THE VISION OF THE DEPARTMENT OF MECHANICAL ENGINEERING

Department of Mechanical Engineering strives to be recognized globally for excelling in Engineering education and research leading to innovative, entrepreneurial and competent Graduates in Mechanical Engineering and allied disciplines.

THE MISSION OF THE DEPARTMENT OF MECHANICAL ENGINEERING

1. To provide a world-class education through the conduct of pioneering and cutting-edge research that inculcate professional, technical, critical-thinking, and communication skills necessary for students and faculty to make impactful contributions to society.
2. To create future leaders in the science and art of mechanical and allied engineering streams.
3. To expand the frontiers of engineering science and to encourage technological innovation while fostering academic excellence and scholarly learning in a collegial environment.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

The PEOs of the Mechanical Engineering Programme are to make our students

1. To achieve success in careers that deal with the design, simulation and analysis of engineering systems, experimentation and testing, manufacturing, technical services, and research.
2. To communicate effectively with peers, and updating and adapting their core knowledge and abilities to ethically compete in the ever-changing multicultural global enterprise.
3. To conduct multi-disciplinary research and development (via graduate study or industry) resulting in tangible applications that advance technology and foster innovation in order to compete successfully in the global economy.
4. To exchange and apply knowledge to create new opportunities that advance our society and proactively address through team efforts to solve a variety of technical, environmental and societal problems.
5. To actively embrace impactful leadership roles in the practice of Mechanical Engineering in industry and government organizations (including both traditional and emerging technical areas) as well as in public service organizations.
PROGRAMME OUTCOMES (POs):

On successful completion of the Mechanical Engineering Degree programme, the Graduates shall exhibit the following:

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<th>Graduate Attribute</th>
<th>Programme Outcome</th>
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<td>1</td>
<td>Engineering knowledge</td>
<td>Apply knowledge of mathematics, basic science and engineering science.</td>
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<td>Problem analysis</td>
<td>Identify, formulate and solve engineering problems.</td>
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<td>Design/development of solutions</td>
<td>Design a system or process to improve its performance, satisfying its constraints.</td>
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<td>4</td>
<td>Conduct investigations of complex problems</td>
<td>Conduct experiments &amp; collect, analyze and interpret the data.</td>
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<td>5</td>
<td>Modern tool usage</td>
<td>Apply various tools and techniques to improve the efficiency of the system.</td>
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<td>The Engineer and society</td>
<td>Conduct themselves to uphold the professional and social obligations.</td>
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<td>7</td>
<td>Environment and sustainability</td>
<td>Design the system with environment consciousness and sustainable development.</td>
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<td>8</td>
<td>Ethics</td>
<td>Interacting industry, business and society in a professional and ethical manner.</td>
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<td>Individual and team work</td>
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<td>Communication</td>
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<td>Project management and finance</td>
<td>Implement cost effective and improved system.</td>
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<td>12</td>
<td>Life-long learning</td>
<td>Continue professional development and learning as a life-long activity.</td>
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PROGRAMME SPECIFIC OUTCOMES (PSOs):

On successful completion of the Mechanical Engineering Degree programme, the Graduates shall exhibit the following:

1. Understand, analyze, apply, design and develop engineering systems adopting thermal, design and manufacturing concepts.
2. Utilize computational and design tools for efficient product development.
3. Apply the acquired knowledge for innovative solutions to cater societal needs and industrial problems.
Mapping PEO with POs:

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MAPPING OF COURSE OUTCOMES WITH POs and PSOs:

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COURSE DESCRIPTION:
This course aims at developing the language skills necessary for the first-year students of Engineering and Technology.

OBJECTIVES:
- To develop the four language skills – Listening, Speaking, Reading and Writing.
- To improve the students’ communicative competence in English.
- To teach students the various aspects of English language usage.

CONTENTS

UNIT I GREETING AND INTRODUCING ONESELF 12
Listening – Types of listening – Listening to short talks, conversations; Speaking – Speaking about one’s place, important festivals etc. – Introducing oneself, one’s family/ friend;
Reading – Skimming a passage– Scanning for specific information;
Writing – Guided writing - Free writing on any given topic ( My favourite place/ Hobbies/ School life, writing about one’s leisure time activities, hometown, etc.);
Grammar – Tenses (present and present continuous) –Question types - Regular and irregular verbs; Vocabulary – Synonyms and Antonyms.

UNIT II GIVING INSTRUCTIONS AND DIRECTIONS 12
Listening – Listening and responding to instructions; Speaking – Telephone etiquette - Giving oral instructions/ Describing a process – Asking and answering questions;
Reading – Reading and finding key information in a given text - Critical reading - Writing –Process description( non-technical)-
Grammar – Tense (simple past& past continuous) - Use of imperatives – Subject – verb agreement – Active and passive voice; - Vocabulary – Compound words – Word formation – Word expansion ( root words).

UNIT III READING AND UNDERSTANDING VISUAL MATERIAL 12
Listening- Listening to lectures/ talks and completing a task; Speaking –Role play/ Simulation – Group interaction; Reading – Reading and interpreting visual material;
Writing- Jumbled sentences – Discourse markers and Cohesive devices – Essay writing (cause & effect/ narrative);
Grammar – Tenses (perfect), Conditional clauses –Modal verbs; Vocabulary –Cause and effect words; Phrasal verbs in context.

UNIT IV CRITICAL READING AND WRITING 12
Listening- Watching videos/ documentaries and responding to questions based on them; Speaking– Informal and formal conversation;
Reading –Critical reading (prediction & inference); Writing– Essay writing ( compare & contrast/ analytical) – Interpretation of visual materials;
Grammar – Tenses (future time reference); Vocabulary – One word substitutes (with meanings) – Use of abbreviations & acronyms – Idioms in sentences.

UNIT V LETTER WRITING AND SENDING E-MAILS 12
Listening- Listening to programe/broadcast/ telecast/ podcast; Speaking – Giving impromptu talks, Making presentations on given topics- Discussion on the presentation; Reading –Extensive reading;
Writing- Poster making – Letter writing (Formal and E-mail) ;
Grammar – Direct and Indirect speech – Combining sentences using connectives;
Vocabulary –Collocation;

TEACHING METHODS:
Interactive sessions for the speaking module.
Use of audio – visual aids for the various listening activities.
Contextual Grammar Teaching.

EVALUATION PATTERN:
Internals – 50%
End Semester – 50%

TOTAL:60 PERIODS
OUTCOMES:
- Students will improve their reading and writing skills
- Students will become fluent and proficient in communicative English
- Students will be able to improve their interpersonal communication

TEXTBOOK:

REFERENCES:
3. Redston, Chris & Gillies Cunningham Face2Face (Pre-intermediate Student’s Book & Workbook) Cambridge University Press, New Delhi: 2005

MA7151 MATHEMATICS – I
(Common to all branches of B.E. / B.Tech. Programmes in I Semester)

OBJECTIVES:
- The goal of this course is for students to gain proficiency in calculus computations. In calculus, we use three main tools for analyzing and describing the behavior of functions: limits, derivatives, and integrals. Students will use these tools to solve application problems in a variety of settings ranging from physics and biology to business and economics.
- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I DIFFERENTIAL CALCULUS
Representation of functions - New functions from old functions - Limit of a function - Limits at infinity - Continuity - Derivatives - Differentiation rules - Polar coordinate system - Differentiation in polar coordinates - Maxima and Minima of functions of one variable.

UNIT II FUNCTIONS OF SEVERAL VARIABLES

UNIT III INTEGRAL CALCULUS
Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.
UNIT IV MULTIPLE INTEGRALS

UNIT V DIFFERENTIAL EQUATIONS
Method of variation of parameters – Method of undetermined coefficients – Homogenous equation of Euler’s and Legendre’s type – System of simultaneous linear differential equations with constant coefficients.

TOTAL: 60 PERIODS

OUTCOMES:
- Understanding of the ideas of limits and continuity and an ability to calculate with them and apply them.
- Improved facility in algebraic manipulation.
- Fluency in differentiation.
- Fluency in integration using standard methods, including the ability to find an appropriate method for a given integral.
- Understanding the ideas of differential equations and facility in solving simple standard examples.

TEXTBOOKS:

REFERENCES:

PH7151 ENGINEERING PHYSICS L T P C
(3 0 0 3)
(Common to all branches of B.E / B.Tech programmes)

OBJECTIVE:
- To introduce the concept and different ways to determine moduli of elasticity and applications.
- To instill the concept of sound, reverberation, noise cancellation, and ultrasonic generation, detection and applications
- To inculcate an idea of thermal properties of materials, heat flow through materials and quantum physics
- To promote the basic understanding of interferometers, principles and applications of lasers, optical fibers and sensors
- To establish a sound grasp of knowledge on the basics, significance and growth of single crystals
UNIT I  PROPERTIES OF MATTER  9

UNIT II  ACOUSTICS AND ULTRASONICS  9

UNIT III  THERMAL AND MODERN PHYSICS  9

UNIT IV  APPLIED OPTICS  9

UNIT V  CRYSTAL PHYSICS  9
Single crystalline, polycrystalline and amorphous materials – Single crystals: unit cell, crystal systems, Bravais lattices, ditrections and planes in a crystal, Miller indices - interplanar distance for a cubic crystal - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - structure and significance of NaCl, CsCl, ZnS and graphite - crystal imperfections: point defects, line defects – Burger vectors, dislocations and stacking faults – Growth of single crystals: Bridgman and Czochralski methods.

TOTAL: 45 PERIODS

OUTCOME:
• The students will understand different moduli of elasticity, their determination and applications.
• The students will gain knowledge on the properties of sound, noise cancellation, and production, detection and applications of ultrasonics
• The students will acquire sound knowledge on thermal expansion and thermal conductivity of materials. Further they will gain an idea of quantum physics.
• The students will gain knowledge on interferometers, lasers and fiber optics
• The students will secure knowledge on the basics of crystal structures and their significance. Further they gain basic ideas of growing single crystals.

TEXTBOOKS:
REFERENCES:

OBJECTIVE
- To develop an understanding about fundamentals of polymer chemistry.
- Brief elucidation on surface chemistry and catalysis.
- To develop sound knowledge photochemistry and spectroscopy.
- To impart basic knowledge on chemical thermodynamics.
- To understand the basic concepts of nano chemistry.

UNIT I POLYMER CHEMISTRY
Introduction: Functionality-degree of polymerization. Classification of polymers- natural and synthetic, thermoplastic and thermosetting. Types and mechanism of polymerization: addition (free radical, cationic, anionic and living); condensation and copolymerization. Properties of polymers: Tg, tacticity, molecular weight-weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension.

UNIT II SURFACE CHEMISTRY AND CATALYSIS

UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY

UNIT IV CHEMICAL THERMODYNAMICS
Second law: Entropy-entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Free energy and work function: Helmholtzand Gibbs free energy functions; Criteria of spontaneity; Gibbs-Helmholtz equation; Clausius Clapeyron equation; Maxwell relations-Van't Hoff isotherm and isochore. Chemical potential; Gibbs-Duhem equation- variation of chemical potential with temperature and pressure.

UNIT V NANO CHEMISTRY

TOTAL: 45 PERIODS
OUTCOMES
- Will be familiar with polymer chemistry, surface chemistry and catalysis.
- Will know the photochemistry, spectroscopy and chemical thermodynamics.
- Will know the fundamentals of nano chemistry.

TEXTBOOKS

REFERENCES

GE7152 ENGINEERING GRAPHICS

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Drawing free hand sketches of basic geometrical shapes and multiple views of objects.
2. Drawing orthographic projections of lines and planes.
3. Drawing orthographic projections of solids.
4. Drawing development of the surfaces of objects.
5. Drawing isometric and perspective views of simple 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 HANDSKETCHING
Basic Geometrical constructions, Curves used in engineering practices-Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles – Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES
Orthographic projection- principles-Principal planes-First angle projection-Projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes- Determination of true lengths and true inclinations by rotating line method and trapezoidal method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to both the principal planes by rotating object method and auxiliary plane method.
UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES
Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS
Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method and vanishing point method.

COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY)
Introduction to drafting packages and demonstration of their use.

L=45+T=30, TOTAL: 75 PERIODS

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

1. Draw free hand sketching of basic geometrical shapes and multiple views of objects.
2. Draw orthographic projections of lines and planes
3. Draw orthographic projections of solids
4. Draw development of the surfaces of objects
5. Draw isometric and perspective views of simple solids.

TEXT BOOK:

REFERENCES:

Publication of Bureau of Indian Standards:

Special points applicable to University Examinations on Engineering Graphics:
1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day.

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BS7161                                BASIC SCIENCES LABORATORY L T P C
(Common to all branches of B.E. / B.Tech Programmes) 0 0 4 2

PHYSICS LABORATORY: (Any Seven Experiments)

OBJECTIVE:
- To inculcate experimental skills to test basic understanding of physics of materials including properties of matter, thermal and optical properties.
- To induce the students to familiarize with experimental determination of velocity of ultrasonic waves, band gap determination and viscosity of liquids.

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of disc
2. Non-uniform bending - Determination of young’s modulus
3. Uniform bending – Determination of young’s modulus
4. Lee’s disc Determination of thermal conductivity of a bad conductor
5. Potentiometer-Determination of thermo e.m.f of a thermocouple
6. Laser- Determination of the wave length of the laser using grating
7. Air wedge - Determination of thickness of a thin sheet/wire
8. a) Optical fibre - Determination of Numerical Aperture and acceptance angle
   b) Compact disc- Determination of width of the groove using laser.
10. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
11. Post office box - Determination of Band gap of a semiconductor.
13. Viscosity of liquids - Determination of co-efficient of viscosity of a liquid by Poiseuille’s flow

OUTCOME:
- To determine various moduli of elasticity and also various thermal and optical properties of materials.
- To determine the velocity of ultrasonic waves, band gap determination and viscosity of liquids.

CHEMISTRY LABORATORY:

(Minimum of 8 experiments to be conducted)
1. Estimation of HCl using Na₂CO₃ as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler’s method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10-
    Phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
12. Pseudo first order kinetics-ester hydrolysis.
14. Determination of CMC.
15. Phase change in a solid.

TOTAL: 60 PERIODS

TEXT BOOKS

GE7162 ENGINEERING PRACTICES LABORATORY
(Common to all Branches of B.E./B.Tech. Programmes) L T P C
0 0 4 2

COURSE OBJECTIVES: The main learning objective of this course is to provide
hands on training to the students in:

1. Drawing pipe line plan; laying and connecting various pipe fittings used in common
   household plumbing work; Sawing; planning; making joints in wood materials used in
   common household wood work.
2. Wiring various electrical joints in common household electrical wire work.
3. Welding various joints in steel plates using arc welding work; Machining various
   simple processes like turning, drilling, tapping in parts; Assembling simple
   mechanical assembly of common household equipment’s; Making a tray out of metal
   sheet using sheet metal work.
4. Soldering and testing simple electronic circuits; Assembling and testing simple
   electronic components on PCB.

GROUP – A (CIVIL & ELECTRICAL)

1. CIVIL ENGINEERING PRACTICES

PLUMBING
Basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers,
elbows and other components used in household fittings. Preparation of plumbing line
sketches.
• Laying pipe connection to the suction side of a pump.
• Laying pipe connection to the delivery side of a pump.
• Practice in connecting pipes of different materials: Metal, plastic and flexible pipes used in
household appliances.

WOOD WORK
• Sawing, planing and making joints like T-Joint, Mortise and Tenon joint and Dovetail
  joint.

STUDY
• Study of joints in door panels and wooden furniture
• Study of common industrial trusses using models.
2. ELECTRICAL ENGINEERING PRACTICES

• Basic household wiring using Switches, Fuse, Indicator and Lamp etc.,
• Stair case light wiring
• Tube – light wiring
• Preparation of wiring diagrams for a given situation.
• Study of Iron-Box, Fan Regulator and Emergency Lamp

GROUP – B (MECHANICAL AND ELECTRONICS) 15

3. MECHANICAL ENGINEERING PRACTICES

WELDING
• Arc welding of Butt Joints, Lap Joints, and Tee Joints
• Gas welding Practice.
• Basic Machining - Simple turning, drilling and tapping operations.
• Study and assembling of the following:
  a. Centrifugal pump
  b. Mixie
  c. Air Conditioner.

DEMONSTRATION ON FOUNDRY OPERATIONS.

4. ELECTRONIC ENGINEERING PRACTICES

• Soldering simple electronic circuits and checking continuity.
• Assembling electronic components on a small PCB and Testing.
• Study of Telephone, FM radio and Low Voltage Power supplies.

TOTAL: 60 PERIODS

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

1. Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.
2. Wire various electrical joints in common household electrical wirework.
3. Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipment’s; Make a tray out of metal sheet using sheet metalwork.
4. Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

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HS7251  TECHNICAL ENGLISH

OBJECTIVES
• To enable students acquire proficiency in technical communication.
• To enhance their reading and writing skills in a technical context.
• To teach various language learning strategies needed in a professional environment.
CONTENTS

UNIT I ANALYTICAL READING 12
Listening- Listening to informal and formal conversations; Speaking – Conversation Skills(opening, turn taking, closing );explaining how something works-describing technical functions and applications;Reading –Analytical reading, Deductive and inductive reasoning; Writing- vision statement–structuring paragraphs.

UNIT II SUMMARISING 12
Listening- Listening to lectures/ talks on Science & Technology;Speaking –Summarizing/ Oral Reporting, Reading – Reading Scientific and Technical articles; Writing- Extended definition –Lab Reports – Summary writing.

UNIT III DESCRIBING VISUAL MATERIAL 12
Listening- Listening to a panel discussion; Speaking – Speaking at formal situations; Reading – Reading journal articles - Speed reading;Writing-data commentary-describing visual material-writing problem-process- solution-the structure of problem-solution texts- writing critiques

UNIT IV WRITING/ E-MAILING THE JOB APPLICATION 12
Listening- Listening to/ Viewing model interviews; Speaking –Speaking at different types of interviews – Role play practice ( mock interview); Reading – Reading job advertisements and profile of the company concerned;Writing- job application – cover letter –Résumé preparation.

UNIT V REPORT WRITING 12
Listening- Viewing a model group discussion;Speaking –Participating in a discussion - Presentation;Reading – Case study - analyse -evaluate – arrive at a solution;Writing– Recommendations- Types of reports (feasibility report)- designing and reporting surveys- – Report format.- writing discursive essays.

