PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):
I. Students will excel in their professional career in automobile industry and research with highest professional and ethical standards to their activities by acquiring knowledge in basic engineering, mathematics, science and automobile engineering.
II. Students will exhibit professionalism, team work in their chosen profession and adapt to current trends, technologies and industrial scenarios by pursuing lifelong learning.

PROGRAMME OUTCOMES (POs):

a. Graduate will demonstrate strong basics in mathematics, science and Engineering
b. Graduate will demonstrate the ability to design and conduct Experiments, as well as to analyze and interpret data.
c. Graduate will demonstrate the ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and Safety, manufacturability and sustainability.
d. Graduate will become familiar with modern Engineering tools and analyze the problems within the domains of Automobile Engineering as the members of multidisciplinary teams.
e. Graduate will acquire the capability to identify, formulate and solve complex engineering problems related to Automobile Engineering
f. Graduate will demonstrate and understanding of professional and ethical responsibility with reference to their career in the field of Automobile Engineering
g. Graduate will be able to communicate effectively both in verbal non-verbal forms
h. Graduate will be trained towards developing the impact of development of Automobile engineering on global, economic environment and societal context
i. Graduate will be capable of understanding the value for life-long learning
j. Graduate will demonstrate knowledge of contemporary issues focusing on the necessary to develop new material, design, and engineering practice in the field of Automobile Engineering
k. Graduate will demonstrate the ability to use the techniques, skills and Modern engineering tools necessary for engineering practice in the field of Automobile Engineering
l. Graduate will have a firm scientific, technological and communication base that helps them either to find a desire placement or to become an Entrepreneur and explore their knowledge in their field.
m. Graduate will be capable of doing higher studies and research in inter and multi-disciplinary areas.
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## MAPPING OF COURSE OUTCOMES WITH PROGRAMME OUTCOMES:

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ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
B.E. AUTOMOBILE ENGINEERING
REGULATIONS – 2015
CHOICE BASED CREDIT SYSTEM
CURRICULA AND SYLLABI I - VIII SEMESTERS
# SEMESTER III

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## EMPLOYABILITY ENHANCEMENT COURSES (EEC)

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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 programmes/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

TEXT BOOK:

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)
L T P C
4 0 0 4

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
12
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
12
UNIT III INTEGRAL CALCULUS 12
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 12

UNIT V DIFFERENTIAL EQUATIONS 12
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.

TEXT BOOKS:

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

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.

TEXT BOOKS:

REFERENCES:

CY7151 ENGINEERING CHEMISTRY

OBJECTIVES
- 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  9

UNIT IV  CHEMICAL THERMODYNAMICS  9
Second law: Entropy-entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Free energy and work function: Helmholtz and 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  NANOCHEMISTRY  9
Basics—distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Preparation of nanoparticles—sol-gel and solvothermal. Preparation of carbon nanotube by chemical vapour deposition and laser ablation. Preparation of nanowires by VLS growth, electrochemical deposition and electro spinning. Properties and uses of nanoparticles, nanoclusters, nanorods, nanotubes and nanowires.

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.

TEXT BOOKS

REFERENCES

GE7152  ENGINEERING GRAPHICS  L T P C
3 2 0 4

OBJECTIVES
- To develop in students, graphic skills for communication of concepts, ideas and design of engineering products and expose them to existing national standards related to technical drawings.
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

OUTCOMES:
On Completion of the course the student will be able to
- Perform free hand sketching of basic geometrical shapes and multiple views of objects.
- Draw orthographic projections of lines, planes and solids
- Obtain development of surfaces.
- Prepare 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.

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

Attested

[Signature]

Centre For Academic Courses
Anna University, Chennai-600 025
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
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

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:
  - Centrifugal pump
  - Mixie
  - 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.

GROUP – B (MECHANICAL AND ELECTRONICS) 15

OUTCOMES
• Ability to fabricate carpentry components and to lay pipe connections including plumbing
  works.
• Ability to use welding equipments to join the structures
• Ability to do wiring for electrical connections and to fabricate electronics circuits.

TOTAL: 60 PERIODS
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.

TEXT BOOK:
REFERENCES:

MA7251 MATHEMATICS - II
(Common to all branches of B.E./B.Tech. Programmes in II Semester)

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

UNIT II VECTOR CALCULUS
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 \( w = z + c, \ ax, \ \frac{1}{z} \), \( z^2 \) - 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.

