear reactors-PWR, BWR, CANDU, Sodium graphite, fast breeder, homogeneous; gas cooled. Advantages and limitations, nuclear power station, waste disposal.

**Non-Conventional Power Generation:** Solar radiation estimation, solar energy collectors, Low, medium & high temperature power plants, OTEC, wind power plants, tidal power plants, geothermal power plants.

Unit IV
**Power Plant Economics:** Load curve, different terms and definitions, cost of electrical energy, tariffs methods of electrical energy, performance & operating characteristics of power plants- incremental rate theory, input-out put curves, efficiency, heat rate, economic load sharing, Problems.

Unit V
**Direct Energy Conversion Systems:** Fuel cell, MHD power generation-principle, open & Closed cycle’s systems, thermoelectric power generation, thermionic power generation.

**TOTAL HOURS** : 60

**Text Books:**

**Reference Books:**
LEARN MANUFACTURING SYSTEMS

Objectives:
1. To gain the knowledge and understanding of basic concepts of lean manufacturing process
2. To understand the various quality improvement methods in lean manufacturing.
3. To gain the knowledge and understanding of basic concepts of scheduling systems.
4. To gain the knowledge and understanding of basic concepts of JIDOKA
5. To gain the knowledge and understanding of basic concepts of employee involvement and systematic planning

UNIT I INTRODUCTION
The mass production system – Origin of lean production system – Necessity – Lean revolution in Toyota – Systems and systems thinking – Basic image of lean production – Customer focus – Muda (waste).

UNIT II STABILITY OF LEAN SYSTEM

UNIT III JUST IN TIME

UNIT IV JIDOKA (AUTOMATION WITH A HUMAN TOUCH)

UNIT V WORKER INVOLVEMENT AND SYSTEMATIC PLANNING METHODOLOGY

TOTAL HOURS : 45

TEXTBOOKS:
1. Pascal Dennis, Lean Production Simplified: A Plain-Language Guide to the
3. Mike Rother and John Shook, Learning to See: Value Stream Mapping to Add

REFERENCES:
UNIT –I INTRODUCTION

UNIT –II - TQM PRINCIPLES

UNIT –III - STATISTICAL PROCESS CONTROL (SPC)
The seven tools of quality- Statistical Fundamentals – Measures of central Tendency and Dispersion- Population and Sample- Normal Curve- Control Charts for variables and attributes- Process capability- Concept of six sigma- New seven Management tools.

UNIT –IV - TQM TOOLS

UNIT –V - QUALITY SYSTEMS

Total Hours : 45

TEXT BOOK:

REFERENCES:
Objectives:
1. To gain knowledge about surfaces and to study the different types of friction in materials.
2. To gain knowledge in wear mechanisms, types of wear for different environment and materials.
3. To study the properties of fluid film for bearing applications.
4. To have a theoretical understanding of the film lubrication theory.
5. To learn the various ways of modifying the surface of the materials for bearing.

UNIT I SURFACES AND FRICTION

UNIT II WEAR

UNIT III LUBRICANTS AND LUBRICATION TYPES

UNIT IV FILM LUBRICATION THEORY
Fluid film in simple shear - Viscous flow between very close parallel plates - Shear stress variation Reynolds Equation for film Lubrication - High speed unloaded journal bearings - Loaded journal bearings – Reaction torque on the bearings - Virtual Co-efficient of friction - The Sommerfield diagram./

UNIT V SURFACE ENGINEERING AND MATERIALS FOR BEARINGS

TEXT BOOK:

REFERENCES:
Objectives:

1. To know about the combustion process.
2. To explain about the thermo chemistry.
3. To explain about the kinetics of combustion.
4. To explain about various flames.
5. To know the combustion process in an engine.

UNIT I COMBUSTION OF FUELS


UNIT II THERMODYNAMICS OF COMBUSTION

Thermo-chemistry- First law analysis of reacting systems- Adiabatic combustion temperature- Second law analysis of reacting systems- criterion for chemical equilibrium- Equilibrium constant for gaseous mixtures- Evaluation of equilibrium composition- chemical availability.

UNIT III KINETICS OF COMBUSTION

Rates of reaction- Reaction order and molecularity complex reactions- chain reactions- Arrhenius rate equation- Collection theory- activated complex theory- Explosive and general oxidative characteristics of fueled.