TEACHING METHODS:
Practice writing
Conduct model and mock interview and group discussion.
Use of audio – visual aids to facilitate understanding of various forms of technical communication.
Interactive sessions.

EVALUATION PATTERN:
Internals – 50%
End Semester – 50%
TOTAL:60 PERIODS

OUTCOMES
• Students will learn the structure and organization of various forms of technical communication.
• Students will be able to listen and respond to technical content.
• Students will be able to use different forms of communication in their respective fields.

TEXTBOOK:

REFERENCES:
MA7251  
MATHEMATICS - II  
(Common to all branches of B.E. / B.Tech. Programmes in II Semester)  
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OBJECTIVES:
- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To acquaint the student with the concepts of vector calculus, needed for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow of the electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

UNIT I  MATRICES  12

UNIT II  VECTOR CALCULUS  12
Gradient and directional derivative – Divergence and Curl – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green’s, Gauss divergence and Stoke’s theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT III  ANALYTIC FUNCTION  12
Analytic functions – Necessary and sufficient conditions for analyticity - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions $W = z + c$, $az$, $\frac{1}{z}$, $z^2$ - Bilinear transformation.

UNIT IV  COMPLEX INTEGRATION  12

UNIT V  LAPLACE TRANSFORMS  12

TOTAL: 60 PERIODS
OUTCOMES:
Upon successful completion of the course, students should be able to:
- Evaluate real and complex integrals using the Cauchy integral formula and the residue theorem
- Appreciate how complex methods can be used to prove some important theoretical results.
- Evaluate line, surface and volume integrals in simple coordinate systems
- Calculate grad, div and curl in Cartesian and other simple coordinate systems, and establish identities connecting these quantities
- Use Gauss, Stokes and Greens theorems to simplify calculations of integrals and prove simple results.

TEXTBOOKS:

REFERENCES:

GE7151 COMPUTING TECHNIQUES
(Common to all branches of Engineering and Technology)

OBJECTIVES
- To learn programming using a structured programming language.
- To provide C programming exposure.
- To introduce foundational concepts of computer programming to students of different branches of Engineering and Technology.

UNIT I INTRODUCTION
Introduction to Computers – Computer Software – Computer Networks and Internet - Need for logical thinking – Problem formulation and development of simple programs - Pseudo code - Flow Chart and Algorithms.

UNIT II C PROGRAMMING BASICS

UNIT III ARRAYS AND STRINGS

UNIT IV POINTERS
Macros - Storage classes –Basic concepts of Pointers– Pointer arithmetic - Example Problems - Basic file operations
UNIT V  FUNCTIONS AND USER DEFINED DATA TYPES

OUTCOMES
At the end of the course, the student should be able to:
- Write C program for simple applications
- Formulate algorithm for simple problems
- Analyze different data types and arrays
- Perform simple search and sort.
- Use programming language to solve problems.

TEXT BOOKS:

REFERENCES:

GE7153  ENGINEERING MECHANICS

COURSE OBJECTIVES: The main learning objective of this course is to prepare the students for:
1. Applying the various methods to determine the resultant forces and its equilibrium acting on a particle in 2D and 3D.
2. Applying the concept of reaction forces (non-concurrent coplanar and noncoplanar forces) and moment of various support systems with rigid bodies in 2D and 3D in equilibrium. Reducing the force, moment, and couple to an equivalent force -couple system acting on rigid bodies in 2D and 3D.
3. Applying the concepts of locating centroids/center of gravity of various sections / volumes and to find out area moments of inertia for the sections and mass moment of inertia of solids.
4. Applying the concepts of frictional forces at the contact surfaces of various engineering systems.
5. Applying the various methods of evaluating kinetic and kinematic parameters of the rigid bodies subjected to concurrent coplanar forces.

UNIT I  STATICS OF PARTICLES


UNIT II  EQUILIBRIUM OF RIGID BODIES

Principle of Transmissiblility, Equivalent Forces, Vector Product of Two Vectors, Moment of a Force about a Point ,Varignon’s Theorem, Rectangular Components of the Moment of a Force, Scalar Product of Two Vectors, Mixed Triple Product of Three Vectors, Moment of a

UNIT III
DISTRIBUTED FORCES
16
Centroids of lines and areas – symmetrical and unsymmetrical shapes, Determination of Centroids by Integration, Theorems of Pappus-Guldinus, Distributed Loads on Beams, Center of Gravity of a Three-Dimensional Body, Centroid of a Volume, Composite Bodies, Determination of Centroids of Volumes by Integration.
Moments of Inertia of Areas and Mass - Determination of the Moment of Inertia of an Area by Integration, Polar Moment of Inertia, Radius of Gyration of an Area, Parallel-Axis Theorem, Moments of Inertia of Composite Areas, Moments of Inertia of a Mass - Moments of Inertia of Thin Plates, Determination of the Moment of Inertia of a Three-Dimensional Body by Integration.

UNIT IV
FRICTION
8

UNIT V
DYNAMICS OF PARTICLES
12

L – 45 + T – 15 TOTAL: 60 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Apply the various methods to determine the resultant forces and its equilibrium acting on a particle in 2D and 3D.
2. Apply the concept of reaction forces (non-concurrent coplanar and nonco-planar forces) and moment of various support systems with rigid bodies in 2D and 3D in equilibrium. Reducing the force, moment, and couple to an equivalent force - couple system acting on rigid bodies in 2D and 3D.
3. Apply the concepts of locating centroids / center of gravity of various sections / volumes and to find out area moments of inertia for the sections and mass moment of inertia of solids.
4. Apply the concepts of frictional forces at the contact surfaces of various engineering systems.
5. Apply the various methods of evaluating kinetic and kinematic parameters of the rigid bodies subjected to concurrent coplanar forces.

TEXT BOOK

REFERENCES
ME7252 MANUFACTURING TECHNOLOGY – I

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

1. Applying the working principles of various metal casting processes.
2. Applying the working principles of various metal joining processes.
3. Analyzing the working principles of bulk deformation of metals.
4. Applying the working principles of sheet metal forming process.
5. Applying the working principles of plastics molding.

UNIT I METAL CASTING PROCESSES

UNIT II METAL JOINING PROCESSES

UNIT III BULK DEFORMATION PROCESSES

UNIT IV SHEET METAL PROCESSES

UNIT V MANUFACTURE OF PLASTIC COMPONENTS
TOTAL: 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Explain the principle of different metal casting processes.
2. Describe the various metal joining processes.
3. Illustrate the different bulk deformation processes.
4. Outline the various sheet metal forming process.
5. Apply suitable molding technique for manufacturing of plastics components.

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ME7261 MANUFACTURING TECHNOLOGY LAB I

COURSE OBJECTIVE:
The main learning objective of this course is to provide hands on training to the students in:
1. Selecting appropriate tools, equipment and machines to complete a given job.
2. Performing various welding process using GMAW.
3. Performing various machining process
4. Understanding the casting process by hands on training
5. Analyzing the defects in the cast and machined components.

LIST OF EXPERIMENTS
1. Fabrication of simple structural shapes using Gas Metal Arc Welding
2. Joining of plates and pipes using Submerged arc welding
3. Friction stir welding of aluminium plates
4. Preparation of green sand moulds
5. Casting of aluminium components
6. Die casting of aluminium components
7. Stir casting of aluminium components
8. Open and closed die forging of light metal components
9. Reducing the thickness of the plates using two-high rolling process
10. Reducing the diameter of using Wire drawing
11. Extrusion of metal components of simple shapes
12. Manufacturing of simple sheet metal components using shearing and bending operations.
13. Drawing of cup shaped products
14. Manufacturing of sheet metal components using metal spinning on a lathe
15. Forming of simple sheet metal parts by Water hammer forming process
16. Extrusion of plastic components

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:** Upon completion of this course, students will be able to:
1. Select appropriate tools, equipment and machines to complete a given job.
2. Perform various welding process using GMAW.
3. Perform various machining operations
4. Perform casting process
5. Analyze the defects in the cast and machined components.

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**OUTCOMES**
At the end of the course, the student should be able to:
- Write and compile programs using C programs.
- Write program with the concept of Structured Programming
- Identify suitable data structure for solving a problem
- Demonstrate the use of conditional statement.

**LABORATORY REQUIREMENTS FOR BATCH OF 30 STUDENTS**
30 Systems with C compiler
COURSE OBJECTIVES: The main learning objective of this course is to prepare students for:
1. Applying the principle concepts behind stress, strain and deformation of solids for various engineering applications.
2. Analyzing the transverse loading on beams and stresses in beam for various engineering applications.
3. Analyzing the torsion principles on shafts and springs for various engineering applications.
4. Analyzing the deflection of beams for various engineering applications.
5. Analyzing the thin and thick shells and principal stresses in beam for various engineering applications.

UNIT I  STRESS, STRAIN AND DEFORMATION OF SOLIDS  9
Rigid bodies and deformable solids— Tension, Compression and Shear Stresses— Deformation of simple and compound bars— Thermal stresses— Elastic constants— Volumetric strains— Stresses on inclined planes— Principal stresses and principal planes— Mohr’s circle of stress.

UNIT II  TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM  9
Beams— Types of transverse loading on beams— Shear force and bending moment in beams— Cantilevers— Simply supported beams and overhanging beams— Theory of simple bending— Bending stress distribution— Load carrying capacity— Proportioning of sections— Flitched beams— Shear stress distribution.

UNIT III  TORSION  9
Torsion formulation— Stresses and deformation in circular and hollow shafts— Stepped shafts— Deflection in shafts fixed at both ends— Stresses in helical springs— Deflection of helical springs, carriage springs.

UNIT IV  DEFLECTION OF BEAMS  9
Double integration method— Macaulay’s method— Area moment theorems for computation of slopes and deflections in beams— Conjugate beam and strain energy— Maxwell’s reciprocal theorems.

UNIT V  THIN CYLINDERS, SPHERES AND THICK CYLINDERS  9
Stresses in thin cylindrical shell due to internal pressure— Circumferential and longitudinal stresses and deformation in thin cylinders— Spherical shells subjected to internal pressure— Deformation in spherical shells— Lamé’s theory— Application of theories of failure.

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course, the students will be able to:
1. Apply the principle concepts behind stress, strain and deformation of solids for various engineering applications.
2. Analyze the transverse loading on beams and stresses in beam for various engineering applications.
3. Analyze the torsion principles on shafts and springs for various engineering applications.
4. Analyze the deflection of beams for various engineering applications.
5. Analyze the thin and thick shells and principal stresses in beam for various engineering applications.
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CE 7352 FLUID MECHANICS AND MACHINERY L T P C 3 0 0 3

OBJECTIVE:
1. To introduce the students about properties of the fluids, behaviour of fluids under static conditions
2. To impart basic knowledge of the dynamics of fluids
3. To expose to the applications of the conservation laws to a) flow measurements b) flow through pipes (both laminar and turbulent) and c) forces on pipe bends with an exposure to the significance of boundary layer theory and its thicknesses
4. To expose the basic principles of working of hydraulic machineries
5. To design Pelton wheel, Francis and Kaplan turbine, centrifugal and reciprocating pumps.

UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS 9
Units and dimensions - Properties of fluids - mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, capillarity and surface tension. Flow characteristics – concept of control volume - application of control volume to continuity equation, energy equation and momentum equation.

UNIT II FLOW THROUGH CIRCULAR CONDUITS 9

UNIT III DIMENSIONAL ANALYSIS 9
Need for dimensional analysis – methods of dimensional analysis – Similitude – types of similitude - Dimensionless parameters - application of dimensionless parameters – Model analysis.
UNIT IV  PUMPS
Impact of jets - Euler’sequation - Theory of rotodynamic machines - various efficiencies - velocity components at entry and exit of the rotor - velocity triangles - Centrifugal pumps - working principle - work done by the impeller - performance curves - Reciprocating pump - working principle - indicator diagram - work saved by fitting air vessels - Rotary pumps - classification - comparison of working principle with other pumps - advantages.

UNIT V  TURBINES
Classification of turbines - heads and efficiencies - velocity triangles - axial, radial and mixed flow turbines - Pelton wheel and Francis turbine - working principles - work done by water on the runner - draft tube - specific speed - unit quantities - performance curves for turbines - governing of turbines.

OUTCOMES:
On completion of the course, the student is expected to be able to

CO1 Understand the difference between solid and fluid, its properties and behaviour in static conditions.
CO2 Understand the conservation laws applicable to fluids and its application through fluid kinematics and dynamics.
CO3 Formulate the relationship among the parameters involved in the given fluid phenomenon and to predict the performances of prototype by model studies.
CO4 Estimate losses in pipelines for both laminar and turbulent conditions and analysis of pipes connected in series and parallel.
CO5 Understand the concept of boundary layer and its application to find the drag force exerted by the fluid on the flat solid surface.

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EC 7354  ELECTRONICS ENGINEERING

OBJECTIVE:
- To provide knowledge in the basic concepts of Electronics Engineering including semiconductors, transistors, electronic devices, signal generators, transducers and digital electronics.

UNIT I  SEMICONDUCTORS AND RECTIFIERS
P-N junction, VI Characteristics of PN junction diode, Zener diode, Zener diode Characteristics,
Zener diode as a regulator, BJT and N-MOSFET working and V-I characteristics.

UNIT II AMPLIFIERS AND OSCILLATORS

UNIT III LINEAR INTEGRATED CIRCUITS
Operational amplifier – Inverting and Non-inverting amplifiers, Adder, integrator and differentiator, Instrumentation amplifier, Digital to Analog converters - R-2R and weighted resistor types, Analog to Digital converters - Successive approximation and Flash types, IC 555 based Astable and Monostable Multivibrators,

UNIT IV DIGITAL ELECTRONICS

UNIT V TRANSUDCERS AND DISPLAY DEVICES
Thermistors, Semiconductor strain gauges, LVDT, Tachometer, Ultrasonic and Thermal flow meter, pressure force and weight measurement, Seven segment display, LED and LCD

OUTCOME:
Upon completion of this course, the students will be able to:
- Ability to understand the basic operation of diode and transistors
- Ability to understand the characteristics of amplifiers and oscillators
- Ability to understand the principles and applications of operational amplifiers
- Ability to understand the operation of basic digital electronic blocks
- Ability to know the concepts of transducers and display devices for electronic systems.

TEXT BOOK:

REFERENCES:
5. Transducers in Mechanical and Electronic Design by Trietley

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OBJECTIVES:
To impart knowledge on
● Electric circuit laws
● Principle of Electrical Machines
● Various measuring instruments

UNIT I ELECTRICAL CIRCUITS
9
Ohms Law – Kirchhoff’s Law-Mesh analysis – Superposition and Thevenin’s theorem -
Introduction to AC circuits – waveforms, RMS and average value – Power and power factor-
Three phase balanced circuits-Three phase Power measurement.

UNIT II ELECTRICAL MACHINES
9
Principle of operation DC machines- Characteristics of DC motor - Single phase transformers,
three-phase and single-phase induction motors – Speed Control.

UNIT III SPECIAL ELECTRICAL COMPONENTS
9
Synchronous machine – Brushless DC Motor - Stepper motor – Switched reluctance motor-
Electromechanical Relays.

UNIT IV ELECTRICAL MEASUREMENTS
9
Classification of instruments – moving coil and moving iron meters – Induction type, dynamometer
type wattmeters – Energy meter – Megger – Instrument transformers (CT & PT) –Wheatstone’s
bridge for measurement of unknown resistance ,Maxwell’s bridge for unknown inductance and
Schering Bridge for unknown capacitance –Instrumentation Amplifiers.

UNIT V MECHANICAL MEASUREMENTS
9
Classification of transducers, strain, RTD, thermocouples, Piezo-electric transducer, LVDT,
Turbine and electromagnetic flow meters, level transducers ultrasonic and fiber optic transducers,
type of sensors, elastic sensors, viscosity, moisture and pH sensors, Digital transducers, vibrating
wire instruments like load cells, stress meter, etc.

OUTCOME:
Upon completion of this course, the students will be able to:
● Explain different types of electrical machines and their performance.

TEXT BOOKS:
2. Alan S. Moris, Principles of Measurements and Instruments, Prentice-Hall of India Pvt. Ltd.,
   New Delhi, 1999.
3. T.Kenjo and S.Nagamori, Permanent magnet and Brushless DC motors, Clarendon 125 press,

REFERENCES:
   2007.
OBJECTIVES:
- To introduce the effective mathematical tools for the solutions of partial differential equations that model physical processes;
- To introduce Fourier series analysis which is central to many applications in engineering.
- To apply Fourier series analysis in solving boundary value problems.
- To demonstrate the utility of numerical techniques of partial differential equations in solving engineering problems where analytical solutions are not readily available. The focus will be on finite difference methods.
- To solve PDEs in one or more "space" dimensions using finite difference methods and to discuss the stability limits for these numerical schemes.

UNIT I  PARTIAL DIFFERENTIAL EQUATIONS

UNIT II  FOURIER SERIES
Dirichlet’s conditions – General Fourier series – Odd and even functions – Half range Sine and Cosine series – Complex form of Fourier series – Parseval’s identity – Harmonic Analysis.

UNIT III  FOURIER SERIES SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS
Method of separation of variables – Solutions of one dimensional wave equation and one-dimensional heat equation – Steady state solution of two-dimensional heat equation – Fourier series solutions in Cartesian coordinates.

UNIT IV  FINITE DIFFERENCE SOLUTION TO HEAT EQUATION

UNIT V  FINITE DIFFERENCE SOLUTION TO POTENTIAL AND WAVE EQUATIONS
Iterative solution of linear system of equations: Gauss-Jacobi, Gauss-Seidel and SOR methods -- Finite difference techniques for the solution of two dimensional Laplace’s and Poisson’s equations on rectangular domain – Leibmann’s method – Lax-Wendroff scheme for first order hyperbolic equation - Explicit finite difference scheme for one space dimensional wave equation.

TOTAL : 60 PERIODS

OUTCOMES:
- Students should be able to solve Partial Differential Equations which arise in application problems.
- Students should be able to determine the Fourier series of the functions.
- Students should be obtain the solutions of the Partial Differential Equations using Fourier series.
- Students should be understand various Numerical Techniques for solving PDE and linear system of Algebraic Equations.
- Students should be able to solve Boundary Value Problems for Potential and Wave Equation using Numerical Methods.
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ME 7301 ENGINEERING THERMODYNAMICS

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

1. Applying the zeroth and first law of thermodynamics by formulating temperature scales and calculating the property changes in closed and open engineering systems.
2. Applying the second law of thermodynamics in analyzing the performance of thermal devices through energy and entropy calculations.
3. Applying the second law of thermodynamics in evaluating the various properties of steam through steam tables and Mollier chart.
4. Applying the properties of pure substance in computing the macroscopic properties of ideal and real gases using gas laws and appropriate thermodynamic relations.
5. Applying the properties of gas mixtures in calculating the properties of gas mixtures and applying various thermodynamic relations to calculate property changes.