TEXT BOOKS:

REFERENCES:
OBJECTIVE

- 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:
OBJECTIVE:
- To impart knowledge on the basics of binary phase diagrams and their applications
- To learn the phase diagram, effect of alloying elements and various transformations in the Fe-C system, and also the heat treatment of steels.
- To introduce various strengthening methods of materials, and also various mechanical properties and their measurement
- To instill the types, properties and applications of magnetic, dielectric and superconducting materials.
- To introduce the preparation, properties and applications of various new materials.

UNIT I  PHASE DIAGRAMS  9
Solid solutions - Hume Rothery's rules - The phase rule - single component system - one-component system of iron - binary phase diagrams - isomorphous systems - the tie-line rule - the lever rule - application to isomorphous system - eutectic phase diagram - peritectic phase diagram - other invariant reactions - free energy composition curves for binary systems - microstructural change during cooling.

UNIT II  FERROUS ALLOYS AND HEAT TREATMENT  9

UNIT III  MECHANICAL PROPERTIES  9

UNIT IV  MAGNETIC, DIELECTRIC AND SUPERCONDUCTING MATERIALS  9

UNIT V  NEW MATERIALS  9
Ceramics - types and applications - Composites: classification, role of matrix and reinforcement - processing of fiber reinforced plastics - Metallic glasses - types, glass forming ability of alloys - Inoue criteria - melt spinning process - applications - Shape memory alloys - phases, shape memory effect, pseudoelastic effect - NiTi alloy - applications - Nanomaterials - preparation: ball milling and chemical vapour deposition - properties and applications - carbon nanotubes - Biomaterials

TOTAL: 45 PERIODS
OUTCOME:
Upon completion of this course, the students will
- gain knowledge on the basics of binary phase diagrams and the use of lever rule
- learn about the Fe-C phase diagram, effect of alloying elements, TTT in the Fe-C system, and also the heat treatment of steels.
- understand the significance of dislocations, strengthening mechanisms, and tensile, creep, hardness and fracture behavior of materials
- acquire knowledge on the types, properties and applications of magnetic, dielectric and superconducting materials.
- get adequate understanding on the preparation, properties and applications of ceramics, composites, metallic glasses, shape-memory alloys and nanomaterials.

TEXT BOOKS:

REFERENCES:

GE7153  ENGINEERING MECHANICS  L T P C  4 0 0 4

OBJECTIVE:
- The objective of this course is to inculcate in the student the ability to analyze any problem in a simple and logical manner and to predict the physical phenomena and thus lay the foundation for engineering applications.

UNIT I  STATICS OF PARTICLES  12

UNIT II  EQUILIBRIUM OF RIGID BODIES  12
UNIT III DISTRIBUTED FORCES
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

UNIT V DYNAMICS OF PARTICLES
Kinematics - Rectilinear Motion and Curvilinear Motion of Particles.

OUTCOME:
- Upon completion of this course, students will be able to construct meaningful mathematical models of physical problems and solve them.

TEXT BOOK

REFERENCES

PR7251 PRODUCTION PROCESSES L T P C
(Common to Aero/Auto/Rubber and Plastics) 3 0 0 3

OBJECTIVES:
- To impart the knowledge about the various production processes available
- To expose the student on the principle and applications of the processes
- To make a decision on a relevant process based on the merits and demerits.
UNIT I  CASTING PROCESSES

UNIT II  METAL FORMING PROCESSES

UNIT III  MACHINING PROCESSES
Machine and machine tool – construction, types operations in the following machines with block diagrams – Lathe, Milling, Drilling and Grinding – Concept of NC/CNC machines – Comparison of CNC with conventional machines – sample manual part programming for CNC Lathe and milling.

UNIT IV  WELDING PROCESSES

UNIT V  UNCONVENTIONAL MACHINING PROCESSES
Need for unconventional – Construction, working principle merits, demerits and applications with block diagram only for AJM, AWJM, USM, CHM, ECM, EDM, EBM, LBM, PAM and IBM.

TOTAL: 45 PERIODS

OUTCOMES:
- Has enough knowledge on the various process available to make a part.
- Confident to select the process to based on cost of time and quantities.
- Can determine processes for new materials.