UNIT IV FLAMES

Laminar and Turbulent flames- Premixed and Diffusion flames- Burning velocity and its determination- Factors affecting burning velocity- Quenching- Flammability and Ignition- Flame stabilization in open burners.

UNIT V ENGINE COMBUSTION

Combustion in SI and CI engines- stages of combustion in SI and CI engines- Normal combustion and abnormal combustion- Emissions from premixed combustion- Emission from Nonpremixed combustion- Control of emissions

TOTAL HOURS : 45

TEXT BOOK:

REFERENCES:
Objective:
1. To understand the classification of Engineering Materials and their relevant applications.
2. To understand the powder metallurgy concepts, process techniques, applications.
3. To understand the basics in composites, fabrication methods, types and applications.
4. To understand the various forms of Smart Materials, applications.
5. To understand the various types of Nano-material’s, production & applications.

UNIT 1: ENGINEERING MATERIALS CLASSIFICATION, PROPERTIES & APPLICATIONS

UNIT 2: POWDER METALLURGY

UNIT 3: COMPOSITES
Composites – Types of composites - Naturally occurring, synthetic & engineered composites - MMC – CMC – PMC - Fibre and whisker reinforced composites (continuous and discontinuous) - particulate composites layered or sheet composites, composite coating or thin fibre, inter metallic composites - properties and characteristics of composites – commercially important components and their applications

UNIT 4: SMART MATERIALS
Introduction to intelligent/smart materials, shape memory alloys-types, NiTiNol-origin, properties, martensitic transformation, Memorization process- applications-medical, satellite etc.

UNIT 5: NANO MATERIALS

TEXTBOOKS:
2. M.V.Gandhi., Thomson - Smart Materials and Structures- Chapman and Hall
3. A.K.Bandhopadyay-Nanomaterials-New Age

REFERENCES:
Objectives:
1. To understand the basic fundamentals of Nanotechnology and applications.
2. To understand the basic fundamentals of Nanoparticles and applications.
3. To understand the various properties of nanomaterials.
4. To understand the basic fundamentals of Nanopowders.
5. To understand the recent developments in Nanotechnology and latest applications.

UNIT I  INTRODUCTION AND DEFINITION OF NANOTECHNOLOGY

UNIT-II  NANO PARTICLES

UNIT-III PROPERTIES
Mechanical properties: Strength of Nano crystalline SiC, Preparation for strength measurements, Mechanical properties, Magnetic properties. Electrical properties: Switching glasses with nanoparticles, Electronic conduction with nanoparticles. Optical properties: Optical properties, special properties and the coloured glasses.

UNIT-IV NANO-POWDERS
Process of synthesis of Nano powders, Electro deposition, Important Nanomaterials.

UNIT -V LATEST DEVELOPMENTS IN NANOTECHNOLOGY & APPLICATIONS

TEXT BOOKS:
2. Nano Essentials- T.Pradeep, TMH
3. Springer Handbook of Nanotechnology - Bharat Bhusan
Objectives:

1. To impart about automotive components.
2. To know various ignition systems and emission.
3. To know how to use various instruments.
4. To know about the use of electronics in brakes and clutches.
5. To know about the engine management system.

UNIT – I: INTRODUCTION TO AUTOMOTIVE SYSTEMS

Introduction to Electronic – “Intensive automobile”
Use of electronic in vehicles today – communications networks and protocols – software applications –
control of engine and transmission – Electronic controls in “Electric – Drive Vehicles” – Vehicle starting and
charging systems navigation and communications partially and fully automated vehicle.

UNIT – II: IGNITION SYSTEMS AND EMISSION

Ignition systems: Ignition fundamental, Electronic ignition systems, Programmed ignition, Distribution less
ignition, direct ignition, Spark plugs.

UNIT – III: INSTRUMENTATION SYSTEMS

Instrumentation Systems: Introduction to instrumentation systems-application of various sensors-Driver
instrumentation systems – Dash board instrumentation - vehicle condition monitoring-different types of
visual Display.

UNIT – IV: ELECTRONIC BRAKING CLUTCHES AND STEERING

Traction and stability control – Adoptive cruise control - Electronic control of Automatic Transmission:
Introduction and description Control of gear shift and torque converter lockup-Break power assistance and
lockup control – Breaking and stability control in Electric vehicle – suspension control – power steering
assist.