UNIT I BASIC CONCEPTS AND FIRST LAW

UNIT II  SECOND LAW  12

UNIT III  PURE SUBSTANCES AND STEAM POWER CYCLE  12
Steam - formation and its thermodynamic properties - p-v, p-T, T-v, T-s, h-s diagrams. PVT surface. Determination of dryness fraction. Calculation of work done and heat transfer in non-flow and flow processes using Steam Table and Mollier Chart. Ideal and actual Rankine cycles.

UNIT IV  IDEAL AND REAL GASES THERMODYNAMIC RELATIONS  12

UNIT V  GAS MIXTURES AND PSYCHROMETRY  12

(Use of Steam tables, Mollier chart and Psychrometric chart permitted)

TOTAL : 60 PERIODS

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

1. Analyze the problems associated with zeroth and first laws of thermodynamics.
2. Apply the concept of second law of thermodynamics in analyzing the thermal systems.
3. Compute the properties of pure substances and analyze energy transfer in vapor power cycles.
4. Summarize the thermodynamic relations and evaluate the applications in thermal systems.
5. Compute the thermodynamic properties of gas mixtures and analyze the Psychrometric processes in real time applications.

TEXT BOOKS:

REFERENCES:
CE 7312  FLUID MECHANICS AND STRENGTH OF MATERIALS LABORATORY

OBJECTIVES:
- To study the mechanical properties of materials when subjected to different types of loading.
- To verify the principles studied in Fluid Mechanics theory by performing experiments in lab.

UNIT – I  STRENGTH OF MATERIALS

LIST OF EXPERIMENTS
1. Tension test on mild steel rod
2. Torsion test on mild steel rod
3. Hardness test on metal beam (Rockwell and Brinell Hardness Tests)
4. Compression test on helical spring
5. Deflection test on carriage spring

UNIT – II  FLUID MECHANICS AND MACHINES LABORATORY

LIST OF EXPERIMENTS
A. FLOW MEASUREMENT
1. Flow through Venturimeter
B. PUMPS
2. Characteristics of Centrifugal pumps
3. Characteristics of Gear pump
4. Characteristics of Submersible pump
5. Characteristics of Reciprocating pump
C. TURBINES
6. Characteristics of Francis turbine
D. DETERMINATION OF METACENTRIC HEIGHT
7. Determination of Metacentric height

OUTCOMES:
Upon completion of this course, the students will be able to:
1. Perform Tension, Torsion, Hardness, Compression, and Deformation test on Solid materials.
2. Use the measurement equipment’s for flow measurement.
3. Perform test on different fluid machinery.
4. Verify and apply Bernoulli equation for flow measurement like orifice/venturi meter.
5. Measure friction factor in pipes and compare with Moody diagram and verify momentum conservation law.
6. Determine the performance characteristics of rotodynamic pumps.
7. Determine the performance characteristics of positive displacement pumps.
8. Determine the performance characteristics of turbine.

REFERENCES:
EE7261 ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

OBJECTIVE:
- To train the students in performing various tests on electrical drives, sensors and circuits.

LIST OF EXPERIMENTS:
1. Load test on separately excited DC shunt generator
2. Load test on DC shunt motor
3. Load test on S Transformer
4. Load test on Induction motor
5. Regulation of 3 Alternator
6. Study of CRO
7. Logic gates
8. Operational amplifiers
9. Time constant of RC circuit
10. Characteristics of LVDT
11. Calibration of Rotometer
12. RTD and Thermistor
13. Flapper Nozzle system

TOTAL: 60 PERIODS

OUTCOMES:
- Ability to perform speed characteristic of different electrical machine
- Ability to use of diodes, transistors for rectifiers
- Ability to use of operational amplifiers

GE 7251 ENVIRONMENTAL SCIENCE AND ENGINEERING

OBJECTIVES:
To the study of nature and the facts about environment.
- To find and implement scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
• To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14
Definition, scope and importance of environment—need for public awareness—concept of ecosystem—structure and function of ecosystems—producers, consumers and decomposers — energy flow in the ecosystem—ecological succession—food chains, food webs and ecological pyramids — Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) — Introduction to biodiversity definition: genetic, species and ecosystem diversity—biogeographical classification of India—value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values—Biodiversity at global, national and local levels—India as a mega-biodiversity nation—hot spot of biodiversity—threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts—endangered and endemic species of India — conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.
Field study of common plants, insects, birds
Field study of simple ecosystems—pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 8
Definition—causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards—soil waste management: causes, effects and control measures of municipal solid wastes — role of an individual in prevention of pollution—pollution case studies—disaster management—floods, earthquake, cyclone, and landslides.
Field study of local polluted site—Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 10
Forest resources: Use and over-exploitation, deforestation, case studies—timber extraction, mining, dams and their effects on forests and tribal people—Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams—benefits and problems —Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies—Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer—pesticide problems, water logging, salinity, case studies—Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources—casestudies—Land resources: Land as a resource, land degradation, man-induced landslides, soil erosion and desertification—role of an individual in conservation of natural resources—Equitable use of resources for sustainable lifestyles.
Field study of local area to document environmental assets—river/forest/grassland/hill/mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7
From unsustainable to sustainable development—urban problems related to energy—water conservation, rain water harvesting, watershed management—resettlement and rehabilitation of people; its problems and concerns, case studies—role of non-governmental organizations—environmental ethics: Issues and possible solutions—climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies—wasteland reclamation—consumerism and waste products—environmental production act—Air (Prevention and Control of Pollution) act—Water (Prevention and Control of Pollution) act—Wildlife protection act—Forest conservation act—enforcement machinery involved in environmental legislation—central and state pollution control boards—Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6
OUTCOMES:
Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental protection. One will obtain knowledge on the following after completing the course.
- Public awareness of environment at infant stage.
- Ignorance and incomplete knowledge has led to misconceptions.
- Development and improvement in standard of living has lead to serious environmental disasters.

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MA7354 NUMERICAL METHODS

OBJECTIVES:
- To provide the mathematical foundations of numerical techniques for solving linear systems, Eigen value problems, interpolation, numerical differentiation and integration and the errors associated with them;
- To apply the techniques of interpolation for equal and unequal intervals for the given data.
- To understand and to apply the techniques of numerical integration and differentiation for solving ODE in Engineering Problems.
- To familiar in solving initial value problems and ODE for given initial and boundary conditions.
- To demonstrate the utility of numerical techniques of ordinary and partial differential equations in solving engineering problems where analytical solutions are not readily available.

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS
UNIT II  INTERPOLATION AND APPROXIMATION  12
Interpolation with unequal intervals - Lagrange interpolation – Newton’s divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton’s forward and backward difference formulae – Least square method - Linear curve fitting.

UNIT III  NUMERICAL DIFFERENTIATION AND INTEGRATION  12

UNIT IV  INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS  12

UNIT V  BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS  12
Finite difference methods for solving two-point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace’s and Poisson’s equations on rectangular domain – One dimensional heat-flow equation by explicit and implicit (Crank-Nicholson) methods - One dimensional wave equation by explicit method.

TOTAL:60 PERIODS

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

- Demonstrate understanding of common Numerical Methods and how they are used to obtain approximate solutions to the Algebraic and Transcendental Equations.
- Apply Numerical Methods to obtain approximate solutions to mathematical problems using interpolation
- Derive Numerical Methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations
- Analyse and evaluate the accuracy of common Numerical Methods in solving First Order Ordinary Differential Equations.
- Understand various Numerical Techniques for solving ODE and PDEs, for given conditions in Heat flow and Wave problems.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To understand the concept and basic mechanics of metal cutting, working of standard machine tools such as lathe, shaping and allied machines, milling, drilling and allied machines, grinding and allied machines and broaching.
- To understand the basic concepts of Computer Numerical Control (CNC) of machine tools and CNC Programming.

UNIT I THEORY OF METAL CUTTING
Mechanics of chip formation, single point cutting tool, forces in machining, Types of chip, cutting tools – nomenclature, orthogonal, oblique metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.

UNIT II TURNING MACHINES

UNIT III RECIPROCATING, MILLING AND GEAR CUTTING MACHINES
Reciprocating machine tools: shaper, planer, slotter: Types and operations- Hole making: Drilling, reaming, boring, tapping, type of milling operations-attachments- types of milling cutter– machining time calculations - Gear cutting, gear hobbing and gear shaping – gear finishing methods.

UNIT IV ABRASIVE PROCESSES AND BROACHING

UNIT V COMPUTER NUMERICAL CONTROL MACHINE TOOLS
Numerical Control (NC) machine tools – CNC types, constructional details, special features, machining centre and part programming fundamentals – manual part programming and computer assisted part programming.

TOTAL: 45 PERIODS

OUTCOME:
Upon completion of this course, the students will be able to:
1. Apply the fundamental concepts of metal cutting to analyse the traditional machining processes.
2. Demonstrate the basic working of various types of turning machines.
3. Explain the working principles and operations of reciprocating, milling and gear cutting machines.
4. Classify the abrasive and broaching processes and their applications.
5. Explain the constructional features of NC/CNC machine tools and part programming.
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ME7401 KINEMATICS OF MACHINES L T P C 3 0 0 3

OBJECTIVES:
The main learning objective of this course is to prepare the students for
1. Applying the basic components of mechanisms and layout of linkages in the assembly of a system / machine
2. Analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism
3. Applying the design of cam mechanisms for specified output motions
4. Applying the basic concepts of toothed gearing and kinematics of gear trains
5. Analyzing the effects of friction in machine elements

UNIT I BASICS OF MECHANISMS 9

UNIT II KINEMATICS OF LINKAGE MECHANISMS 9
Displacement, velocity and acceleration analysis of mechanisms – Velocities and accelerations by relative velocity method -Velocity analysis using instantaneous centre method- Velocities and accelerations by Analytical method -Coriolis Acceleration.

UNIT III KINEMATICS OF CAM MECHANISMS 9
Classification of cams and followers – law of cams-Terminology and definitions – Displacement diagrams – Uniform velocity, parabolic, simple harmonic, Cycloidal – Derivatives of follower
motions – Layout of plate cam profiles – Specified contour cams – Circular arc and tangent
cams – Pressure angle and undercutting – sizing of cams.

UNIT IV GEARS AND GEAR TRAINS
Law of gearing – Spur Gear terminology and definitions – Involutes and cycloidal tooth profiles
Gear tooth action – Contact ratio – Interference and undercutting – corrected and uncorrected
gear teeth – Gear terminology and definitions -Helical, Bevel, Worm, Rack and Pinion gears–
Gear trains – Speed ratio, train value – Epicyclic Gear Trains – Differentials – Automobile gear
box

UNIT V FRICTION IN MACHINE ELEMENTS
Surface contacts - Sliding and Rolling friction - Friction drives - Friction in screw threads -
Bearings and lubrication - Friction clutches - Belt and rope drives - Friction aspects in brakes -
Friction in vehicle propulsion and braking.

TOTAL:45 PERIODS

OUTCOME:
Upon completion of this course, the students will be able to:
1. Understand the basic components of mechanisms and layout of linkages in the
assembly of a system / machine
2. Analyze the assembly with respect to the displacement, velocity, and acceleration at any
point in a link of a mechanism
3. Design of cam mechanisms for specified output motions
4. Express the basic concepts of toothed gearing and kinematics of gear trains
5. Report the effects of friction in machine elements

TEXT BOOKS:

REFERENCES:
2005.
Delhi, 1992.
6. John Hannah and Stephens R.C., “Mechanics of Machines”, Viva Low-Prices Student
COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:

1. Applying the concepts and laws of thermodynamics to predict the operation of thermodynamic cycles and performance of Internal Combustion (IC) engines and Gas Turbines.
2. Analyzing the performance of steam nozzle, calculate critical pressure ratio
3. Evaluating the performance of steam turbines through velocity triangles, understand the need for governing and compounding of turbines
4. Analyzing the working of IC engines and various auxiliary systems present in IC engines
5. Evaluating the various performance parameters of IC engines

UNIT I  GAS AND STEAM POWER CYCLES

UNIT II  RECIPROCATING AIR COMPRESSOR

UNIT III  INTERNAL COMBUSTION ENGINES AND COMBUSTION

UNIT IV  INTERNAL COMBUSTION ENGINE PERFORMANCE AND SYSTEMS

UNIT V  GAS TURBINES

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

1. Identify and perform thermodynamical analysis of various gas and steam power cycles.
2. Evaluate performance of air compressors.
3. Explain the working, air fuel ratio requirements and combustion in SI and CI engines.
4. Describe the procedures for various engine tests and working of auxiliary systems.
5. Compare the open and closed cycle for gas turbines configuration and predict its performance.

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ML7451 ENGINEERING MATERIALS AND METALLURGY

OBJECTIVES:
1. Constructing the phase diagram and using of iron-iron carbide phase diagram for microstructure formation.
2. Selecting and applying various heat treatment processes and its microstructure formation.
3. Applying the different types of ferrous and non-ferrous alloys and their uses in engineering field.
4. Applying the different polymer, ceramics and composites and their uses in engineering field.
5. Applying the various testing procedures and failure mechanism in engineering field.

UNIT I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS

UNIT II HEAT TREATMENT

UNIT III FERROUS AND NON-FERROUS METALS

UNIT IV NON-METALLIC MATERIALS

UNIT V MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS
Mechanisms of plastic deformation, slip and twinning – Types of fracture – Testing of materials
under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell), Micro and nano-hardness tests, Impact test - Izod and Charpy, Fatigue and Creep failure mechanisms.

**TOTAL:45 PERIODS**

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

1. Construct the phase diagram and interpret the various phases.
2. Identify suitable heat treatment process to achieve the desired properties.
3. Choose proper ferrous and non-ferrous alloys for an engineering application.
4. Select appropriate polymer, ceramics and composites for an engineering application.
5. Examine the mechanical properties of materials by adopting various testing procedures.

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**REFERENCES:**

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**ME 7361 MANUFACTURING TECHNOLOGY LABORATORY - II**

**OBJECTIVE:**
The main learning objective of this course is to provide hands on training to the students in:

1. Selecting appropriate machining process, equipment and cutting tool to machine a given job.
2. Perform various secondary and finishing machining processes.
3. Select the appropriate process parameters for a given machining process.
4. Manufacture gears using different processes
5. Write CNC milling and turning part programmes for a given component.

**LIST OF EXPERIMENTS**
1. Taper Turning and Eccentric Turning using lathe
2. External and Internal Thread cutting using lathe
3. Knurling
4. Shaping – Square and Hexagonal Heads
5. Drilling and Reaming
6. Contour milling - vertical milling machine
7. Spur and helical gear cutting using milling machine
8. Gear generation using gear hobber
9. Gear generation using gear shaper
10. Grinding – Cylindrical, Surface and Centerless grinding
11. Tool angle grinding with tool and Cutter Grinder
12. Spline Broaching
13. Measurement of cutting forces in Milling /Turning Process
14. CNC Part Programming

TOTAL: 60 PERIODS

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

- Make use of various machining processes to manufacture a component.
- Select the suitable machine tool and cutting tool for a given workpiece.
- Choose appropriate process parameters for a given machining application.
- Analyse machining processes by measuring the cutting forces.
- Develop CNC part programmes.

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ME 7411 THERMAL ENGINEERING LABORATORY – I

COURSE OBJECTIVES: The main learning objective of this course is to provide hands on training to the students in:
1. Analyzing the performance characteristics of various engines
2. Applying for proper valve and port timing in IC engines
3. Conducting boiler operation and performance test on a boiler and steam turbine

UNIT – I IC ENGINE LAB

LIST OF EXPERIMENTS:
2. Actual p-v diagrams of IC engines.
3. Performance test of Reciprocating Air compressor
4. Performance Test on four – stroke Diesel Engine.
6. Morse Test on Multi-cylinder Petrol Engine.
7. Retardation Test on a Diesel Engine.
8. Determination of p-θ diagram and heat release characteristics of an IC engine.
9. Determination of Flash Point and Fire Point of various fuels / lubricants.

UNIT – II STEAM LAB

LIST OF EXPERIMENTS:
1. Study of Steam Generators and Turbines.

TOTAL: 60 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Test the performance of the IC engines under various operating conditions
2. Determine the port, valve opening and overlap periods of the IC engines
3. Assess the characteristics of various fuels and lubricants used in IC engines
4. Prepare the heat balance sheet for a boiler
5. Evaluate the performance of steam turbine and arrive at various losses.
OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Analyzing the force-motion relationship in components subjected to external forces 
   and in standard mechanisms.
2. Studying the undesirable effects of unbalances resulting from prescribed motions in 
   mechanism.
3. Analyzing the effect of dynamics of undesirable free vibrations.
4. Analyzing the effect of dynamics of undesirable forced vibrations.
5. Learning the principles in mechanisms used for governing of machines.

UNIT I FORCE ANALYSIS 
Applied and constraint forces – Free body diagrams – Static equilibrium conditions – force 
equilibrium analysis of simple mechanisms – friction in mechanisms – Dynamic force analysis – 
Inertia force and Inertia torque – D Alembert’s principle – Dynamic Analysis in reciprocating 
engines – Gas forces – Inertia effect of connecting rod – Bearing loads – Crank shaft torque – 
Turning moment diagrams – Flywheels for engines and punching presses.

UNIT II BALANCING 
Static and dynamic balancing – Balancing of rotating masses – Balancing a single cylinder engine 
– Balancing of Multi-cylinder inline engines, V-engines – Partial balancing in engines – Balancing 
of linkages – Balancing machines- Balancing standards - Field balancing of single disc.

UNIT III FREE VIBRATION 
Basics of vibratory systems – Degrees of freedom – Natural frequency -Spring mass system- 
equations of motion — Viscously damped free vibration- Logarithmic decrement- Transverse 
vibration – Dunkerley’s method- Critical speed of shafts -Two and three rotor torsional vibration.

UNIT IV FORCED VIBRATION 
Response of one degree freedom system to Harmonic excitation force – Vibration Isolation 
-rotating unbalance - support motion – Transmissibility - Energy dissipated by damping- Vibration 
measuring instruments.