TEXT BOOKS
1. Serope Kalpakjian, Steven R. Schmid, Manufacturing Engineering and Technology - Anna University, 4/e, Pearson Education, 2014

REFERENCES:
GE7161  COMPUTER PRACTICES LABORATORY  

OBJECTIVES

- To understand the basic programming constructs and articulate how they are used to develop a program with a desired runtime execution flow.
- To articulate where computer programs fit in the provision of computer-based solutions to real world problems.
- To learn to use user defined data structures.

LIST OF EXPERIMENTS

1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Problem formulation, Problem Solving and Flowcharts
4. C Programming using Simple statements and expressions
5. Scientific problem solving using decision making and looping.
6. Simple programming for one dimensional and two dimensional arrays.
7. Solving problems using String functions
8. Programs with user defined functions
9. Program using Recursive Function
10. Program using structures and unions.

TOTAL: 60 PERIODS

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

PR7261  PRODUCTION PROCESSESS LABORATORY  

OBJECTIVES:

- To get hands on experience in the machines for production
- To prepare the process planning sheets for all the operations and then follow the sequence during the machining processes.

LIST OF EXPERIMENTS:

1. Study of all the machining tools- identification of parts/mechanisms and position of tool and work piece.
2. Facing, plain turning/step turning operations in Lathe.
3. Taper Turning/Threading and knurling operations in Lathe.
5. Machining to make a cube using shaper
6. Machining to make a V-block using shaper.
7. Counter sinking, counter Boring and Tapping operations in a drilling machine.
8. Surfacing/pocket milling in a vertical milling machine.
9. Polygonal shape milling in a horizontal milling machine
10. Flat surface grinding and cylindrical grinding operations
11. Machining an internal spline in slotting machine.
12. To machine the given part drawing using Lathe and milling machines.

**TOTAL: 60 PERIODS**

**OUTCOME:**
- Enough experience to operate machines and processes commonly used in production of components.
- Enable interpretation of process plan sheets to be followed for he machining of products.

**AE7352 MECHANICS OF SOLIDS**

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**OBJECTIVES**
- The objective of this course is to make the students to understand the concepts of stress and strain and their relationships by analysis of solids and structures, to analyze determinate and indeterminate axial members, torsional members, and beams, in order to determine axial forces, torque, shear forces, bending moments, stresses and deflections.

**UNIT I STRESS-STRAIN – AXIAL LOADING**
Definition of stress and strain - Stress-Strain relation - Relation between material constants. - Bar under axial loading - Statically determinate and indeterminate cases – Thermal stress-Impact Loading

**UNIT II STRESSES IN BEAMS**
Types of beams and loadings - Relation between shear force and bending moment - Shear force and bending moment diagrams – Euler beam theory - Bending stress in beams – Shear stress in beam – Composite beam.

**UNIT III DEFLECTION OF BEAM**

**UNIT IV TORSION AND SPRINGS**
Shear stress and twist relation for circular section – Comparison of hollow shaft and solid shaft – Compound shaft – Power transmission by circular shafts – Springs – Deflection expression for close coiled helical spring – Stress in springs.

**UNIT V BIAXIAL STRESS**
Thin walled cylinder under internal pressure – Principal stresses for general biaxial stress field – Mohr’s circle - Stresses in combined loading

**OUTCOMES**
At the end of the course, the students are expected to
- Know about how a solid (materials, structures) behaves when it is exposed to forces and deformations.
- Apply the fundamental concepts of principle of superposition, equilibrium, compatibility, force-deformation, and stress-strain relationships to the solid and structural mechanics problems
- Analyze determinate and indeterminate bars, beams, to determine axial forces, torques, shear forces, and bending moments
- Have physical insight into distribution of stresses and strains in structural members
TEXT BOOKS:

REFERENCES:

AU7301 AUTOMOTIVE PETROL ENGINES L T P C 3 0 0 3

OBJECTIVE
• To impart basic knowledge on IC engines and its types and to develop the knowledge on various additional systems which are helps to improve the engine characteristics. Also to give through knowledge on complete construction and working details of petrol engine and its different accessories.

UNIT I ENGINE CONSTRUCTION AND WORKING 9

UNIT II FUEL AND IGNITION SYSTEM 9
Carburetor – requirements, working principle, types, different circuits – Compensation & Maximum power devices – Petrol injection in SI engines, Magneto coil and battery coil spark ignition system. Advance mechanism. Electronic ignition System – CDI.