UNIT V. VEHICLE MANAGEMENT SYSEM

Combined ignition and fuel management systems-Exhaust emission control - Artificial intelligence and
Engine management - Lighting and Security Systems: Vehicles lighting Circuits, - Central locking and
electric windows- security systems - Alarm occupant protection system – self diagnostics – event data
recorders – next generation systems: - Steering – by wire and break – by – wire – vehicle to vehicle and
vehicle to infrastructure communications – (V2V) & (V2I).

TOTAL HOURS: 45
TEXT BOOKS:
1. Human factors in the design of automotive electronics systems, Lane departure warning and keeping parallel packing assistance.

REFERENCES:
2. TOM DENTON, Automobile Electrical and Electronic Systems, Edward Arnold PB. 1995.
Objectives:
1. To understand the basics of governing equations and boundary conditions
2. To gain knowledge about finite difference method
3. To enable student to learn about FVM – Diffusion.
4. To inherit knowledge about FVM – Convection diffusion.
5. To elaborate about FVM flow field calculation

UNIT I  GOVERNING EQUATIONS AND BOUNDARY CONDITIONS  9

UNIT II  FINITE DIFFERENCE METHOD  9

UNIT III  FINITE VOLUME METHOD (FVM) FOR DIFFUSION  9
Finite volume formulation for steady state One, Two and Three - dimensional diffusion problems. One dimensional unsteady heat conduction through Explicit, Crank – Nicolson and fully implicit schemes.

UNIT IV  FINITE VOLUME METHOD FOR CONVECTION DIFFUSION  9
Steady one-dimensional convection and diffusion – Central, upwind differencing schemes-properties of discretization schemes – Conservativeness, Boundedness, Trasnportiveness, Hybrid, Power-law, QUICK Schemes.

UNIT V  CALCULATION FLOW FIELD BY FVM  9
Representation of the pressure gradient term and continuity equation – Staggered grid – Momentum equations – Pressure and Velocity corrections – Pressure Correction equation, simple algorithm and its variants. Turbulence models, mixing length model, two equation (k-€) models – High and low Reynolds number models

TOTAL :45
TEXT BOOKS:

REFERENCES:
5. Introduction to Computational Fluid Dynamics Anil W. Date Cambridge University Press, 2005.
Objectives:

1. To learn the principles of fluid machinery.
2. To understand various fans and blowers.
3. To understand the concept of compressors.
4. To learn the concept of axial flow compressors.
5. To understand the concept of various turbines.

UNIT I PRINCIPLES

Energy transfer between fluid and rotor-classification of fluid machinery,-dimensionless Parameters-specific speed-applications-stage velocity triangles-work and efficiency.

UNIT II CENTRIFUGAL FANS AND BLOWERS

Types- stage and design parameters-flow analysis in impeller blades-volute and Diffusers, losses, characteristic curves and selection, fan drives and fan noise.

UNIT III CENTRIFUGAL COMPRESSOR

Construction details, impeller flow losses, slip factor, diffuser analysis, losses and Performance curves.

UNIT IV AXIAL FLOW COMPRESSOR

Stage velocity diagrams, enthalpy-entropy diagrams, stage losses and efficiency, work Done simple stage design problems and performance characteristics.

UNIT V AXIAL AND RADIAL FLOW TURBINES

Stage velocity diagrams, reaction stages, losses and coefficients, blade design Principles, testing and performance characteristics.

TOTAL HOURS  :45
TEXT BOOK:


REFERENCES:

OBJECTIVES:
1. To understand the importance of entrepreneurship for engineering students.
2. To inculcate entrepreneurship skills for engineering students.
3. To create awareness of business and train in preparing the project report and create awareness for engineering students.
4. To understand the importance of finance and its transactions.
5. To develop the skills of consequences of business sickness and take corrective measures.

UNIT I  ENTREPRENEURSHIP

UNIT 2  MOTIVATION

UNIT 3  BUSINESS AND ENTERPRISE MANAGEMENT

UNIT 4  FINANCIAL MANAGEMENT
Need and objectives of financial management for engineers-Sources of Finance- Term Loans- Capital structure- Financial Institutions- Management of working capital- Costing - Break Even Analysis-Managerial uses of Breakeven analysis-Network analysis Techniques –Problems on PERT &CPM – Taxation

UNIT 5  BUSINESS SICKNESS AND GROWTH STRATEGIES

TOTAL HOURS :45
TEXT BOOKS:

REFERENCES:
1. EDII - “A manual for Entrepreneurs”- Entrepreneurship Development Institute of India, Ahmedabad- Tata McGrawHill-2006...
Objectives:
1. To learn marketing skills for engineering students.
2. To understand the behavioural pattern of customers
3. To learn marketing research and develop skills of sales forecasting.
4. To learn the skills of developing a market plan and formulation of strategies.
5. To understand various promotion mix details.