UNIT V MECHANISMS FOR CONTROL 
Governors – Types – Centrifugal governors – Gravity controlled and spring controlled centrifugal 
governors – Characteristics – Effect of friction – Controlling force. Gyroscopes – Gyroscopic forces 
and torques – Gyroscopic stabilization – Gyroscopic effects in Automobiles, ships and airplanes.

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Examine the force-motion relationship in components subjected to external forces 
   and in standard mechanisms.
2. Determine the undesirable effects of unbalances resulting from prescribed motions 
   in mechanism.
3. Evaluate the effect of dynamics of undesirable free vibrations.
4. Estimate the effect of dynamics of undesirable forced vibrations.
5. Decide the mechanisms used for governing of machines.
TEXT BOOKS:

REFERENCES:

ME 7502 METROLOGY AND MEASUREMENTS

COURSE OBJECTIVES: The main learning objective of this course is to prepare the students for:
1. Explaining the importance of measurements in engineering and the factors affecting measurements and to estimate measurement uncertainty.
2. Applying the working principle and applications of various linear and angular measuring instruments and basic concepts of measurement of assembly and transmission elements.
3. Interpreting the various tolerance symbols given in engineering drawings to choose the appropriate manufacturing process.
4. Applying the principles and methods of form and surface metrology.
5. Applying the advances in measurements for quality control in manufacturing Industries.

UNIT I BASICS OF METROLOGY

UNIT II LINEAR AND ANGULAR MEASUREMENTS

UNIT III METROLOGY OF SURFACES
Fundamentals of GD & T - Measurement of straightness, flatness and roundness, Simple problems
– Measurement of Surface finish – Functionality of surfaces, Parameters, Comparative, Stylus based and Optical Measurement techniques, Filters, Introduction to 3D surface metrology.

UNIT IV METROLOGY OF ASSEMBLY AND TRANSMISSION ELEMENTS
9

UNIT V ADVANCES IN METROLOGY
9
TOTAL: 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Explain the factors affecting measurements and estimate measurement uncertainty.
2. Outline the working principles and applications of various linear and angular measuring instruments.
3. Interpret the GD&T symbols given in engineering drawings and explain the different methods of surface finish measurement.
4. Explain the principles and methods for measurement of assembly and transmission elements.
5. Apply measurements for quality control in manufacturing Industries.

TEXT BOOKS:

REFERENCES:
9. NPL Measurement good practice guides relevant to the syllabus – No. 40, No. 41, No. 42, No. 43, No. 80, No. 118, No. 130, No. 131.

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

1. Evaluating the critical pressure ratio of a CD nozzle.
2. Analyzing different types of boilers and compute their performance parameters.
3. Evaluating velocity triangle and theoretical work of a steam turbine.
4. Applying the working principles of various refrigeration systems and perform COP calculations.
5. Analyzing the psychrometric properties and how they are utilized in arriving at calculations to determine heating loads.

UNIT I STEAM NOZZLE
Types and Shapes of nozzles, Flow of steam through nozzles, Critical pressure ratio, Variation of mass flow rate with pressure ratio. Effect of friction. Metastable flow.

UNIT II BOILERS

UNIT III STEAM TURBINES
Types, Impulse and reaction principles, Velocity diagrams, Work done and efficiency – optimal operating conditions. Multi-staging, compounding and governing.

UNIT IV COGENERATION AND RESIDUAL HEAT RECOVERY

UNIT V REFRIGERATION AND AIR – CONDITIONING

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

1. Understand and apply the concept of critical pressure ratio in designing nozzles.
2. Evaluate the performance of boilers adopting direct and indirect approach.
3. Develop relevant velocity triangles of steam turbines and analyze parametric influences.
4. Appraise the waste heat of industrial processes and adoption of relevant cogeneration technologies.
5. Design and develop suitable refrigeration and air conditioning systems accounting all heat loads.

TEXT BOOKS:

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

1. Designing machine members subjected to static and variable loads.
2. Designing shafts and couplings for various applications.
3. Analyzing bolted and welded joints for various kinds of loads.
4. Designing helical, leaf springs and flywheels for various applications.
5. Designing and select sliding and rolling contact bearings.

UNIT I  FUNDAMENTAL CONCEPTS IN DESIGN  12

UNIT II  SHAFTS AND COUPLINGS  12
Shafts and Axles - Design of solid and hollow shafts based on strength, rigidity and critical speed – Keys and splines – Rigid and flexible couplings.

UNIT III  TEMPORARY AND PERMANENT JOINTS  12

UNIT IV  ENERGY STORING ELEMENTS AND ENGINE COMPONENTS  12
Types of springs, design of helical and concentric springs–surge in springs, Design of laminated springs - Flywheels considering stresses in rims and arms for engines and presses - Solid and Rimmed flywheels - Connecting Rods and crank shafts.

UNIT V  BEARINGS  12
Sliding contact and rolling contact bearings - Hydrodynamic journal bearings, Sommerfeld Number, Raimondi & Boyd graphs, -- Selection of Rolling Contact bearings -Seals and Gaskets.

TOTAL:60 PERIODS

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

1. Design machine members subjected to static and variable loads.
2. Design shafts and couplings for various applications.
3. Choose the bolted, welded and riveted joints for various kinds of loads.
4. Design helical, leaf springs and flywheels for the required mechanical systems.
5. Select sliding and rolling contact bearings.
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ME 7553 HYDRAULICS AND PNEUMATICS

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Applying the working principles of fluid power systems and hydraulic pumps.
2. Applying the working principles of hydraulic actuators and control components.
3. Designing and develop hydraulic circuits and systems.
4. Applying the working principles of pneumatic power system and its components.
5. Solving problems and troubles in fluid power systems.

UNIT I FLUID POWER PRINCIPLES AND HYDRAULIC PUMPS

UNIT II HYDRAULIC ACTUATORS AND CONTROL COMPONENTS
UNIT III HYDRAULIC CIRCUITS AND SYSTEMS
Accumulators, Intensifiers, Industrial hydraulic circuits – Regenerative, Pump Unloading, Double-Pump, Pressure Intensifier, Air-over oil, Sequence, Reciprocation, Synchronization, Fail-Safe, Speed Control, Hydrostatic transmission, Electro hydraulic circuits, Mechanical hydraulic servo systems.

UNIT IV PNEUMATIC AND ELECTRO PNEUMATIC SYSTEMS

UNIT V TROUBLE SHOOTING AND APPLICATIONS

TOTAL: 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Make use of the principles of fluid mechanics and thermodynamics to develop fluid power systems.
2. Discuss the working principles of hydraulic actuators and control components.
3. Design and develop hydraulic circuits and systems.
4. Develop solutions for industrial automation with pneumatic circuits.
5. Troubleshoot and provide solutions for the problems in Hydraulic and Pneumatics systems.

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57
COURSE OBJECTIVES: The main learning objective of this course is to provide hands-on training to the students in:

1. Demonstrating the calibration of simple linear measuring instruments used in manufacturing industries.
2. Demonstrating the important linear and angular measurements carried out in manufacturing industries.
3. Demonstrating the measurement of prismatic components using contact and non-contact methods and surface metrology.
4. Applying the principles of kinematics involved in various mechanisms.
5. Applying the principles of Dynamics involved in various experiments.

UNIT I  METROLOGY AND MEASUREMENTS  30

LIST OF EXPERIMENTS
2. Calibration and use of measuring instruments – depth micrometer, bore gauge, telescopic gauge
3. Measurement of linear dimensions using Comparators
4. Measurement of angles using bevel protractor and sine bar
5. Measurement of screw thread parameters – Screw thread Micrometers, Three wire method, Toolmaker’s microscope
6. Measurement of gear parameters – Micrometers, Vernier caliper, Gear tester
7. Measurement of features in a prismatic component using Coordinate Measuring Machine (CMM)
8. Programming of CNC Coordinate Measuring Machines for repeated measurements of identical components
9. Non-contact (Optical) measurement using Measuring microscope / Profile projector and Video measurement system
11. Measurement of Surface finish in components manufactured using various processes (turning, milling, grinding, etc..) using stylus based instruments

UNIT II  DYNAMICS MEASUREMENTS  30

LIST OF EXPERIMENTS
1. a) Study of gear parameters.
   b) Experimental study of velocity ratios of simple, compound, epicyclic and differential gear trains.
2. a) Kinematics of Crank Rocker, Double crank, Double rocker, Slider Crank and Oscillating cylinder Mechanisms.
   b) Kinematics of single and double universal joints.
3. a) Determination of Mass moment of inertia of Fly wheel and Axle system.
   b) Determination of Mass Moment of Inertia of axisymmetric bodies using Turn table apparatus.
   c) Determination of Mass Moment of Inertia using bifilar suspension and compound pendulum.
4. Motorized gyroscope – Study of gyroscopic effect and couple.
5. Governor - Determination of range sensitivity and effort for Watts, Porter, Proell, and Hartnell Governors.
6. Cams – Cam profile drawing, Motion curves and study of jump phenomenon
7. a) Single degree of freedom Spring Mass System – Determination of natural Frequency and
verification of Laws of springs – Damping coefficient determination.
b) Multi degree freedom suspension system – Determination of influence coefficient.
8. a) Determination of torsional natural frequency of single and double rotor systems - Undamped and Damped Natural frequencies.
b) Vibration Absorber – Tuned vibration absorber.
9. Vibration of Equivalent Spring mass system – undamped and damped vibration.
11. a) Balancing of rotating masses. (b) Balancing of reciprocating masses.
12. a) Transverse vibration of Free-Free beam – with and without concentrated masses.
b) Forced Vibration of Cantilever beam – Mode shapes and natural frequencies.
c) Determination of transmissibility ratio using vibrating table.

TOTAL:60 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Select a suitable instrument for the measurement of linear and angular dimensions.
2. Demonstrate the Calibration of linear measuring instruments.
3. Make use of advanced equipment for linear, GD&T and surface finish measurements.
4. Measure the various kinematic parameters.
5. Evaluate the vibration parameters of different mechanical systems.

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ME 7561 COMPUTER AIDED MACHINE DRAWING

OBJECTIVES:
The main learning objective of this course is to provide hands on training to the students in:

1. Applying standard drawing practices using fits and tolerances.
2. Modeling 2D views of machine components
3. Modeling 3D views of machine components
4. Preparing assembly drawings both manually and using standard CAD packages.
5. Gaining practical experience in handling 2D drafting and 3D modeling software systems.

UNIT I DRAWING STANDARDS & FITS AND TOLERANCES 12

UNIT II INTRODUCTION TO 2D DRAFTING 16
- Drawing, Editing, Dimensioning, Layering, Hatching, Block, Array, Detailing, Detailed drawing.
- Bearings - Bush bearing, Plummer block
- Valves – Safety and non-return valves.

UNIT III 3D GEOMETRIC MODELING AND ASSEMBLY 32
• Couplings – Flange, Universal, Oldham’s, Muff, Gear couplings
• Joints – Knuckle, Gib & cotter, strap, sleeve & cotter joints
• Engine parts – Piston, connecting rod, cross-head (vertical and horizontal), stuffing box, multi-plate clutch
• Miscellaneous machine components – Screw jack, machine vice, tail stock, chuck, vane and gear pumps

TOTAL: 60 PERIODS

**Total:** 20% of classes for theory classes and 80% of classes for practice

**Note:** 25% of assembly drawings must be done manually and remaining 75% of assembly drawings must be done by using any CAD software. The above tasks can be performed manually and using standard commercial 2D / 3D CAD software.

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

1. Practice drawing standards using fits and tolerances.
2. Develop and visualize 2D views of machine components
3. Develop and visualize 3D Views of machine components
4. Construct part drawings, sectional views and assembly drawings as per standards
5. Create standard drawing for modeled parts or assemblies using modeling software.

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**ME 7354**

**MECHATRONICS**

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

1. Selecting sensors to develop mechatronics systems.
2. Explaining the architecture and timing diagram of microprocessor, and also interpret and develop programs.
3. Designing appropriate interfacing circuits to connect I/O devices with microprocessor.
4. Applying PLC as a controller in mechatronics system.
5. Designing and develop the apt mechatronics system for an application.

**UNIT I**

**INTRODUCTION**
Introduction to Mechatronics – Systems – Need for Mechatronics – Emerging areas of

UNIT II 8085 MICROPROCESSOR

UNIT III PROGRAMMABLE PERIPHERAL INTERFACE

UNIT IV PROGRAMMABLE LOGIC CONTROLLER
Introduction – Architecture – Input / Output Processing – Programming with Timers, Counters and Internal relays – Data Handling – Selection of PLC.

UNIT V ACTUATORS AND MECHATRONICS SYSTEM DESIGN

TOTAL:45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Identify suitable sensors to develop mechatronics systems.
2. Explain the architecture and timing diagram of microprocessor, and also interpret and develop programs.
3. Design appropriate interfacing circuits to connect I/O devices with microprocessor.
4. Apply PLC as a controller in mechatronics system.
5. Design and develop an appropriate mechatronics system for the given application

TEXT BOOKS:

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

1. Applying the fundamental concepts of computer graphics and its tools in a generic framework.
2. Creating and manipulating geometric models using curves, surfaces and solids.
3. Applying concept of CAD systems for 3D modeling and visual realism.
4. Creating and adding geometric tolerances in assembly modeling.
5. Applying CAD standard practices in engineering design.

UNIT I FUNDAMENTALS OF COMPUTER GRAPHICS
Product cycle - Design process - Computer Aided Design - Computer graphics - coordinate systems - 2D and 3D transformations - homogeneous coordinates - graphic primitives (point, line, circle drawing algorithms) - Clipping - viewing transformation.

UNIT II GEOMETRIC MODELING
Representation of curves - Hermite cubic spline curve, Bezier curve, B-spline curves, Surface Modeling - Surface Entities, Representation of Surface, Bezier Surface, B-Spline Surface and Coons Surface. Solid Modeling - Solid Entities, Solid Representation, Boundary Representation (B-Rep), Sweeps Representation, Constructive Solid Geometry (CSG).

UNIT III VISUAL REALISM

UNIT IV PART ASSEMBLY
Mass properties - Assembly modeling - Inference of position and orientation - Geometric Dimensioning and Tolerancing - Functional importance of various types of fits, Geometrical dimensioning and Tolerancing, Tolerance stacking - types and remedies.

UNIT V CAD STANDARDS
Standards for computer graphics - Graphical Kernel System (GKS) - Open Graphics Library (OpenGL) - Data exchange standards - IGES, STEP, ACIS and DXF - communication standards.

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Employ the fundamental concepts of computer graphics and its tools in a generic framework.
2. Create and manipulate the geometric models using curves, surfaces and solids.
3. Develop 3D model and visual realism in CAD systems.
4. Apply geometrical dimensioning and tolerancing in assembly modeling.
5. Adapt the standard CAD practices in engineering design.

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ME 7601    DESIGN OF TRANSMISSION SYSTEMS

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

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

UNIT I    DESIGN OF FLEXIBLE ELEMENTS
Motor power capacity for various applications - Design of Flat belts and pulleys - Selection of V belts and sheaves – Selection of wire ropes and pulleys – Design of Transmission chains and Sprockets.

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

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

UNIT IV   GEAR BOXES

UNIT V    CLUTCHES, BRAKES AND CAMS
Design of single and multi plate clutches, cone clutches, internal expanding rim clutchess and Electromagnetic clutches. Design of brakes: External shoe brakes - Single and Double Shoe, Internal expanding shoe brakes and Band brakes. 
Design of Cams: Types- Pressure angle and under cutting, determination of base circle -forces and surface stresses.

TOTAL:60 PERIODS

Note: (Use of standard Design Data Book is permitted in the University examination)
COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Select flexible elements like belt, ropes and chain drives for power transmission.
2. Design spur and helical gear drives for power transmission.
3. Design bevel and worm drives for power transmission.
4. Design multi speed gear box for machine tool and automotive applications.
5. Choose clutch and brake systems for power transmission.

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ME 7602 HEAT AND MASS TRANSFER

COURSE OBJECTIVES: The main learning objective of this course is to prepare the students for:
1. Applying the principle mechanism of heat transfer under steady state and transient conditions.
2. Applying the fundamental concept and principles in convective heat transfer.
3. Applying the theory of phase change heat transfer and design of heat exchangers.
4. Applying the fundamental concept and principles in radiation heat transfer.
5. Analyzing the relation between heat and mass transfer and to solve simple mass transfer problems.

UNIT I CONDUCTION
UNIT II CONVECTION 12

UNIT III PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS 12

UNIT IV RADIATION 12

UNIT V MASS TRANSFER 12

TOTAL:60 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Interpret the boundary conditions and analyse problems on conduction heat transfer.
2. Apply the concept of free and forced convection heat transfer principles in engineering systems.
3. Design the heat exchangers and understand the phase change characteristics of fluids.
4. Implement the concept of radiation heat transfer in various systems.
5. Analyze the mass transfer in engineering systems.

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HS7561 COMMUNICATION SKILLS AND SOFT SKILLS L T P C
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COURSE DESCRIPTION
This course aims to help engineering students acquire the employability skills necessary for the workplace. It also attempts to meet the expectations of the employers by giving special attention to
presentation skills, group discussion skills and soft skills. This aim will be achieved through expert guidance and teaching activities focusing on the above listed skills and language skills in the Language Laboratory.

OBJECTIVES
- To enhance the employability skills of students with a special focus on presentation skills, group discussion skills and interview skills and soft skills.
- To help them improve their writing skills necessary for the workplace situation.

CONTENTS

UNIT I WRITING SKILLS
Preparing job applications – writing the cover letter and resume – applying for jobs online – e-mail etiquette – writing reports – collecting, analyzing and interpreting data.

UNIT II SOFT SKILLS

UNIT III PRESENTATION SKILLS
Preparing slides using the computer– structuring the content (parts of a presentation)- body language – answering questions – individual presentation practice — mini presentation (practice sessions)

UNIT IV GROUP DISCUSSION SKILLS
Participating in group discussions – understanding group dynamics – brainstorming – questioning and clarifying – GD strategies (expressing opinions, accepting or refusing others opinions, turn taking) – activities to improve GD skills – viewing recorded GD – mock GD.

UNIT V INTERVIEW SKILLS
Interview etiquette–technical Interview/HR Interview/body language – mock interview – attending job interviews – Types of interviews- telephone/skype interview – stress interview, one to one/panel interview – FAQs related to job interview.