UNIT III COOLING AND LUBRICATION SYSTEM 9

UNIT IV COMBUSTION AND COMBUSTION CHAMBERS 9

UNIT V TWO STROKE ENGINES 9
Two stroke engine – types, terminologies, definitions, construction and operation. Comparison of four stroke and two stroke engine operation. Theoretical scavenging processes. Merits and demerits, scavenging efficiency, Scavenging pumps, Rotary valve engine.

TOTAL : 45 PERIODS
OUTCOMES
Student can able to,
  • identify various components of petrol engines and its sub systems.
  • understand the actual engine working principle and its related components
  • enhance their knowledge on other sub systems like ignition , lubrication etc.
  • understand basic knowledge on petrol combustion and its related parameters

TEXT BOOKS

REFERENCES

AU7302 THERMODYNAMICS AND THERMAL ENGINEERING L T P C
4 0 0 4

OBJECTIVE:
  • The objective of this course is to introduce the basic principles of thermodynamics and thermal engineering via real world engineering examples, to show students how thermodynamics is applied in engineering practice.

UNIT I BASIC THERMODYNAMICS 14
Systems, closed, open and isolated. Property, state, path and process, quasi-static process,
Zeroth law, First law. Steady flow energy equation. Heat and work transfer in flow and non-flow
processes. Second law, Kelvin-Planck statement – Clausius statement - Concept of Entropy,
Properties of gases and vapours.

UNIT II AIR STANDARD CYCLES AND COMPRESSORS 12
Otto, Diesel, Dual combustion and Brayton cycles. Air standard efficiency. Mean effective
pressure. Compressors, Classifications of compressors, Single stage and multi stage, Effect of
intercooler in multi stage compressor, Perfect and imperfect intercooler, work done by the
compressor, Reciprocating, Rotary, Axial, Vane compressors.

UNIT III STEAM AND JET PROPULSION 12
Properties of steam, Dryness fraction, Quality of steam by steam tables and Mollier chart –
Rankine cycle, Work done, Steam rate – Steam Nozzles, Types of nozzles, Friction in nozzles -
Simple jet propulsion system – Thrust rocket motor – Specific impulse.

UNIT IV REFRIGERATION AND AIR-CONDITIONING 10
Principles of refrigeration, Vapor compression – Vapor absorption types, comparison - Co-efficient
of performance (COP), Properties of refrigerants – Basic Principle, Summer, winter and Year
round Air conditioning.

UNIT V HEAT AND MASS TRANSFER 12
Modes of heat transfer, Heat conduction in parallel, radial and composite wall – Basics of
Convective heat transfer. Fundamentals of Radiative heat transfer – Flow through heat...
exchangers. Logarithmic Mean Temperature Difference (LMTD) for parallel flow and Arithmetic Mean Temperature Difference (AMTD) counter flow heat exchangers.

TOTAL: 60 PERIODS
(Use of standard Steam tables with mollier chart and Refrigerant tables are permitted)

OUTCOMES:
- Students will demonstrate a basic understanding of the nature of the thermodynamic processes for pure substances of ideal gases
- Student will demonstrate a basic understanding of the First law Thermodynamics and its application to systems and control volumes
- To analyze any problem in an engineering approach based on basic concepts and logic sequences.
- To understand the basics and modes of heat transfer, Refrigeration and Air-conditioners.

TEXT BOOKS:

REFERENCES:

EI7306 ELECTRICAL AND ELECTRONICS ENGINEERING L T P C 3 0 0 3

OBJECTIVES
- Gain knowledge on network theorems.
- Understand the basics of AC circuits and the terms related to AC circuits.
- Gain knowledge on construction and working principle of AC and DC machines.
- Get exposed to basic electronic devices and their applications.
- Gain knowledge on logic gates and their applications in digital electronics.

UNIT I BASIC CONCEPTS AND D.C. CIRCUIT ANALYSIS 9

UNIT II A.C. CIRCUITS 9
Sinusoidal voltage and current-RMS and average value of periodic waves - Form factor - Phase and Phase difference – Simple RC,RL and RLC circuits - series and parallel resonance - power and power factor – introduction to three phase systems – power measurement in 3 phase system.