UNIT I MARKETING ENGINEERING APPROACH


UNIT II BUYING BEHAVIOUR & MARKET SEGMENTATION

Customer value assessment and valuing customers- Understanding customer needs and wants-Customer Buying behavior- Motives- types- Buying decisions- segmentation factors- Demographic- Psychographic & Geographic Segmentation- Buying Patterns-Social and Ethical considerations.

UNIT III MARKETING RESEARCH & SALES FORECASTING


UNIT IV MARKETING PLANNING & STRATEGY FORMULATION


UNIT V POSITIONING AND PROMOTION MIX


TOTAL HOURS :45
TEXT BOOKS:

REFERENCES:
Objectives:
1. To understand the importance of work study methods and its importance in various fields.
2. To develop the skills of selection of a plant and also material handling equipment required.
3. To learn PPC and its functions.
4. To learn the skills of purchasing materials and their management.
5. To learn the awareness on various labour acts and management principles.

UNIT-I WORK STUDY
Evolution and importance of industrial engineering – Production-Classification-Productivity- Factors influencing productivity, Work study - Definition-Procedure and benefits of work study –Method study- Charting techniques-Time study-Procedure and techniques of work measurement –Stop watch time study- Motion study –SIMO chart.

UNIT-II PLANT LAYOUT AND MATERIALS HANDLING
Plant location-Factors influencing the location-selection of site-Plant layout- Types of layout-Plant layout procedure- Material handling –Objective and Principles of Material Handling-Types of Material Handling equipment–Relationship to plant layout.

UNIT-III: PRODUCTION PLANNING AND CONTROL
Introduction-Advantages of PPC-Functions of PPC-Demand Forecasting- Types of Forecasting-Routing- Objectives and procedure of routing-Scheduling-purpose and preparation of schedules-Scheduling techniques like CPM and PERT-Functions and types of dispatching-

UNIT-IV: MATERIAL MANAGEMENT
Procurement of materials-codification of materials-Inventory control-Objectives of inventory control-EOQ- Inventory models-ABC analysis-Material requirements planning (MRP)-Enterprise resource planning (ERP)- supply chain Management (SCM)-Inspection and quality control-SQC-control charts-sampling procedures- Bench marking.

UNIT-V: INDUSTRIAL LEGISLATION AND MANAGEMENT CONCEPTS
Importance and necessity of Labour acts-principles of labour legislation-various acts-Industrial Ownership and various types-Functions of management-Manpower Planning-Recruitment and Selection-Break Even Analysis-Managerial applications of breakeven point-Decision making -Techniques of decision making.

TOTAL HOURS :45
TEXT BOOKS:

REFERENCES:
3. Vijay Seth-“Industrial Engineering-methods and practices”-Pernam International publishing,Mumbai-2005
OBJECTIVE
At the end of this elective, student shall be able to:
1. Get an exposure to the Aerospace Industry.
2. Understand the Basics of Aircraft Systems and Aircraft Structures.

Chapter-1 –Aircraft industry overview, Duration- 3 hours
Evolution and History of Flight, Types Of Aerospace Industry, Key Players in Aerospace Industry, Aerospace Manufacturing, Industry Supply Chain, Prime contractors, Tier 1 Suppliers, Key challenges in Industry Supply Chain, OEM Supply Chain Strategies, Mergers and Acquisitions, Aerospace Industry Trends, Advances in Engineering/CAD/CAM/CAE Tools and Materials technology, Global and Indian Aircraft Scenario

Chapter-2 –Introduction to Aircrafts, Duration- 5 hrs
Basic components of an Aircraft, Structural members, Aircraft Axis System, Aircraft Motions, Control surfaces and High lift Devices. Types of Aircrafts - Lighter than Air/Heavier than Air Aircrafts Conventional Design Configurations based on Power Plant Location, Wing vertical location, intake location, Tail Unit Arrangements, Landing Gear Arrangements. Unconventional Configurations-Biplane, Variable Sweep, Canard Layout, Twin Boom Layouts, Span loaders, Blended Body Wing Layout, STOL and STOVL Aircraft, Stealth Aircraft. Advantages and disadvantages of these Configurations.