TOTAL: 45 PERIODS

OUTCOMES:
- Students will be able to make presentations and participate in group discussions with confidence.
- Students will be able to perform well in interviews.
- They will have adequate writing skills.

REFERENCES:

EXTENSIVE READERS
WEB RESOURCES
1. www.humanresources.about.com
2. www.careerride.com

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ME 7611  THERMAL ENGINEERING LABORATORY – II

COURSE OBJECTIVES: The main learning objective of this course is to provide hands on training to the students in:
1. Predicting the thermal conductivity of solids and liquids.
2. Estimating the heat transfer coefficient values of various fluids.
3. Analyzing the working of cooling tower.
5. Testing the performance of the refrigeration and air-conditioning systems

LIST OF EXPERIMENTS:
1. Thermal conductivity measurement using guarded plate apparatus.
2. Thermal conductivity measurement of pipe insulation using lagged pipe apparatus.
3. Determination of heat transfer coefficient under natural convection from a vertical cylinder.
4. Determination of heat transfer coefficient under forced convection from a tube.
5. Determination of Thermal conductivity of composite wall.
6. Determination of Thermal conductivity of insulating powder.
7. Heat transfer from pin-fin apparatus (natural & forced convection modes)
8. Determination of Stefan – Boltzmann constant.
10. Determination of Effectiveness of Parallel / counter flow heat exchanger.
11. Determination of COP of a refrigeration system
12. Performance test in a simple Air-Conditioning system
13. Performance test on a cooling tower

TOTAL: 60 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Predict the thermal conductivity of solids and liquids.
2. Estimate the heat transfer coefficient values of various fluids.
3. Analyze the working of cooling tower.
4. Test the performance of tubes in tube heat exchangers.
5. Test the performance of the refrigeration and air-conditioning systems
OBJECTIVES:
- To understand the working of power plants and analyse their performance.
- To learn the economics of power generation.

UNIT I HYDRO POWER PLANTS  

UNIT II COAL, OIL AND GAS TURBINE POWER PLANTS  

UNIT III NUCLEAR POWER PLANTS  

UNIT IV RENEWABLE ENERGY POWER PLANTS  

UNIT V ECONOMICS OF POWER GENERATION  

OUTCOMES:
Upon completion of this course the students will be able to:
1. Describe the working of a hydro-electric power plant and select appropriate turbine
2. Compare the pro's and con’s of coal, diesel and gas turbine power plants
3. Enumerate components associated with the nuclear power plants
4. Apply suitable technologies for harnessing renewable energy
5. Perform economic analysis of power plants and carbon credit calculation

TOTAL:45 PERIODS

TEXT BOOKS:

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

1. Applying the concept of CIM & Automation and analyzing the Manufacturing process.
2. Applying the Manufacturing knowledge in Process Planning and will gain Confidence in controlling production.
3. Analyzing Cellular Manufacturing.
4. Converting conventional system to FMS.
5. Selecting and applying Industrial Robots for Industries

UNIT I INTRODUCTION 9

UNIT II PRODUCTION PLANNING & CONTROL AND COMPUTERISED PROCESS PLANNING 9

UNIT III CELLULAR MANUFACTURING 9

UNIT IV FLEXIBLE MANUFACTURING SYSTEM (FMS) AND AUTOMATED GUIDED VEHICLE SYSTEM (AGVS) 9

UNIT V INDUSTRIAL ROBOTICS 9

TOTAL: 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Apply the concept of CIM & Automation and analyze the Manufacturing process.
3. Implement the concepts of Group Technology for the formation of Machine cells in cellular manufacturing.
5. Select suitable Robot configuration for Industrial applications.

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ME 7751        FINITE ELEMENT ANALYSIS        L  T  P  C
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COURSE OBJECTIVES: The main learning objective of this course is to prepare the students for:
1. Developing mathematical models for Boundary Value Problems and their numerical solution.
2. Applying concepts of Finite Element Analysis to solve one dimensional problem.
3. Determining field variables for two dimensional scalar variable problems.
4. Determining field variables for two-dimensional vector variable problems.
5. Applying the need for Isoperimetric transformation and the use of numerical integration

UNIT I  INTRODUCTION

UNIT II  ONE-DIMENSIONAL PROBLEMS

UNIT III  TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS

UNIT IV  TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS
Equations of elasticity – Plane stress, plane strain and axisymetric problems – Constitutive matrices and Strain displacement matrices – Stiffness matrix – Stress calculations - Plate and shell elements.

UNIT V  ISOPARAMETRIC FORMULATION AND ADVANCED TOPICS
Natural co-ordinate systems – Isoparametric elements – Shape functions for isoparametric elements – One and two dimensions – Serendipity elements – Numerical integration - Matrix
solution techniques – Solutions Techniques to Dynamic problems – Introduction to Analysis
Software- Introduction to Non Linearity.

TOTAL:45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Develop mathematical models for Boundary Value Problems and their numerical solution
2. Formulate the Finite Element methodology to solve the one dimensional problem(s).
3. Estimate field variables for two dimensional scalar variable problems
4. Determine field variables for two-dimensional vector variable problems
5. Apply the Isoparametric transformation and the use of numerical integration to engineering problems.

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ME 7711 CREATIVE AND INNOVATIVE PROJECT

TOTAL:60 PERIODS

COURSE OBJECTIVES:
The main learning objective of this course is to provide hands on training to the students in:
1. Creative and innovative thinking towards potential research areas in the field of Mechanical Engineering.
2. Comparing and contrast the several existing solutions for the problem identified.
3. Formulating and propose a plan for creating a solution for the research plan identified.
4. Conducting the experiments as a team and interpret the results.
5. Reporting and presenting the findings of the work conducted.

A project topic must be selected by the students in consultation with their guides. The ultimate aim of the project work is to deepen comprehension of mechanical principles by applying them to a new problem which may be the creative and innovative project for a specific application.

TOTAL:60 PERIODS

OUTCOME:
Upon completion of this course, the students will be able to:
1. Think creatively and innovatively towards potential research areas in the field of Mechanical Engineering.
2. Compare and contrast the several existing solutions for the problems identified.
3. Formulate and propose a plan for creating a solution for the research plan identified.
4. Conduct the experiments as a team and interpret the results.
5. Report and present the findings of the work conducted.

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**ME 7712 SIMULATION AND ANALYSIS LABORATORY**

**COURSE OBJECTIVES:**
The main learning objective of this course is to provide hands on training to the students in:
1. Applying the fundamental working principle of CNC machine tool.
2. Programming G & M Code programming and simulate the CNC program.
3. Generating part programming data through CAM software and Integrating CNC for unconventional machine tools.
4. Applying the principles of EDM Processes and Additive Manufacturing process.
5. Analyzing the force, stress, deflection, thermal stress, heat transfer, vibrations in mechanical components.

**UNIT I SIMULATION**

**LIST OF EXPERIMENTS**

1. **MANUAL PART PROGRAMMING:**
   (i) Part Programming - CNC Machining Centre
   a) Linear Cutting.
   b) Circular cutting.
   c) Cutter Radius Compensation.
   d) Canned Cycle Operations.
   (ii) Part Programming - CNC Turning Centre
   a) Straight, Taper and Radius Turning.
   b) Thread Cutting.
   c) Rough and Finish Turning Cycle.
   d) Drilling and Tapping Cycle.

2. **COMPUTER AIDED PART PROGRAMMING**
   e) CL Data and Post process generation using CAM packages.
   f) Application of CAPP in Machining and Turning Centre.

3. **STUDY OF CNC EDM, CNC EDM WIRE-CUT AND RAPID PROTOTYPING.**

**UNIT II ANALYSES**

**LIST OF EXPERIMENTS**

Use of any finite element analysis software for following problems:
1. Force and Stress analysis using link elements in Trusses, cables and bars.
2. Stress and deflection analysis in beams with different support conditions.
3. Stress analysis of flat plates and simple shells.
5. Thermal stress and heat transfer analysis of fins, plates and cylinders.
6. Vibration analysis of spring-mass systems.
7. Modal analysis of Beams.
8. Harmonic, transient and spectrum analysis of simple systems

**COURSE OUTCOMES:** Upon completion of this course, the students will be able to:
1. Apply the fundamental working principle of CNC machine tool.
2. Program G & M Code programming and simulate the CNC program.
3. Generate part programming data through CAM software and integrating the CNC and unconventional machine tools. Apply the principles of EDM Processes and Additive Manufacturing process.
4. Evaluate and determine the force, stress, deflection and vibrational characteristics in structural components.
5. Simulate and evaluate the thermal stress and heat transfer characteristics in mechanical components.

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**ME 7761 MECHATRONICS LABORATORY**

**OBJECTIVES:**
- Measuring of physical quantity such as displacement, force and temperature, and also the operation of signal conditioning circuits.
- Applying a suitable sensor and image processing technique for Mechatronics Systems.
- Designing appropriate circuits to automate and control the Hydraulic, Pneumatic, and Electric actuators.
- Applying PLC, PID and microcontroller as a control unit in the Mechatronics System.
- Developing a model of robot by using simulation software, and also execute real-time control over a Robot by IoT.

**LIST OF EXPERIMENTS:**
- Experimental study of basic Signal Conditioning Circuits.
- Experiments on application of LDR, Optocoupler, Ultrasonic and Infrared sensors.
- Modelling and Analysis of basic Hydraulic, Pneumatic and Electro-Pneumatic Circuits using Simulation Software.
- Actuation of Hydraulic, Pneumatic and Electro-Pneumatic circuits.
- Application of PLC with Timers and Counters.
- Solving basic Arithmetic Problems using 8085 Microprocessor and 8051 Microcontroller.
- Automatic Temperature Control System.
- Speed and Direction Control of DC drives by Microcontroller.
- Speed Control of AC drives by Microcontroller.
- Stepper Motor Actuation and Control.
- Servo Motor Actuation and Control.
- Actuation of Double-Acting Cylinder by Microcontroller and PLC.
- Application of Image Processing System.
- Data Acquisition System - Measurement and Analysis of Displacement, Force and Temperature.
- Modelling and Analysis of Robot using Simulation Software.
- Control of Robotic Actuation by Microcontroller. **TOTAL: 60 PERIODS**
COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Measure the displacement, force and temperature, and design the signal conditioning circuits for measurement systems.
2. Apply a suitable sensor and image processing technique for Mechatronics Systems.
3. Design appropriate circuits to automate and control the Hydraulic, Pneumatic, and Electric actuators.
4. Apply PLC, PID and microcontroller as controllers in the Mechatronics System.
5. Develop a model of robot by using simulation software, and also execute real-time control over a Robot by IoT.

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ME 7811 PROJECT WORK

OBJECTIVES:
- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students in preparing project reports and to face reviews and viva voce examination.
- A project topic must be selected by the students in consultation with their guides.
- The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and fabrication of a device for a specific application, a research project with a focus on an application needed by the industry/society, a computer project, a management project or a design project.
- 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. A project report is required at the end of the semester. The project work is evaluated jointly by external and internal examiners constituted by the Head of the Department based on oral presentation and the project report.

TOTAL: 300 PERIODS

OUTCOME:

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Discover potential research areas in the field of Mechanical Engineering.
2. Compare and contrast the several existing solutions for the problems identified.
3. Formulate and propose a plan for creating a solution for the research plan identified.
4. Conduct the experiments as a team and interpret the results.
5. Report and present the findings of the work conducted.
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GE 7071 DISASTER MANAGEMENT

OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Evaluating the types of disasters, causes and their impact on environment and society.
2. Evaluating the vulnerability using various methods of risk reduction measures and mitigation efforts.
3. Evaluating the inter-relationship between disaster and development.
4. Designing hazard and vulnerability profile of Indian scenario.
5. Analysing the disaster damage assessment and management.

UNIT I INTRODUCTION TO DISASTERS 9
Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don’ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9
Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9
Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9
Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9
Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

OUTCOMES:
Upon completion of this course, the students will be able to:
1. Evaluate the types of disasters, causes and their impact on environment and society.
2. Evaluate the vulnerability using various methods of risk reduction measures and mitigation efforts.
3. Evaluate the inter-relationship between disaster and development.
4. Design hazard and vulnerability profile of Indian scenario.
5. Analyse the disaster damage assessment and management.

**TEXT BOOKS:**

**REFERENCES**
1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005

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**OBJECTIVES**
The main learning objective of this course is to prepare the students for:
1. Applying the basic principles of human rights.
2. Analysing the evolution of human rights.
3. Applying the UN Laws on human rights.
4. Analysing the human rights scenario in India.
5. Analysing the relationship between human rights and social movement.

**UNIT I**

**UNIT II**

**UNIT III**
Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

**UNIT IV**
Human Rights in India – Constitutional Provisions / Guarantees.

**UNIT V**

**TOTAL : 45 PERIODS**
OUTCOMES:

Upon completion of this course, the students will be able to:
1. Apply the basic principles of human rights.
2. Analyse the evolution of human rights.
3. Apply the UN Laws on human rights.
4. Analyse the human rights scenario in India.
5. Analyse the relationship between human rights and social movement.

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IE7451 PRODUCTION AND OPERATIONS MANAGEMENT L T P C
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COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Recognize and appreciate the concept of Production and Operations Management in creating and enhancing a firm’s competitive advantages.
2. Describe the concept and contribution of various constituents of Production and Operations Management (both manufacturing and service).
3. Relate the interdependence of the operations function with the other key functional areas of a firm.
4. Teach analytical skills and problem-solving tools to the analysis of the operations problems.

UNIT I INTRODUCTION

UNIT II FORECASTING
Need, Determinants of Demand, Demand Patterns, Measures of forecast error, Qualitative Forecasting Methods-Delphi techniques. Market Research, Nominal Group Technique Quantitative Forecasting methods – Moving Average Methods, Exponential Smoothing Methods, Regression methods, Monitoring and Control of Forecasts, Requirements and Selection of Good forecasting methods.
UNIT III  AGGREGATE PLANNING AND MATERIAL REQUIREMENT PLANNING  
Role of aggregate Product planning, Managerial inputs to Aggregate planning, Pure and Mixed strategies, Mathematical Models for Aggregate planning – Transportation Method, Linear programming Formulation, Linear Decision Rues, Master Production Schedule(MPS). Procedure for developing MPS, MRP, Lot sizing methods of MRP, MRP Implementation issues.

UNIT IV  CAPACITY MANAGEMENT  

UNIT V  PRODUCTION ACTIVITY CONTROL AND LEAN MANUFACTURING  
Objectives and Activities of Production Activity Control - Introduction to Scheduling in different types of Production Systems.
Lean Manufacturing-Principles – Activities - Tools and techniques - Case studies.

TOTAL: 45 PERIODS

COURSE OUTCOME (CO): Upon completion of this course, the students will be able to:
1. The students will appreciate the role of Production and Operations management in enabling and enhancing a firm’s competitive advantages in the dynamic business environment.
2. The students will obtain sufficient knowledge and skills to forecast demand for Production and Service Systems.
3. The students will able to Formulate and Assess Aggregate Planning strategies and Material Requirement Plan.
4. The students will be able to develop analytical skills to calculate capacity requirements and developing capacity alternatives.
5. The students will be able to apply scheduling and Lean Concepts for improving System Performance

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MA 7352  APPLIED STATISTICS  
OBJECTIVE: The students will have a fundamental knowledge of the concepts of statistical method analyse and apply the tools in solving management problems.
UNIT I TESTS OF SIGNIFICANCE

Sampling distributions – Central limit theorem - Tests for single mean, proportion and difference of means, proportions (large and small samples) - Tests for single variance and equality of variances - $\chi^2$ - test for goodness of fit - Independence of attributes.

UNIT II NON-PARAMETRIC TESTS


UNIT III DESIGN OF EXPERIMENTS

Completely randomized design - Randomized block design - Latin square design - $2^2$ factorial design - Taguchi’s robust parameter design.

UNIT IV STATISTICAL QUALITY CONTROL

Control charts for variables - Control charts for attributes - Tolerance limits - Acceptance sampling by attributes.

UNIT V TIME SERIES


TOTAL: 60 PERIODS

OUTCOME:

- The students can independently participate in the processes of analysis, planning, formulating strategies of development, decision-making, governing and management, and independent making of tactical and strategic decisions related to the statistics.

TEXT BOOKS:


REFERENCES:


ME 7001 ADVANCED INTERNAL COMBUSTION ENGINEERING

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

1. Explaining the working of Gasoline fuel injection systems and SI combustion.
2. Explaining the working of Diesel fuel injection systems and CI combustion.
3. Identifying the source and measure it; explain the mechanism of emission formation and control methods.
4. Selecting alternative fuel resources and its utilization techniques in IC engines.
5. Explaining advanced combustion modes and future power train systems.

UNIT I SPARK IGNITION ENGINES


UNIT II COMPRESSION IGNITION ENGINES

UNIT III POLLUTANT FORMATION AND CONTROL 9

UNIT IV ALTERNATIVE FUELS 9
Alcohol, Hydrogen, Compressed Natural Gas, Liquefied Petroleum Gas and Bio Diesel - Properties, Suitability, Merits and Demerits - Engine Modifications.

UNIT V RECENT TRENDS 9

TOTAL: 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Describe the operation of SI engine and its combustion characteristics
2. Explain the operation of CI engine and its combustion characteristics.
3. Identify the source of engine pollutants, measure pollutant concentration and use appropriate control strategies
4. Categorize and utilize the various liquids and gaseous alternate fuels in IC engines.
5. Identify and understand modern combustion concepts and engine advancements

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ME 7002 ADVANCED METROLOGY

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COURSE OBJECTIVES:
1. To introduce the fundamentals of measurements and the procedure for estimating measurement uncertainty when conducting experiments.
2. To give an overview of the various optical measuring instruments used in industries.
3. To give an understanding of the importance of surface metrology and the different
methods of measuring surface finish.
4. To give an understanding of the concepts of nanometrology.
5. To provide an overview of the various measurements and their applications in manufacturing industries for research and in quality control.

UNIT I FUNDAMENTALS OF METROLOGY
Basic metrological concepts, Quality of measurements – errors, Uncertainty, Basic to advanced metrology evolution, Regression analysis, Design of experiments.

UNIT II OPTICAL DIMENSIONAL METROLOGY

UNIT III  ADVANCES IN SURFACE METROLOGY - 2D, 3D
Surface Geometry and Its Importance in Function, Surfaces and Manufacture, Filtering – Gaussian, 2RC, Advanced Filters, Surface finish parameters – Amplitude, Spacing, Hybrid, Shape, Autocorrelation, Power Spectral Density, Bearing Area.3D areal and parametric measurement, Need for 3D surface topography measurement, Stylus instruments, Optical Instruments – Chromatic confocal Microscopy, Interferometry, Non-optical Scanning Microscopy – Scanning electron Microscopes, Scanning probe microscopes, Parameters for characterizing 3D surface topography.