UNIT III ELECTRICAL MACHINES 9
UNIT IV  ANALOG ELECTRONICS

UNIT V  DIGITAL ELECTRONICS
Number systems – binary codes - logic gates - Boolean algebra, laws & theorems - simplification of Boolean expression - implementation of Boolean expressions using logic gates - standard forms of Boolean expression-Combinational circuits- Design of adder, subtractor, encoders, decoders, multiplexers and demultiplexers-Flip flops.

TOTAL : 45 PERIODS

OUTCOMES
- Able to analyze and solve problems for all types of electrical networks by applying various theorems.
- Able to understand and solve problems for basic AC circuits.
- Will be in a position to suggest suitable AC/DC machines for a given application.
- Able to analyze the characteristics of electronic devices such as PN junction and other diodes.

REFERENCES

GE7251  ENVIRONMENTAL SCIENCE AND ENGINEERING  L T P C
3 0 0 3

OBJECTIVES:
To the study of nature and the facts about environment.
- To finding and implementing 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
Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – 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 – bio geographical 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-diversity nation – hot-spots 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, case studies – 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

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

TOTAL : 45 PERIODS

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 environmental is at infant stage.
• Ignorance and incomplete knowledge has lead to misconceptions
• Development and improvement in std. of living has lead to serious environmental disasters
TEXT BOOKS

REFERENCES

MA7354  NUMERICAL METHODS L T P C

OBJECTIVES:
- To provide the mathematical foundations of numerical techniques for solving linear system, eigen value problems, interpolation, numerical differentiation and integration and the errors associated with them;
- 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 12

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

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.

OUTCOMES:
- Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions.
- Apply numerical methods to obtain approximate solutions to mathematical problems.
- 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.
- Analyze and evaluate the accuracy of common numerical methods.

TEXT BOOKS:

REFERENCES:

AU7311 MECHANICAL TESTING AND IC ENGINES LABORATORY

OBJECTIVE:
To give on hand training to the students in testing and quantifying the various mechanical properties of Engineering Materials and to find various performance characteristics of Internal combustion engine.

LIST OF EXPERIMENTS
- Tension Test
- Torsion Test
- Testing of springs
- Impact test i) Izod, ii) Charpy
- Hardness test i) Vickers, ii) Brinell, iii) Rockwell, iv) Shore
- Deflection of Beams
- Dye Penetrant Test
- Tensile testing of polymers.
- Relaxation Fatigue test for Elastomers.
- Injection molding machine operation.
- Performance test on a 4 stroke diesel engine
- Performance test on a 4 stroke petrol engine
- Moment of inertia of connecting rod
- Determination of Effectiveness of a parallel and counter flow heat exchangers.
- Valve timing of a 4 stroke engine
- Port timing of a 2 stroke engine.

TOTAL : 60 PERIODS

OUTCOMES:
- Student can able to understand,
  - various physical characterization and mechanical properties of materials
  - various testing methods of mechanical properties
  - basics of internal combustion engine and its performance characteristics
  - type of materials used for automotive application

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 moor
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
AE7351 ENGINEERING FLUID MECHANICS AND MACHINERY

L T P C
3 0 0 3

OBJECTIVE:
- The student is introduced to the mechanics of fluids through a thorough understanding of the properties of the fluids. The dynamics of fluids is introduced through the control volume approach which gives an integrated understanding of the transport of mass, momentum and energy. The applications of the conservation laws to flow through pipes and hydraulics machines are studied.

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

UNIT II FLOW THROUGH CIRCULAR CONDUITS

UNIT III DIMENSIONAL ANALYSIS
Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude - Dimensionless parameters- application of dimensionless parameters – Model analysis.

UNIT IV TURBINES

UNIT V PUMPS

TOTAL: 45 PERIODS

OUTCOME:
- On completion of the course, students will be familiar with all the basic concepts of fluids and fluid flow phenomenon, conservation equations and their applications to simple problems.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- The student shall gain appreciation and understanding function of front axle, types of stub axle, types of steering gear box, Shall be able to understand need of suspension and its types, types of tyre, tyre specification, tyre rotation, Student shall gain knowledge of design consideration braking system, suspension system and for chassis.