Chapter-3-Introduction to Aircraft Systems, Duration- 16 hrs

Chapter-4-Basic Principles of Flight, Duration- 10 hrs
Significance of speed of Sound, Air speed and Ground Speed, Properties of Atmosphere, Bernoulli’s Equation, Forces on the airplane, Airflow over wing section, Pressure Distribution over a wing section, Generation of Lift, Drag, Pitching moments, Types of Drag, Lift curve, Drag Curve, Lift/Drag Ratio Curve, Factors affecting Lift and Drag, Center of Pressure and its effects. Aerofoil Nomenclature, Types of Aerofoil, Wing Section- Aerodynamic Center, Aspect Ratio, Effects of lift, Drag, speed, Air density on drag,
Chapter-5-Basics of Flight Mechanics, Duration 6 hrs

Mach Waves, Mach Angles, Sonic and Supersonic Flight and its effects

**Stability and Control**

Degree of Stability- Lateral, Longitudinal and Directional Stability and controls of Aircraft. Effects of Flaps and Slats on Lift Coefficients, Control Tabs, Stalling, Landing, Gliding Turning, Speed of Sound, Mach Numbers, Shock Waves

**Aircraft Performance and Maneuvers**

Power Curves, Maximum and minimum speeds of horizontal flight, Effects of Changes of Engine Power, Effects of Altitude on Power Curves, Forces acting on an Aeroplane during a Turn, Loads during a Turn, Correct and incorrect Angles of Bank, Aerobatics, Inverted Maneuvers, Maneuverability

Reference Books:
4. Introduction to Flight by Dave Anderson
5. Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration by Ian moir, Allan Seabridge
6. An Introduction to Aircraft Certification; A Guide to Understanding Jaa, Easa and FAA by Filippo De Florio, Butterworth-Heinemann
At the end of this elective, student shall be able to:
1. Industry Practices on Design of Aircraft Structures.
2. Understand the applicability of Design aspects in Aircraft Design.
3. Relate the theoretical knowledge with the design of Aircraft Structures.

Chapter 1 - Overview of the Aircraft Design Process, Duration- 2hrs


Chapter 2 - Fundamentals of Structural Analysis, Duration 2 hrs

Review of Hooke’s Law, Principal stresses, Equilibrium and Compatibility, Determinate Structures, St Venant’s Principle, Conservation of Energy, Stress Transformation, Stress Strain Relations

Chapter 3 - Introduction to Aircraft Structures, Duration 3 hrs

Types of Structural members of Fuselage and wing section Ribs, Spars, Frames, Stringers, Longeron, Splices, Sectional Properties of structural members and their loads, Types of structural joints, Type of Loads on structural joints

Chapter 4 - Aircraft Loads, Duration- 4 hrs

Aerodynamic Loads, Inertial Loads, Loads due to engine, Actuator Loads, Maneuver Loads, VN diagrams, Gust Loads, Ground Loads, Ground conditions, Miscellaneous Loads

Chapter 5 - Aircraft Materials and Manufacturing processes Duration- 4 hrs

Chapter-6 Structural Analysis of Aircraft Structures Duration-20

Theory of Plates- Analysis of plates for bending, stresses due to bending, Plate deflection under different end conditions, Strain energy due to bending of circular, rectangular plates, Plate buckling, Compression buckling, shear buckling, Buckling due to in plane bending moments, Analysis of stiffened panels in buckling. Rectangular plate buckling, Analysis of Stiffened panels in Post buckling, Post buckling under shear. **Sample Exercises.**

Theory of Shells-Analysis of Shell Panels for Buckling, Compression loading, Shear Loading / Shell Shear Factor, Circumferential Buckling Stress, **sample exercises**

Theory of Beams-Symmetric Beams in Pure Bending, Deflection of beams, Unsymmetrical Beams in Bending, Plastic Bending of beams,Shear Stresses due to Bending in Thin Walled Beams, Bending of Open Section Beams, Bending of Closed Section Beams, Shear Stresses due to Torsion in Thin Walled Beams. **Sample Exercises.**

Theory of Torsion - Shafts of Non-Circular Sections, Torsion in Closed Section Beams, Torsion in Open Section Beams, Multi Cell Sections, **Sample Exercises.**