UNIT IV NANOMETROLOGY
Precision to Nanometrology, Optical Micro-Metrology of Small Objects - White-Light Interference 3D Microscopes, Focus-Based Optical Metrology- Fringe projection method, Measurement of Typical Nanofeatures, Measuring Length to Nanoscale with Interferometers and Other Devices, Nano Geometry in Macro Situations.

UNIT V METROLOGY IN MANUFACTURING
Case studies relating to various manufacturing sectors - Automobile, space, nuclear, Tool wear; Metrology in manufacturing research, Role of Metrology in Industry 4.0.

TOTAL: 45 PERIODS

OUTCOME:
Upon completion of this course, the students will be able to:
1. Plan the experiments and analyse the measured data, and estimate measurement uncertainty
2. Describe the working principle and applications of optical measuring instruments.
3. Apply surface finish measurement in manufacturing process analysis.
4. Outline the principles and methods of nanometrology.
5. Enumerate the role of metrology in I4.0 and apply measurements for quality control in manufacturing.

TEXT BOOKS:

REFERENCES:
ME 7003 CASTING AND WELDING PROCESSES  L T P C
3 0 0 3

OBJECTIVE:
- To impart knowledge on Design of Gating system for Castings, Foundry Practice of Ferrous, Non Ferrous alloys, Foundry Mechanisation, Welding Processes and Welding Metallurgy.

UNIT I DESIGN OF GATING SYSTEM 9

UNIT II FERROUS AND NON FERROUS CASTINGS 9
Steel Casting – The family of cast iron – melting of steels and cast irons – Grey ironfoundry practice – Ductile iron – Malleable Iron casting design – Aluminium, Magnesium, Copper, Zinc., Duplex Stainless Steel and Titanium alloys foundry practice.

UNIT III FOUNDRY MECHANISATION 9
Mechanical equipments in foundry – plant site location, layout – Plant Engineering – Maintenance – Services – Practical aspects.

UNIT IV WELDING PROCESS AND TECHNOLOGY 9

UNIT V WELDING METALLURGY 9

TOTAL: 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Explain the design of gating system in casting process
2. Explain the ferrous casting metallurgy and its applications.
3. Explain the nonferrous casting metallurgy and its applications.
4. Explain the ferrous welding metallurgy, the defects associated and its applications.
5. Explain the welding metallurgy of alloy steels and non-ferrous metals, the defects associated and its applications.

TEXT BOOK:

REFERENCES:
COURSE OBJECTIVES: The main learning objective of this course is to prepare the students for:
1. Analyzing mechanical strength of the composite material
2. Developing the FRP and other composites by different manufacturing methods
3. Analyzing fiber reinforced Laminates for different combinations of plies with different orientations of the fiber.
4. Evaluating the stresses in the lamina of the laminate using different failure theories
5. Analyzing thermo-mechanical behavior and evaluate residual stresses in different types of laminates using the Classical Laminate Theory.

UNIT I  INTRODUCTION TO COMPOSITE MATERIALS

UNIT II  MANUFACTURING OF COMPOSITES
Manufacturing of Polymer Matrix Composites (PMCs)-handlay-up, spray technique, filament winding, Pultrusion, Resin Transfer Moulding (RTM)-, bag moulding, injection moulding, Sandwich Mould Composites (SMC) - Manufacturing of Metal Matrix Composites (MMCs) - Solid state, liquid state, vapour state processing, Manufacturing of Ceramic Matrix Composites (CMCs) – hot pressing-reaction bonding process-infiltration technique, direct oxidation- interfaces.

UNIT III  INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS

UNIT IV  LAMINA STRENGTH ANALYSIS AND ANALYSIS OF LAMINATED FLAT PLATES

UNIT V  THERMAL ANALYSIS

TOTAL: 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Analyze mechanical strength of the composite material
2. Develop the FRP and other composites by different manufacturing methods
3. Analyze fiber reinforced Laminates for different combinations of plies with different orientations of the fiber.
4. Evaluate the stresses in the lamina of the laminate using different failure theories
5. Analyze thermo-mechanical behavior and evaluate residual stresses in different types of laminates using the Classical Laminate Theory.

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ME 7006 ENGINEERING MANAGEMENT

OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Explaining basic concepts of management; approaches to management; contributors to management studies; various forms of business organization and trade unions function in professional organizations.
2. Applying various functions of management in professional organization.
3. Applying organizational theory in professional organization.
4. Applying the principles of productivity and operations management in professional organization.
5. Applying modern concepts and marketing in management in professional organization.

UNIT II FUNCTIONS OF MANAGEMENT

UNIT III ORGANIZATIONAL BEHAVIOUR

UNIT IV GROUP DYNAMICS

UNIT V MODERN CONCEPTS

TOTAL : 45 PERIODS

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

1. Explain basic concepts of management; forms of business organization and trade unions function in professional organizations.
2. Identify the various functions of management.
3. Analyze the concepts of organizational behavior.
4. Adapt group dynamics in an organization.
5. Apply modern concepts and marketing in management.

TEXT BOOK:

REFERENCES:
ME 7007

GAS DYNAMICS AND SPACE PROPULSION

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

1. Applying the fundamentals of compressible flow concepts and the use of gas tables.
2. Analyzing the compressible flow behaviour in constant area ducts.
3. Analyzing the development of shock waves and its effects.
4. Explaining the types of jet engines and their performance parameters.
5. Explaining the types of rocket engines and their performance parameters.

UNIT I BASIC CONCEPTS AND ISENTROPIC FLOWS


UNIT II FLOW THROUGH DUCTS

Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – variation of flow properties. Choking concept, Isothermal flow with friction. Use of Gas tables.

UNIT III NORMAL AND OBLIQUE SHOCKS


UNIT IV JET PROPULSION

Theory of jet propulsion – thrust equation – Performance parameters - thrust, power and efficiency. Operation, cycle analysis and performance of ram jet, turbojet, turbofan, turbo prop and pulse jet engines.

UNIT V SPACE PROPULSION


TOTAL: 45 PERIODS

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

1. Outline the concepts of compressible flow and compute fluid properties using gas tables.
2. Analyze the fluid flow behaviour in constant area ducts under different thermodynamic conditions.
3. Describe the formation of shock waves and its effects.
4. Compare the performance characteristics of various jet engines.
5. Examine the various propellants and compute the performance parameters of rocket engine.
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ME 7008 MACHINE VISION

OBJECTIVES:
1. Explaining the concepts of Physics behind Digital Image Processing.
2. Illustrating the Methods of Image Acquisition.
3. Applying the different knowledge in different types image Processing.
4. Developing knowledge of different types analyzing the Captured Image.
5. Implementing at the idea about Machine Vision Applications.

UNIT I INTRODUCTION

UNIT II IMAGE ACQUISITION

UNIT III IMAGE PROCESSING

UNIT IV IMAGE ANALYSIS
Feature Extraction – Region Features, Shape and Size Features – Texture Analysis – Template

UNIT V  MACHINE VISION APPLICATIONS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Explain the concepts of Physics behind Digital Image Processing.
2. Illustrate the Methods of Image Acquisition.
3. Apply the different knowledge in different types image Processing.
4. Develop knowledge of different types analyzing the Captured Image.
5. Implement the idea about Machine Vision Applications.

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ME 7009  MEASUREMENT AND CONTROLS

COURSE OBJECTIVES: The main learning objective of this course is to prepare the students for:
1. Identify measurement parameters and analyze errors of measurements.
2. Select and apply suitable transducer for a particular measurement.
3. Identify measurement parameters and select the appropriate sensor for it.
4. Explain the working of various types of control systems of apply for specific applications.
5. Apply the principle of automatic control systems to control various parameter(s).

UNIT I  MEASUREMENTS

UNIT II  INSTRUMENTS
UNIT III  PARAMETERS FOR MEASUREMENT

UNIT IV  AUTOMATIC CONTROL SYSTEMS

UNIT V  APPLICATION OF CONTROL SYSTEMS
Governing of speed, kinetic and process control – pressure, temperature, fluid level, flow-thrust and flight control – photo electric controls.

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Identify measurement parameters and analyze errors of measurements.
2. Select and apply suitable transducer for a particular measurement.
3. Identify measurement parameters and select the appropriate sensor for it.
4. Explain the working of various types of control systems of apply for specific applications.
5. Apply the principle of automatic control systems to control various parameter(s).

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ME 7010  MECHANICAL VIBRATION AND NOISE CONTROL

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Apply the fundamental concepts of vibration.
2. Apply the fundamentals of noise.
3. Describe the various sources of noise for automotive applications.
4. Determine the natural frequencies and mode shapes of the two-degrees of freedom systems.
5. To apply the various control techniques to reduce the vibration and noise and improve the life of the components.
linear and non linear 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.

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 TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS
Vibration isolation, tuned absorbers, un-tuned viscous dampers, damping treatments, dynamic forces generated by IC engines, engine isolation, crank shaft damping, modal analysis of the mass elastic model shock absorbers.

UNIT V SOURCES OF NOISE AND ITS 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:45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Apply the fundamental concepts of vibration.
2. Apply the fundamentals of noise.
3. Describe the various sources of noise for automotive applications.
4. Determine the natural frequencies and mode shapes of the two-degree freedom systems.
5. Expose themselves to various control measures of both vibration and noise in different industrial applications.

TEXT BOOKS:

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

1. Selecting suitable material for MEMS and Microsystems, and explain the scaling laws involved in miniaturization.
2. Explaining the various micro-manufacturing processes.
3. Applying the working principle of electrostatic and thermal based MEMS sensors and actuators in the design of MEMS devices.
4. Applying the working principle of piezo-resistive, piezo-electric and magnetic effect in the design of MEMS devices.
5. Designing the elements of Micro-fluidic systems, and select suitable MEMS devices for Industrial applications.

UNIT I BASIC ENGINEERING FOR MEMS

UNIT II MICROMANUFACTURING TECHNIQUES
Photolithography, Ion Implantation, Diffusion, Oxidation, Chemical Vapour Deposition, Physical Vapour Deposition-Sputtering, Deposition by Epitaxy, Etching, Bulk Micromanufacturing, Micromachining Processes, LIGA Process, Micrsystem Assembly and Testing.

UNIT III ELECTROSTATIC AND THERMAL BASED MEMS

UNIT IV PIEZO / RESISTIVE / ELECTRIC AND MAGNETIC BASED MEMS

UNIT V MICROFLUIDICS AND APPLICATIONS OF MEMS
Microfluidics - Fluid Mechanics Concepts, Design and Fabrication of Channels, Valves, Pumps, Case Studies - Accelerometer, Gyros, RF MEMS and MOEMS.

TOTAL:45 PERIODS

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

1. Select suitable material for MEMS and Microsystems, and explain the scaling laws involved in miniaturization.
2. Explain the various micro-manufacturing processes.
3. Apply the working principle of electrostatic and thermal based MEMS sensors and
actuators in the design of MEMS devices.
4. Apply the working principle of piezo-resistive, piezo-electric and magnetic effect in the
design of MEMS devices.
5. Design the elements of Micro-fluidic systems, and select suitable MEMS devices for
Industrial applications.

TEXT BOOKS:
2. Tai-Ran Hsu, “MEMS and Micro systems Design and Manufacture”, McGraw Hill Education,
2015.

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ME 7012 MICROCONTROLLER AND EMBEDDED SYSTEMS

OBJECTIVE:
1. To impart knowledge about 8051 microcontroller and PIC
2. To get acquainted with programming of 8051 microcontroller
3. To become familiarized with PIC18FXXX
4. To provide insight into the methods of interfacing the i/o devices with microcontroller
5. To perceive the real-time applications of microcontrollers

UNIT I INTRODUCTION TO MICROCONTROLLER

UNIT II PROGRAMMING OF 8051 MICROCONTROLLER
Instruction Set - Addressing Modes - I/O Programming - Timer/Counter - Interrupts - Serial Communication of 8051.

UNIT III PROGRAMMING OF PIC18FXXX MICROCONTROLLER
Instruction Set - Addressing Modes - I/O Programming - Timer/Counter - Interrupts – Serial Communication, CCP, ECCP, PWM Programming of PIC18FXXX.

UNIT IV PERIPHERAL INTERFACING
Interfacing of Relays, Memory, Key Board, Displays - Alphanumeric and Graphic, RTC, ADC and DAC, I^2C, Stepper Motors and DC Motors, SPI with 8051 and PIC Family.

UNIT V SPECIAL PURPOSE MICROCONTROLLER & APPLICATIONS
OUTCOME:
Upon completion of this course, the students will be able to:
1. To explain the basic concepts of 8051 microcontroller and PIC
2. To program the 8051 microcontroller by using timers and counters
3. To program the PIC18FXXX microcontroller and will also able to apply ECCP module suitable for a variety of power and motor control applications
4. To execute the interfacing of sensors and actuators with 8051 microcontroller and PIC.
5. To design and create automated systems with the aid of microcontroller and PIC

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ME 7013 NEW AND RENEWABLE SOURCES OF ENERGY L T P C 3 0 0 3

COURSE OBJECTIVES: The main learning objective of this course is to prepare the students for:
1. Describing the current energy scenario in terms of conventional renewable energy and future plan.
2. Applying the principle of various solar energy generating devices.
3. Applying the principle of various wind energy devices.
4. Applying the principle of various bio energy devices.
5. Applying the principle of various ocean and geothermal energy devices.

UNIT I SOLAR ENERGY

UNIT II WIND ENERGY
UNIT III  BIO - ENERGY
Bio resources – Biomass direct combustion – Biomass gasifier - Types of biomass gasifiers -
Cogeneration — Carbonisation – Pyrolysis - Biogas plants – Digesters –Biodiesel production –
Ethanol production - Applications.

UNIT IV  OCEAN AND GEOTHERMAL ENERGY
Small hydro - Tidal energy – Wave energy – Open and closed OTEC Cycles – Limitations –
Geothermal energy – Geothermal energy sources - Types of geothermal power plants –
Applications - Environmental impact.

UNIT V  NEW ENERGY SOURCES
Storage – Transport and utilisation - Safety issues.

TOTAL:45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Assess and apply different technologies for harnessing solar energy
2. Analyse and evaluate the performance of wind mills
3. Examine and recommend appropriate technologies for conversion of biomass to energy
4. Summarise the different option for receiving energy from ocean and compare their
   relative pros and cons.
5. Analyse and interpret the relevance of new energy sources namely fuel cells, hydrogen
   energy for the current scenario.

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ME 7014  NON-DESTRUCTIVE MATERIALS EVALUATION

OBJECTIVE:
1. To make the students to understand the importance of NDT in quality assurance.
2. To imbibe the students the basic principles of various NDT techniques, its
   applications, limitations, codes and standards.
3. To equip the students with proper competencies to locate a flaw in various materials,
   products.
4. To make the students to be ready to use NDT techniques for in-situ applications too.
5. To inculcate the knowledge of selection of the right NDT technique for a given
   application.
UNIT I  INTRODUCTION AND VISUAL INSPECTION METHODS  
NDT versus Mechanical testing, Need for NDT, Relative merits and limitations, various physical characteristics of materials and their applications in NDT. Visual Inspection - Unaided, Aided-Borescopes - Videoscopes, Special features in Borescopes, Selection of borescopes, Optical sensors, Microscopes & replication Microscopy Technique and applications.

UNIT II  LIQUID PENETRANT TESTING AND MAGNETIC PARTICLE TESTING  
LPT - Principle, types, Procedures, Penetrants and their characteristics, Emulsifiers, Solvent Cleaners / Removers, Developers- properties and their forms, Equipments, Advantages and limitations, Inspection and Interpretation, Applications.  

UNIT III  THERMOGRAPHY AND EDDY CURRENT TESTING  
Thermography – Introduction, Principle, Contact & Non-Contact inspection methods, Active & Passive methods, Liquid Crystal – Concept, example, advantages & limitations. Electromagnetic spectrum, infrared thermography- approaches, IR detectors, Instrumentation and methods and applications.  
Eddy current Testing – Principle, properties of eddy currents, Eddy current sensing elements, probes, Instrumentation, Types of arrangement, Advantages & Limitations, Interpretation of Results & applications.

UNIT IV  ULTRASONIC TESTING AND ACOUSTIC EMISSION TESTING  
Ultrasonic Testing- Principle, Basic Equipment, Transducers, couplants, Ultrasonic wave, Variables in UT, Transmission and Pulse-echo method, Straight beam and angle beam, A-Scan, B-Scan & C-Scan, Phased Array Ultrasound & Time of Flight Diffraction, Advantages & Limitations, Interpretation of Results & Applications.  

UNIT V  RADIOGRAPHY  

TOTAL: 45 PERIODS

COURSE OUTCOMES:  
The students will be able to:  
1. Compare the various visual inspection techniques and select a suitable inspection technique for the given component.  
2. Make use of the Penetrant and magnetic particle testing methods for flaw detection.  
3. Interpret the data obtained from Thermographic and Eddy current inspections.  
4. Evaluate the results obtained through Ultrasonic inspection and Acoustic Emission techniques.  
5. Explain the techniques involved in the Radiographic testing and the various advancements in Radiography.

TEXT BOOKS:  
1. ASM Metals Handbook, “Non-Destructive Evaluation and Quality Control”, American Society of
ME 7015 PRINCIPLES OF ROBOTICS

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

1. Explaining the concepts of industrial robots with respect to its classification, specifications and coordinate systems. Reviewing the need and application of robots in different engineering fields.
2. Exemplifying the different types of robot drive systems as well as robot end effectors.
3. Applying the different sensors and image processing techniques in robotics to improve the ability of robots.
4. Developing robotic programs for different tasks and analyzing the kinematics motions of robot.
5. To gain knowledge about Robot Control, Robot Programming and Applications of Robots.

UNIT I FUNDAMENTALS OF ROBOTICS AND THEIR ACTUATORS
Introduction to Robotics, Robot Joints, Robot Configurations - Joint Notations - Work Envelope – Applications and Limitations, Speed of Motion and Load Carrying Capacity, Robot Control Systems, Precision of Movement.
Overview of Electric, hydraulic and Pneumatic Drives, Stepper & Servo Drives – Linear & Rotary types, Smart Actuators of Micro Robots.