Chapter-7 Airworthiness and Aircraft Certification, Duration- 4 hrs
Definition, Airworthiness Regulations, Regulatory Bodies, Type certification, General Requirements, Requirements Related to Aircraft Design Covers, Performance and Flight Requirements, Airframe Requirements, Landing Requirements, Fatigue and Failsafe requirements, Emergency Provisions, Emergency Landing requirements

Chapter-8 Aircraft Structural Repair, Duration- 3 hrs
Types of Structural damage, Nonconformance, Rework, Repair, Allowable damage Limit, Repairable Damage Limit, Overview of ADL Analysis, Types of Repair, Repair Considerations and best practices

Reference Books:
Objectives:

1. To understand the basics of pipes and their material’s selection.
2. To understand the various pipeline accessories and fittings.
3. To know about various valves and their selection.
4. To know about various special piping elements.
5. To understand about various flows of fluids and frictional losses through pipes due to the flow.

UNIT 1: FUNDAMENTALS OF PIPING


UNIT 2: ACCESSORIES AND FITTINGS


UNIT 3: VALVES

Definition – Types – Functions – Operators - Valves Layout Considerations – Valve Data Sheet - Valve Selection

UNIT 4: PIPING SPECIAL ELEMENTS


UNIT 5: FLOW THROUGH PIPES


TOTAL HOURS : 45
BOOKS:

REFERENCES:
Objectives:

1. To make the students to understand the importance of ceramics in various advanced fields.
2. The application of ceramic in bio and medical field will help the students to gain knowledge in those fields.
3. To familiarize the ceramics applications in electronic industries.
4. To understand the application of ceramics in special and precious items
5. To enable students to understand about the Nano technology in ceramic field.

UNIT 1: CERAMICS USED IN ADVANCED APPLICATIONS:


UNIT 2: CERAMICS FOR MEDICAL AND SCIENTIFIC PRODUCTS:


UNIT 3: CERAMICS FOR OPTICAL APPLICATIONS:

CRT and TV picture tubes - Telecommunication and related uses - Information display - Laser – Fibre optics - Electromagnetic windows.

UNIT 4: MAGNETIC CERAMICS:

Spinel Ferrites - Hexagonal Ferrites - Garnet - Processing -Single crystal ferrite -Applications.

UNIT 5: CERAMIC SUPERCONDUCTORS AND NANOCERAMICS:


Total Hours :45
BOOKS:

REFERENCES:
2. The ceramic society of Japan-“Advanced ceramic technologies & Products”-Springer.
4. Laurent sedal, Christian Rey-“Bio ceramics”-volume 10, proceedings of ceramics in medicine, 1997
Objectives:

1. To understand the various types of vibration and analyses.
2. To understand the basics of Noise and the relevant parameters.
3. To understand the noise sources relevant to automotives.
4. To understand the various vibration control techniques.
5. To understand the various noise control techniques.

UNIT I BASICS OF VIBRATION

Introduction, classification of vibration: free and forced vibration, undamped and damped vibration, linear and nonlinear vibration, response of damped and undamped systems under harmonic force, analysis of single degree and two degree of freedom systems, torsional vibration, determination of natural frequencies - Vibration Analyses.

UNIT II BASICS OF NOISE

Introduction, amplitude, frequency, wavelength and sound pressure level, addition, subtraction and averaging decibel levels, noise dose level, legislation, measurement and analysis of noise, measurement environment, equipment, frequency analysis, tracking analysis, sound quality analysis.

UNIT III AUTOMOTIVE NOISE SOURCES


UNIT IV CONTROL TECHNIQUES

Vibration isolation, tuned absorbers, untuned viscous dampers, damping treatments, application dynamic forces generated by IC engines, engine isolation, crank shaft damping, modal analysis of the mass elastic model shock absorbers.

UNIT V SOURCE OF NOISE AND CONTROL

Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative treatments and enclosures, automotive noise control principles, sound in enclosures, sound energy absorption, sound transmission through barriers

Total Hours : 45

TEXT BOOKS:

REFERENCES:
AIM
To study the critical need for ensuring Cyber Security in real time problems

OBJECTIVES
1. To understand the basics of Cyber Security
2. To know the legal, ethical and professional issues in Cyber Security
3. To know the various attacker techniques

UNIT I CYBER SECURITY FUNDAMENTALS

UNIT II ATTACKER TECHNIQUES AND MOTIVATIONS
Antiforensics – Tunneling techniques – Fraud Techniques - Threat Infrastructure.

UNIT III EXPLOITATION
Techniques to gain a foot hold – Misdirection, Reconnaissance, and disruption methods.

UNIT IV MALICIOUS CODE

UNIT V DEFENSE AND ANALYSIS TECHNIQUES

TEXT BOOK

REFERENCE BOOKS

OBJECTIVE:
To provide knowledge of production operations in the oil and gas wells such as artificial lifts and subsurface equipments.

UNIT I  Components of the petroleum systems

UNIT II  Well Production

UNIT III Surface Equipment and Operations
Flow control and well heads. Gathering systems; service and cleaning systems; design and testing of flow lines. Separation and separators; separator components, stage separation; design and construction of separators. Meeting-Oil and gas metering techniques.

UNIT IV Flow Measurement System

UNIT V Completion Techniques
Well completion techniques and equipment, drill stem test (DST) flowing well performance, vertical lift performance, optimum size tubing and chokes, production forecast for a pool. Design and analysis of artificial methods of petroleum production. Work over and sand exclusion technique.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCE:
UNIT I COAL FACE MECHANISATION
Recent Trends, mechanised bord and pillar mining, case studies.

UNIT II MINING OF THICK SEAMS
Problems, past experiences in India, current methods, mining of thick, contiguous, and steep seams

UNIT III HYDRAULIC MINING
Applicability, operating parameters, equipment, layouts, Indian experience. Computer applications such as remote control and environmental monitoring in hydraulic mining.

UNIT IV LONGWALL MINING
Powered supports, development of powered supports, their types and designs, selection for different conditions, last drivages for longwall panelling, remotely operated powered support and longwall faces, Indian experiments, salvaging in longwall.

UNIT V UNDERGROUND COAL GASSIFICATION
Objective, application, methods of gasification, design of gasification plants, coal bed methane. Environmental monitoring techniques and computer applications in coal gasification techniques.

TEXT BOOKS:
1. Das S.K., Modern Coal Mining Technology, Lovely Prakashan, Dhanbad, 1994

REFERENCES:
1. Peng S.S. and Chiang, H.S., Longwall Mining, John Willey and Sons, New York, 1992
UNIT I IMPORTANCE OF ENERGY CONSERVATION AND MANAGEMENT 8

UNIT II ELECTRICAL SYSTEMS 12

UNIT III THERMAL SYSTEMS 10

UNIT IV ENERGY CONSERVATION 8
Energy conservation in Pumps, Fans (flow control) and blowers, Compressed Air Systems, Refrigeration and air conditioning systems – Waste heat recovery recuperators, heat sheets, heat pipes, heat pumps.

UNIT V ENERGY MANAGEMENT, ECONOMICS 7

TOTAL: 45 PERIODS

TEXT BOOK:

REFERENCES:
OBJECTIVES:
• To study and understand the various Non Destructive Evaluation and Testing methods, theory and their industrial applications.

UNIT I OVERVIEW OF NDT
NDT Versus Mechanical testing, Overview of the Non Destructive Testing Methods for the detection of manufacturing defects as well as material characterisation. Relative merits and limitations, Various physical characteristics of materials and their applications in NDT., Visual inspection – Unaided and aided.

UNIT II SURFACE NDE METHODS

UNIT III THERMOGRAPHY AND EDDY CURRENT TESTING (ET)

UNIT IV ULTRASONIC TESTING (UT) AND ACOUSTIC EMISSION (AE)

UNIT V RADIOGRAPHY (RT)

TOTAL : 45 PERIODS
TEXT BOOKS:

REFERENCES:
2, Liquid Penetrant Testing, Vol. 3, Infrared and Thermal Testing Vol. 4,
Ultrasonic Testing
Objective:
1. To study tools and technique of work study.
2. To understand process planning concepts.
3. To understand cost estimation.
4. To know about depreciation and ladder cost.
5. To study production cost estimation.

1. WORK STUDY AND ERGONOMICS

2. PROCESS PLANNING
   - Definition – Objective – Objective – approaches to process planning- Process planning activities – Finished part requirements - operating sequences - machine selection – material selection parameters- Set of documents for process planning - Developing manufacturing logic and knowledge- production time calculation – selection of cost optimal processes – Introduction to ERP

3. INTRODUCTION TO COST ESTIMATION

4. ELEMENTS OF COST

5. PRODUCTION COST ESTIMATION

TOTAL HOURS: 45

TEXT BOOKS

REFERENCES