UNIT II ROBOT LOCOMOTION AND END EFFECTORS

UNIT III ROBOT SENSORS AND VISION
Tactile Sensors, Proximity and Range Sensors, Sensing and digitizing function in Robot Vision, Image processing and Analysis, Training the Vision System, Applications of Robot Sensors and
UNIT IV ROBOT MOTION ANALYSIS AND CONTROL 9
Introduction to manipulator Kinematics, Homogeneous Transformations and Robot Kinematics, Manipulator Path Control, Robot Arm Statics and Dynamics, Trajectory Planning, Robot Control System.

UNIT V ROBOT PROGRAMMING AND APPLICATIONS 9

TOTAL:45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Explain the different types of joints and drives to design robotic configuration.
2. Design the appropriate locomotive mechanisms for robots and grippers.
3. Identify the different sensors and apply the image processing techniques to enhance robots maneuverability.
4. Apply kinematic and dynamic principles in robot motion control.
5. Develop programs for robotic applications.

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ME 7016 REFRIGERATION AND AIR CONDITIONING L T P C
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COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:

1. Explaining the different types of refrigerant, their properties, and selecting appropriate refrigerant for a HVAC system.
2. Explaining different types and components of RAC systems.
3. Designing the heat load and system size.
4. Explaining types of air-conditioning system and air distribution configurations.
5. Applying the safety and types of control in HVAC systems.
UNIT I  VAPOUR COMPRESSION REFRIGERATION SYSTEM

UNIT II  REFRIGERANTS AND COMPONENTS OF REFRIGERATION SYSTEMS
Refrigerants desirable properties – Classification - Nomenclature - ODP & GWP; Equipments: Type of Compressors, Condensers, Expansion devices, Evaporators.

UNIT III  OTHER REFRIGERATION SYSTEMS
Working principles of Vapour absorption systems and adsorption cooling systems - Steam jet refrigeration- Thermoelectric refrigeration- Air refrigeration - Magnetic - Vortex and Pulse tube refrigeration systems.

UNIT IV  PSYCHROMETRIC PROPERTIES AND PROCESSES

UNIT V  AIR CONDITIONING SYSTEMS AND LOAD ESTIMATION
Air conditioning loads: Outside and inside design conditions; Heat transfer through structure, Solar radiation, Electrical appliances, Infiltration and ventilation, internal heat load; Apparatus selection; fresh air load, human comfort & IAQ principles, effective temperature & chart, calculation of summer & winter air conditioning load; Classifications, Layout of plants; Air distribution system. Air Conditioning Systems with Controls: Temperature, Pressure and Humidity sensors, Actuators & Safety controls, Filters.

TOTAL:45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Identify the different types of refrigeration cycles, refrigerant and their properties, and select appropriate refrigerant for specific application.
2. Categorize different types of components in RAC systems.
3. Apply non compression based refrigeration systems depending upon energy input.
4. Compute the thermodynamic properties of moist air and analyze the Psychrometric processes.
5. Estimate the heat load and design the appropriate air-conditioning systems with proper safety controls.

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COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Applying the 7 QC tools in problem solving for continuous improvement.
2. Designing online sampling plan for quality control using control charts and perform process capability studies.
3. Applying the strategies of acceptance sampling plan to perform quality audit in the customer site.
4. Evaluating the different reliability measurements applying the reliability concepts
5. Selecting the suitable method of improving the reliability and integrate reliability concepts in new product design and development.

UNIT I  INTRODUCTION AND STATISTICAL PROCESS CONTROL  9
Introduction:-definitions of quality, Evolution of Quality: Inspection, Quality Control, Quality assurance Customer-Orientation: Internal & External Customer Concept, Life cycle approach to quality costs- Prevention; Appraisal and Failure costs. Seven SPC tools -Histogram, Check sheets, Ishikawa diagrams, Pareto, Scatter diagrams, Control charts and flow chart.

UNIT II  ONLINE QUALITY CONTROL  9
Control chart for attributes –control chart for non conformings– p chart and np chart – control chart for nonconformities– C and U charts, Control chart for variables – X chart, R chart and S chart - State of control and process out of control identification in charts, pattern study and process capability studies.

UNIT III  OFFLINE QUALITY CONTROL  9

UNIT IV  RELIABILITY CONCEPTS  9
Reliability engineering - fundamentals – failure data analysis, Mean failure rate, Mortality curve-concept of burn –in period, useful life and wear out phase of a system, mean time to failure, mean time between failure, hazard rate – failure density and conditional reliability-Maintainability and availability – simple problems.

UNIT V  RELIABILITY ESTIMATION  9

TOTAL: 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Apply the 7 QC tools in problem solving for continuous improvement.
2. Design online sampling plan for quality control using control charts and perform process capability studies.
3. Apply the strategies of acceptance sampling plan to perform quality audit in the customer site.
4. Evaluate the different reliability measurements applying the reliability concepts
5. Select the suitable method of improving the reliability and integrate reliability concepts in new product design and development.

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ME 7018  THEORY OF METAL FORMING  L T P C
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OBJECTIVES:
- To impart knowledge on plasticity, surface treatment for forming of various types of metal forming process.
- To study the basic concepts of metal forming techniques and force calculation in metal forming process.
- To study the various sheet metal forming concepts.
- To study the powder metallurgy and special forming process concepts.
- To study the surface treatment and metal forming concepts.

UNIT I  THEORY OF PLASTICITY 9

UNIT II  THEORY AND PRACTICE OF BULK FORMING PROCESSES 9
Analysis of plastic deformation in Forging, Rolling, Extrusion, rod/wire drawing and tube drawing – Effect of friction – calculation of forces, work done – Process parameters, equipment used – Defects – applications – Recent advances in Forging, Rolling, Extrusion and Drawing processes – Design consideration in forming.

UNIT III  SHEET METAL FORMING 9

UNIT IV  POWDER METALLURGY AND SPECIAL FORMING PROCESSES 9

**OUTCOME:**
Upon completion of the course the students will be able to:
1. Ability to learn stress-strain concepts and apply suitably to find out the solution to plastic deformation
2. Apply the theory of plasticity and its application for analysing various bulk forming processes
3. Understand the principle of Sheet metal forming and apply in different applications
4. Ability to use powder metallurgy and special forming processes for different applications
5. Understand the different treatment applied on forming components

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**ME 7019 TURBO MACHINERY**

**COURSE OBJECTIVES:**
The main learning objective of this course is to prepare the students for:
1. Explaining the energy transfer in rotor and stator parts of the turbo machines.
2. Explaining the function of various elements of centrifugal fans and blowers.
3. Evaluating the working and performance of centrifugal compressor.
5. Explaining the types and working of axial and radial flow turbines
UNIT I  WORKING PRINCIPLES

UNIT II  CENTRIFUGAL FANS AND BLOWERS

UNIT III  CENTRIFUGAL COMPRESSOR

UNIT IV  AXIAL FLOW COMPRESSOR

UNIT V  AXIAL AND RADIAL FLOW TURBINES

TOTAL: 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Analyze and compute the energy transfer in turbo machines.
2. Evaluate the performance of centrifugal fans and blowers through velocity triangles
3. Design the centrifugal compressor for various engineering applications.
4. Interpret the effect of blade geometries on performance of axial flow compressors
5. Categorize the different types of turbines and their applications

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVES: The main learning objective of this course is to prepare the students for:
1. Explaining various types of automobiles, their power packs and types of vehicle bodies.
2. Analyzing the various types of power train and fuel supply and management systems.
3. Analyzing the various types of transmission systems for a vehicle.
4. Analyzing the working parameters of various braking and suspension system in a vehicle.
5. Analyzing the working parameters of various electrical and electronic devices in a vehicle

UNIT I INTRODUCTION TO AUTOMOTIVES
An overview of different types of automobiles and their power sources. Specifications, Performance Parameters, Quality standards, Trends in automobile design.

UNIT II POWER SOURCE FEATURES
Reciprocating Engine systems, Rotary Engine systems, Gas Turbine systems, Hybrid systems. Pollutant emissions and their control; Catalytic converter systems, Electronic Engine Management systems.

UNIT III TRANSMISSION, SUSPENSION AND BRAKING SYSTEMS
Clutch system, Gear box system, propeller shafting, differential, axles, wheels and tyres and preliminaries of suspension systems.

UNIT IV AUXILIARY SYSTEMS
Electrical and electronic systems, safety systems, Heating, Ventilation, and Air Conditioning (HVAC) systems, Vehicle Thermal Management System and vehicle body design features.

UNIT V TESTS, SERVICE AND MAINTENANCE
Engine Tuning, vehicle maintenance, engine and Chassis Dynamometry Pollutants and emissions check, Wind Tunnel Tests, preliminaries of engine and vehicle testing.

TOTAL: 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Identify different types of automobiles and emerging trends in automotive design.
2. Compare the constructional and operational features of reciprocating and rotary engines.
3. Outline the construction and working features of transmission, differential and axle systems of a vehicle.
4. Enumerate the functioning and troubleshooting HVAC and vehicle thermal management systems.
5. Understand the vehicle testing and maintenance procedures

TEXT BOOK:

REFERENCES:
ME7072  COMPUTATIONAL TECHNIQUES FOR FLUID DYNAMICS  L  T  P  C
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COURSE OBJECTIVES: The main learning objective of this course is to prepare the students for:
1. Applying the fundamentals of CFD, and developing case specific governing equations.
2. Performing finite difference and finite volume-based analysis for steady and transient diffusion problems.
3. Implementing various mathematical schemes under finite volume method for convention diffusion.
4. Solving complex problems in the field of fluid flow and heat transfer with the support of high speed computers.
5. Applying the various discretization methods, solution procedure and the concept of turbulence modeling.

UNIT I  GOVERNING EQUATIONS AND BOUNDARY CONDITIONS  9

UNIT II  FINITE DIFFERENCE AND FINITE VOLUME METHODS FOR DIFFUSION  9

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

UNIT IV  FLOW FIELD ANALYSIS  9

UNIT V  TURBULENCE MODELS AND MESH GENERATION  9

TOTAL: 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Use the concepts of CFD and formulate governing equations for different systems.
2. Compute the solutions for steady and transient diffusion problems using finite difference and finite volume methods.
3. Implement various discretization schemes under finite volume method for convection diffusion systems.
4. Evolve the solutions for complex fluid flow and heat transfer problems using various algorithms.
5. Apply the various turbulence models for the engineering systems.

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ME 7073 DESIGN FOR MANUFACTURING

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

1. Applying economic process selection principles and general design principles for manufacturability in the development and design of products for various engineering applications. Also, apply design consideration principles of casting in the design of cast products.
2. Applying design consideration principles of forming in the design of extruded, stamped, and forged products.
3. Applying design consideration principles of machining in the design of turned, drilled, milled, planed, shaped, slotted, and ground products.
4. Applying design consideration principles of welding in the design of welded products.
5. Applying design consideration principles of assembly in the design of assembled products.

UNIT I INTRODUCTION AND DESIGN FOR CASTING
Introduction - Economics of process selection - General design principles for manufacturability; Design considerations for: Sand cast – Die cast – Permanent mold cast parts.

UNIT II DESIGN FORMFORMING
Design considerations for: Metal extruded parts – Impact/Cold extruded parts – Stamped parts – Forged parts.

UNIT III DESIGN FORWELDING

UNIT IV DESIGN FORMACHINING
Design considerations for: Turned parts – Drilled parts – Milled, planed, shaped and slotted parts– Ground parts.

UNIT V DESIGN FORASSEMBLY
COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Interpret the economics and design of cast components.
2. Design best manufacturing practices for forming of components.
3. Formulate design consideration in the design of welded products.
4. Develop design principles for machining.
5. Apply principles of assembly in the design of assembly of parts.

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ME 7074 DESIGN OF HEAT EXCHANGERS

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Explaining the fundamentals of heat exchangers and its types, performing the thermal analysis on heat exchangers.
2. Designing the components of heat exchangers for various applications.
4. Explaining the fundamentals and applications of compact heat exchangers.
5. Explaining the fundamentals and applications of condenser and cooling towers.

UNIT I INTRODUCTION
Types of heat exchangers, shell and tube heat exchangers – regenerators and recuperators - Temperature distribution and its implications - Parts description, Classification as per Tubular Exchanger Manufacturers Association (TEMA).

UNIT II PROCESS DESIGN OF HEAT EXCHANGERS

UNIT III STRESS ANALYSIS
Stress in tubes – header sheets and pressure vessels – thermal stresses, shear stresses - types of failures, buckling of tubes, flow induced vibration.

UNIT IV COMPACT AND PLATE HEAT EXCHANGER
Types- Merits and Demerits- Design of compact heat exchangers, plate heat exchangers, performance influencing parameters, limitations.
UNIT V CONDENSERS AND COOLING TOWERS

Design of surface and evaporative condensers – cooling tower – performance characteristics.

TOTAL: 45 PERIODS

OUTCOME:
Upon completion of this course, the students will be able to:
1. Summarize and select the different types of heat exchangers for specific applications.
2. Design the heat exchangers for various applications.
3. Predict the different thermal stresses in heat exchangers.
4. Categorize and formulate the design aspects of compact and plate heat exchangers.
5. Analyze and evaluate parametric influences on performance of condenser and cooling towers.

TEXT BOOKS:

REFERENCES:
UNIT II  STRESSES IN PRESSURE VESSELS  9
Introduction – Stresses in a circular ring, cylinder – Dilatation of pressure vessels. Membrane stress
Analysis of Vessel – Cylindrical, spherical and, conical heads – Thermal Stresses – Discontinuity
stresses in pressure vessels.

UNIT III  DESIGN OF VESSELS  9
Design of Tall cylindrical self supporting process columns – Supports for short vertical vessels –
Stress concentration at a variable Thickness transition section in a cylindrical vessel, about a
round hole, elliptical openings. Theory of Reinforcement – Pressure Vessel Design.

UNIT IV  BUCKLING AND FRACTURE ANALYSIS IN VESSELS  9
Buckling phenomenon – Elastic Buckling of circular ring and cylinders under external pressure –
collapse of thick walled cylinders or tubes under external pressure – Effect of supports on Elastic
Buckling of Cylinders – Buckling under combined External pressure and axial loading.

UNIT V  PIPING  9

OUTCOMES:
Upon completion of this course, the students will be able to:
1. understand the design philosophy and different failure modes of pressure vessels.
2. explore the knowledge of stresses and deflection in various form of vessels.
3. obtain the knowledge of design of pressure vessels, stress concentration in pressure
   vessel and theory of reinforcement.
4. acquire the knowledge of buckling and fracture mechanisms in pressure vessels.
5. study the principle of pipe drafting and material selection for piping.

TEXT BOOK:

REFERENCES:
2. Stanley, M. Wales, “Chemical process equipment, selection and Design. Buterworths series in
3. William. J., Bees, “Approximate Methods in the Design and Analysis of Pressure Vessels and

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ME 7076  ENERGY CONSERVATION IN INDUSTRIES  L T P C
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OBJECTIVES:
- To understand and analyse the energy data of industries.
- To carry out energy accounting and balancing.
- To conduct energy audit and suggest methodologies for energy savings.
- To utilise the available resources in optimal ways.
UNIT I  INTRODUCTION

UNIT II  ECONOMICS

UNIT III  ELECTRICAL SYSTEMS

UNIT IV  THERMAL SYSTEMS

UNIT V  ENERGY CONSERVATION IN MAJOR UTILITIES
Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems - Cooling Towers – D.G. sets

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Analyse the energy data of industries.
2. Apply ESCO and other financial evaluation techniques to estimate the accruable energy savings/monetary benefits for any energy efficiency project
3. Diagnose the causes for under performance of various electrical utilities and suggest remedies for improving their efficiency
4. Compute the stoichiometric air requirement for any given fuel and quantify the energy losses associated with thermal utilities of industries
5. Improve the efficiency by adopting energy conservation in major utilities

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

1. Explaining the types, characteristics of entrepreneurship and its role in economic development.
2. Applying the theories of achievement motivation and the principles of entrepreneur development program to enterprise.
3. Selecting the appropriate form of business ownership in setting up an enterprise.
4. Applying the fundamental concepts of finance and accounting to enterprise.
5. Identifying sickness in industry, selecting the appropriate corrective measures, and identifying the growth strategies in enterprise.

UNIT I ENTREPRENEURSHIP

UNIT II MOTIVATION

UNIT III BUSINESS

UNIT IV FINANCING AND ACCOUNTING

UNIT V SUPPORT TO ENTREPRENEURS

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

1. Explain the types, characteristics of entrepreneurship and its role in economic development.
2. Apply the theories of achievement motivation and the principles of entrepreneurship development program.
3. Select the appropriate form of business ownership in setting up an enterprise.
4. Apply the fundamental concepts of finance and accounting to enterprise.
5. Identify sickness in industry, select the appropriate corrective measures, and identify the growth strategies in enterprise.

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ME 7078  INTRODUCTION TO OPERATIONS RESEARCH  

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

1. Selecting the constraints on the availability of resources and developing a model and render an optimal solution during the given circumstances.
2. Appraising the challenges in the transportation and production problems and furnishing a rational solution to maximize the benefits.
3. Planning the purchase/ manufacturing policies, managing the spares/ stocks and meeting the customer demands.
4. Analyzing the queue discipline and exploring the avenues for better customer service.
5. Investigating the nature of the project/ failure and offering methodical assistance towards decision making.

UNIT I  LINEAR PROGRAMMING PROBLEMS  

OR-Definition - Phases - models, LP problems formulation – Graphical solution, GLPP, Standard and Canonical forms of LPP- simplex methods- Big M, Two phase methods, Alternate optimal solutions, Duality in LP.

UNIT II  TRANSPORTATION  

Transportation problems- Basic feasible solution, Optimal solution By MODI method, Balanced and Unbalanced TP, Degeneracy, Production problems. Assignment problems – Hungarian method Traveling salesman problems - Sequencing models- Johnson algorithm, n job 2 machines, n job 3 machines and n job m machines.

UNIT III  INVENTORY CONTROL  

Types of inventory- Inventory cost - EOQ - Deterministic inventory problems – Purchase and Production models with and without shortages EOQ with price breaks - Stochastic inventory problems - Multi product problems - Systems of inventory control (P and Q Systems)- Determination of buffer stock and re-order levels -Selective inventory control techniques (ABC, VED, SDE, etc.)

UNIT IV  QUEUING THEORY  

Queueing system - Characteristics - symbols - Poisson process and exponential distribution - Single server queuing models - Multiserver queuing models, Simulation Monte Carlo technique- Inventory & Queuing problems.

UNIT V  PROJECT MANAGEMENT AND REPLACEMENT MODELS  

Project management: Network logic – Ford-Fulkerson's rule - AON diagram - CPM and PERT techniques, Critical path and float calculations Replacement models - types of failures – Gradual failures-replacement of items: Efficiency deteriorates with time, sudden failures- individual and group replacement policies.
COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Select the constraints on the availability of resources, develop a model and render an optimal solution for the given circumstances.
2. Appraise the challenges in the transportation and production problems and furnish a rational solution to maximize the benefits.
3. Plan the purchase/manufacturing policies, manage the spares/stocks and meet the customer demands.
4. Analyze the queue discipline and explore the avenues for better customer service.
5. Investigate the nature of the project/failure and offer methodical assistance towards decision making.

TEXT BOOKS:

REFERENCES:
1. G. Srinivasan, “Operations research principles and applications”, 2\textsuperscript{nd} edition EEE 2010, PHI.
3. Frederick S. Hiller and Gerald J. Lieberman, “Operations research concepts and cases”, 8\textsuperscript{th} edition (SIE) 2008, TMH.

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ME 7079 LEAN SIX SIGMA

OBJECTIVE:
1. To explain the lean principles and the need to follow these principles in industries.
2. To give an overview of the various tools and techniques involved in lean manufacturing used in industries.
3. To provide the necessary skills needed to analyze a given situation to draw the current state map and to identify potential improvement areas and then draw the future state map.
4. To give an understanding of the various tools used in a six sigma project for quality improvement.
5. To provide an overview of the DMAIC methodology in a six sigma project.

UNIT I EVOLUTION AND OVERVIEW OF LEAN MANUFACTURING

UNIT II LEAN MANUFACTURING – TOOLS AND TECHNIQUES
3Ms – Muda, Mura, Muri, 7 Wastes in Manufacturing, Lean Tools to eliminate Muda - 5S,
Standardised work, TPM, SMED, Jidoka – Poka Yoke, JIT, Heijunka, Kanban, One piece production.

UNIT III VALUE STREAM MAPPING 9
Need for Value Stream mapping; Steps involved in Value stream mapping – Choose value stream – PQ and PR analysis, Current State map, Lean Metrics, Future State Map, Kaizen plans; Lean implementation - Cultural change, Lean in the Supply chain.

UNIT IV SIX SIGMA – TOOLS AND TECHNIQUES 9
Cost of Quality – Conformance and Non-Conformance cost, 7 Basic Quality Control Tools, Seven Management tools, FMEA.

UNIT V SIX SIGMA METHODOLOGY 9
Need for Six Sigma, Six Sigma Team, DMAIC Methodology - Define, Measure, Analyse, Improve and Control; Lean Six Sigma.

TOTAL:45 PERIODS

TEXT BOOKS:
1. Pascal Dennis, “Lean production Simplified: A plain language guide to the world’s most powerful Production system”, Productivity Press 2007

REFERENCES:
2. Taichi Ohno, Toyota “Production System: Beyond Large-Scale Production”, Productivity Press 1988

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ME 7080 MARKETING MANAGEMENT L T P C 3 0 0 3

COURSE OBJECTIVES: The main learning objective of this course is to prepare the students for:
1. Explaining the basic concepts in marketing.
2. Explaining the various buying behaviour methods.
3. Analyzing the various product pricing concepts.
4. Analyzing the various marketing planning principles and its strategies.
5. Describing the trends of advertising, sales promotion methods.

UNIT I CONCEPTS IN MARKETING 9
UNIT II  BUYING BEHAVIOUR AND MARKET SEGMENTATION
Cultural, Demographic factors, Motives, Types, Buying Decisions, Segmentation factors, Demographic, Psycho graphic and Geographic Segmentation, Process, Patterns. Services marketing and Industrial marketing.

UNIT III  PRODUCT, PRICE AND MARKETING RESEARCH

UNIT IV  MARKETING PLANNING AND STRATEGY FORMULATION

UNIT V  ADVERTISING, SALES PROMOTION AND DISTRIBUTION

TOTAL:45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Explain the basic concepts in marketing.
2. Distinguish the various buying behavior methods.
3. Analyze the different pricing concepts.
4. Outline the marketing planning principles and its strategies.
5. Illustrate the trends of advertising, sales, promotion and distribution.

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Creating a process plan for a given Product.
2. Preparing cost elements for a given product.
3. Allocating overhead to different departments.
5. Analyzing the costs for machining a product.

UNIT I INTRODUCTION TO PROCESS PLANNING 9
Aims and Objectives, Place of process planning in Manufacturing cycle, Drawing interpretation, Dimensional tolerance vs Production processes.

UNIT II PROCESS PLANNING STEPS 9

UNIT III INTRODUCTION TO COST ESTIMATION 9
Importance, Types, Purpose, Components, Procedure, Classification of costs, Cost elements, Overhead expenses, Break-even analysis.

UNIT IV PRODUCTION COST ESTIMATION 9
Estimation of production cost for - Casting processes, Welding processes, and Forging processes.

UNIT V ESTIMATION OF MACHINING TIME AND COST 9
Estimation of Machining time – Lathe operations, Drilling, Milling, Shaping and Planing, and Grinding, Cost estimation for machining processes.

TOTAL: 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Explain the Process flow for a given Product.
2. Create a process plan for manufacturing a component.
3. Estimate the overhead cost associated with manufacturing plant.
4. Evaluate the total cost for the Cast, welded and Forged products.
5. Analyze the machining time and estimate the cost of machined product.

TEXT BOOKS:

REFERENCES:
ME 7082            PRODUCT DESIGN AND DEVELOPMENT            L  T  P  C
            3  0  0  3

COURSE OBJECTIVES:  The main learning objective of this course is to prepare the students for:
1. Applying the principles of generic development process; conducting customer need analysis; and setting product specification for new product design and development.
2. Generating, selecting, screening, and testing concepts for new product design and development.
3. Applying the principles of product architecture and industrial design to concept generation, selection, design and develop new products.
4. Applying the principles of DFM and Prototyping to design and develop new product.
5. Applying the concepts of economics principles; project management practices in the development of new product by prototyping

UNIT I  INTRODUCTION  9

UNIT II  PRODUCT PLANNING, IDENTIFYING CUSTOMER NEEDS, PRODUCT SPECIFICATION  9
Product Planning Process: Identification of opportunities; evaluation and prioritization of projects; allocation of resources & plan timing; completion of pre-project planning. Identification of Customer Needs: Collection of raw data from customers; interpretation of raw data of customer needs; organization of the needs into a hierarchy; establishment of relative importance of needs. Product Specifications: Establishment of Target Specifications, Setting-up of Final Specifications.

UNIT III  CONCEPT GENERATION, SELECTION, TESTING  9
Concept Generation: clarification of the problem; searching externally; searching internally, systematic exploration. Concept Selection: concept screening steps; concept scoring steps. Concept Testing: Defining the purpose of concept test; choosing a survey population; format; communicating the concept; measuring the customer response; interpretation of results.

UNIT IV  PRODUCT ARCHITECTURE, INDUSTRIAL DESIGN, DESIGN FOR MANUFACTURE  9

UNIT V  PROTOTYPING AND MANAGING PRODUCTS  9

TOTAL: 45 PERIODS
COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Apply the principles of generic development process; conduct customer need analysis; and set product specification for new product design and development.
2. Create and Generate concepts for new product design and development.
3. Implement the principles of product architecture and industrial design to design and develop new products.
4. Select the principles of DFMA and Prototyping for new product development.
5. Adapt the concept of economics principles; project management practices in the development of new product

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ME7083 SUSTAINABLE AND GREEN MANUFACTURING L T P C
3 0 0 3

COURSE OBJECTIVES: The main learning objective of this course is to prepare the students for:
1. Applying the knowledge of sustainability in manufacturing.
2. Evaluating the environment management system by applying environmental strategic assessment and life cycle assessment
3. Applying various strategies for sustainable manufacturing.
4. Applying the concepts of green manufacturing, waste management, energy consumption in any manufacturing industry
5. Analysing and applying the concept of recycling of waste; designing consciously for systematic framework.

UNIT I INTRODUCTION TO SUSTAINABLE MANUFACTURING
Sustainable Manufacturing - Concept of Triple bottom line, Environmental, Economic and Social Dimensions of Sustainability, Sustainable Product Development – Various Phases.

UNIT II EVALUATING SUSTAINABILITY
Sustainability performance evaluators- Frameworks and techniques - environmental management systems - life cycle assessment - strategic and environmental impact assessments - carbon and water foot-printing.

UNIT III MANUFACTURING STRATEGY FOR SUSTAINABILITY
UNIT IV GREEN MANUFACTURING

UNIT V RECYCLING
Reclamation and recycling of waste- Recycling as Universal resource policy- Innovation towards environmental sustainability – systematic framework for conscious design- International green manufacturing standards and compliance.

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Apply the knowledge of sustainability in manufacturing.
2. Evaluate the environment management system by applying environmental strategic assessment and life cycle assessment
3. Apply various strategies for sustainable manufacturing.
4. Apply the concepts of green manufacturing, waste management, energy consumption in any manufacturing industry
5. Analyze and apply the concept of recycling of waste; design consciously for systematic framework.

TEXT BOOKS:

REFERENCES:
6. Joseph Sarkis “Greener manufacturing and operations: from design to delivery and back” Greenleaf Pub., 2001

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5. Applying the principles of material selection, costing and manufacturing in design

UNIT I DESIGN TERMINOLOGY
Definition- various methods and forms of design-importance of product design-static and dynamic products- various design projects-morphology of design-requirements of a good design-concurrent engineering-computer aided engineering-codes and standards-product and process cycles-bench marking.

UNIT II DESIGN PROCESS
Basic modules in design process-scientific method and design method- Need identification, importance of problem definition-structured problem, real life problem- information gathering -customer requirements- Quality Function Deployment (QFD)- product design specifications-generation of alternative solutions- Analysis and selection-Detail design and drawings-Prototype, modeling, simulation, testing and evaluation.

UNIT III CREATIVITY IN DESIGN
Creativity and problem solving-vertical and lateral thinking-invention-psychological view, mental blocks-Creativity methods-brainstorming, synectics, force fitting methods, mind map, concept map-Theory of innovative problem solving (TRIZ) - conceptual decomposition creating design concepts.

UNIT IV HUMAN AND SOCIETAL ASPECTS
Human factors in design, ergonomics, user friendly design-Aesthetics and visual aspects environmental aspects-marketing aspects-team aspects-legal aspects-presentation aspects.

UNIT V MATERIAL AND PROCESSES IN DESIGN
Material selection for performance characteristics of materials-selection for new design substitution for existing design-economics of materials-selection methods-recycling and material selection-types of manufacturing process, process systems- Design for Manufacturability (DFM) - Design for Assembly (DFA).

TOTAL: 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Articulate the various design requirements and get acquainted with the processes involved in product development.
2. Design the processes to develop a successful product.
3. Implement the scientific approaches to provide design solutions.
4. Integrate human and societal aspects in design.
5. Select materials and manufacturing processes in design.

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COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Applying the principles of locating and clamping in Jigs and fixtures and various
   components related to Press tools.
2. Designing various types of Jigs for given components and draw multiple views of the
   same with dimensions and parts List.
3. Designing various types of Fixtures for given components and draw multiple views of
   the same with dimensions and parts List.
4. Designing various parts of cutting dies and draw the standard dimensioned views.
5. Designing various parts of forming dies and draw the standard dimensioned views.

UNIT I  PRINCIPLES OF JIGS, FIXTURES AND PRESS WORKING
Objectives and importance of tool design—work holding devices- Basic elements of jigs and
fixtures- location – clamping-indexing-operational chart-Fits and Tolerances
Tools for press working- Press Working Terminologies –cutting and non cutting operations –
Types of presses – press accessories – Computation of press capacity – Strip layout – Material
Utilization – Shearing action – Clearances – Press Work Materials – Center of pressure–
knockouts – direct and indirect – pressure pads – Ejectors- Die Block – Punch holder, Die set,
guide plates – Stops – Strippers – Pilots – Selection of Standard parts –Recent trends in tooling-
recent trends in tool design- computer Aids for sheet metal forming Analysis – basic introduction -
tooling for numerically controlled machines- setup reduction for work holding – Single minute
exchange of dies-Poka Yoke.

UNIT II  JIGS
Design and development of jigs for given component - Types of Jigs – Post, Turnover, Channel,
latch, box, pot, angular post jigs – Indexing jigs.

UNIT III  FIXTURES
Design and development of fixtures for given component- General principles of milling, Lathe,
boring, broaching and grinding fixtures – Assembly, Inspection and Welding fixtures – Modular
fixturing systems- Quick change fixtures.

UNIT IV  DESIGN OF CUTTING DIES
Complete design and preparation of standard views of simple blanking, piercing, compound and
progressive dies -fine Blanking dies.

UNIT V  DESIGN OF BENDING, FORMING, DRAWING AND MISCELLANEOUS DIE
Difference between bending forming and drawing – Blank development for above operations –
Types of Bending dies – Press capacity – Spring back– Variables affecting Metal flow in drawing
operations – draw die inserts – draw beads- ironing – Design and development of bending,
forming, drawing, reverse redrawing and combination dies – Blank development for axisymmetric,
rectangular and elliptic parts – Single and double action dies.

TOTAL:45 PERIODS

Note: (Use of P S G Design Data Book is permitted in the University examination)

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Apply the principles of locating and clamping in Jigs and fixtures and various
   components related to Press tools.
2. Design various types of Jigs for given components and draw multiple views of the
   same with dimensions and parts List.
3. Design various types of Fixtures for given components and draw multiple views of
   the same with dimensions and parts List.
4. Design various parts of cutting dies and draw the standard dimensioned views.
5. Design various parts of forming dies and draw the standard dimensioned views.

**TEXT BOOKS:**

**REFERENCES:**

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**MF7071**  ADDITIVE MANUFACTURING TECHNOLOGY  L T P C  3 0 0 3

**COURSE OBJECTIVES:**
1. To introduce the development of Additive Manufacturing (AM), various business opportunities and application.
2. To familiarize various software tools, processes and techniques to create physical objects that satisfy product development / prototyping requirements, using AM.
3. To be acquainted with vat polymerization and material extrusion processes.
4. To be familiar with extrusion based and sheet lamination processes
5. To gain knowledge on various printing processes and beam deposition processes

**UNIT I  INTRODUCTION**

**UNIT II  DESIGN FOR ADDITIVE MANUFACTURING**

**UNIT III  PHOTOPOLYMERIZATION AND POWDER BED FUSION PROCESSES**
UNIT IV  EXTRUSION BASED AND SHEET LAMINATION PROCESSES  9

UNIT V  PRINTING PROCESSES AND BEAM DEPOSITION PROCESSES  9

COURSE OUTCOMES: At the end of this course students shall be able to:
1. Outline the evolution of AM technology and compare the various techniques.
2. Explain the process of transforming a concept into the final product by AM technology.
3. Elaborate the SLA and powder based processes, and their applications.
4. Describe the working principles and applications of extrusion based and sheet lamination processes.
5. Enumerate the advantages, limitations and applications of various printing processes and beam deposition processes for various applications.

TEXT BOOKS:

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MF7651 NON-TRADITIONAL MACHINING PROCESSES  L T P C  3 0 0 3

COURSE OBJECTIVES:
1. To classify non-traditional machining processes and describe mechanical energy based non-traditional machining processes.
2. To differentiate chemical and electro chemical energy-based processes.
3. To describe thermo-electric energy-based processes.
4. To explain nano finishing processes.
5. To introduce hybrid non-traditional machining processes and differentiate hybrid non-traditional machining processes.
UNIT I  INTRODUCTION AND MECHANICAL ENERGY BASED PROCESSES  9
Introduction to non-traditional machining processes, need for non-traditional machining, classification of non-traditional machining processes, their applications, advantages, limitations. Abrasive jet machining, abrasive water jet machining, ultrasonic machining their working principles, equipments, effect of process parameters, applications, advantages and limitations.

UNIT II  CHEMICAL AND ELECTRO CHEMICAL ENERGY BASED PROCESSES  9
Chemical machining, electro-chemical machining, electro-chemical honing, electro-chemical grinding, electro-chemical deburring their working principles, equipments, effect of process parameters, applications, advantages and limitations.

UNIT III  THERMO-ELECTRIC ENERGY BASED PROCESSES  9
Electric discharge machining, wire electric discharge machining, laser beam machining, plasma arc machining, electron beam machining, Ion beam machining their working principles, equipments, effect of process parameters, applications, advantages and limitations.

UNIT IV  ADVANCED NANO FINISHING PROCESSES  9
Abrasive flow machining, chemo-mechanical polishing, magnetic abrasive finishing, magneto rheological finishing, magneto rheological abrasive flow finishing their working principles, equipments, effect of process parameters, applications, advantages and limitations.

UNIT V  RECENT TRENDS IN NON-TRADITIONAL MACHINING PROCESSES  9
Recent developments in non-traditional machining processes, their working principles, equipments, effect of process parameters, applications, advantages and limitations. Comparison of non-traditional machining processes.

TOTAL: 45 PERIODS

COURSE OUTCOMES: At the end of this course the students shall be able to:
1. Formulate different types of non-traditional machining processes and evaluate mechanical energy based non-traditional machining processes.
2. Illustrate chemical and electro chemical energy based processes.
3. Evaluate thermo-electric energy based processes.
4. Interpret nano finishing processes.
5. Analyse hybrid non-traditional machining processes and differentiate non-traditional machining processes.

TEXT BOOKS:

REFERENCES:
GE7072  FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT  

OBJECTIVES:  
1. To understand the global trends and development methodologies of various types of products and services  
2. To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems  
3. To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification  
4. To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics  
5. To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer  

UNIT I  FUNDAMENTALS OF PRODUCT DEVELOPMENT  

UNIT II  REQUIREMENTS AND SYSTEM DESIGN  

UNIT III  DESIGN AND TESTING  

UNIT IV  SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT  
UNIT V  BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY  9


TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to:
- Define, formulate and analyze a problem
- Solve specific problems independently or as part of a team
- Gain knowledge of the Innovation & Product Development process in the Business Context
- Work independently as well as in teams
- Manage a project from start to finish

TEXTBOOKS:
1. Book specially prepared by NASSCOM as per the MoU.

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