UNIT I LAYOUT, FRAME, FRONT AXLE AND STEERING SYSTEM

UNIT II DRIVE LINE, FINAL DRIVE AND DIFFERENTIAL

UNIT III REAR AXLES, WHEELS, RIMS AND TYRES
Construction of rear axles, Types of Loads acting on rear axles, Full –Floating, Three–Quarter Floating and Semi–Floating Axles, Twist beam rear axle, Types, Multi axles vehicles. Wheels and Rims, Types of Tyres and their constructional details. tubeless, cross ply radial type, tyre sizes and designation.

UNIT IV SUSPENSION SYSTEM

UNIT V BRAKE SYSTEMS

OUTCOMES
- Ability to know the steering geometry, what should be the tyre pressure for different vehicle, which type of brakes are best for vehicle.
- Ability to recognize which safety systems are best for vehicle and also for safety consideration.

TEXT BOOKS
REFERENCES

AU7402 AUTOMOTIVE DIESEL ENGINES

OBJECTIVES
• To impart knowledge on basic concepts of automotive diesel engines, combustion process involved in diesel engines and the various subsystems used along with their functions in detail.

UNIT I BASICS OF DIESEL ENGINES

UNIT II FUEL INJECTION IN DIESEL ENGINES

UNIT III AIR MOTION, COMBUSTION AND COMBUSTION CHAMBERS

UNIT IV SUPERCHARGING AND TURBOCHARGING

UNIT V ENGINE TESTING AND RECENT DEVELOPMENTS

TOTAL : 45 PERIODS

OUTCOMES
• On completion of the course the students will understand the basic principle of operation of diesel engine, its subsystems
• The students can be able to apply their knowledge in operating the diesel engine and analyzing the engine performance characteristics.
TEXT BOOKS

REFERENCES

AU7403 METROLOGY AND MEASUREMENT SYSTEM

OBJECTIVE:
- To understand the different degree of accuracy obtained from different types of instruments and the process of reducing uncertainties in measurements

UNIT I SCIENCE OF MEASUREMENT

UNIT II LINEAR AND ANGULAR MEASUREMENT
Linear measuring instruments: Vernier, micrometer, interval measurement, Slip gauges and classification, interferometer, optical flats, limit gauges – Comparators: Mechanical, pneumatic and electrical types, applications. Angular measurements:- Sine bar, optical bevel protractor, angle Decker– Taper measurements, coordinate measuring machine (CMM)

UNIT III FORM MEASUREMENT

UNIT IV PRESSURE, FORCE AND TORQUE MEASUREMENT
Bourdon tube, diaphragm, bellows and pressure capsules: Transducers used in pressure measurement – potentiometer, strain gauges, LVDT, capacitive and variable reluctance type transducers. Dynamic pressure measurement piezo electric and piezo resistive transducers. Farnboro engine indicator. Low pressure measurement – Mc leod gage, Pirani gauge, thermal conductivity type pressure measurement. Force measuring devices – Balances, platform scales, weigh bridges, load cells, proving ring. Torque measurement – prony brake, rope brake and fan type brakes. Dynamometers – hydraulic, electric cradle and eddy current dynamometers.

UNIT V MEASUREMENT OF TEMPERATURE AND FLOW
thermocouples – industrial thermocouples and their ranges – pyrometers – optical total radiation and photo electric


TOTAL: 45 PERIODS

OUTCOMES:
The Students will
- Be able to demonstrate their knowledge about different measurement method and devices used in industries.
- Have the ability to handle and interpret measurement data, to estimate measurement uncertainties
- Design measuring equipments for the measurement of Pressure Force, temperature and flow.

TEXT BOOKS:

REFERENCES:

AU7404 THEORY OF FUELS AND LUBRICANTS L T P C 3 0 0 3

OBJECTIVE
- To understand the basic of manufacturing of fuels and lubricants along with properties of fuels and lubricants for the design and operation of the I.C engines.

UNIT I MANUFACTURE OF FUELS AND LUBRICANTS 9
Introduction to Structure of petroleum, refining process-Distillation, cracking processes, Catalytic reforming, alkylation, isomerisation and polymerization, finishing process- blending, products of refining process. Manufacture of lubricating oil base stocks, manufacture of finished automotive lubricants.

UNIT II THEORY OF LUBRICATION 9
Engine friction: introduction, total engine friction, effect of engine variables on friction, hydrodynamic lubrication, elasto hydrodynamic lubrication, boundary lubrication, bearing lubrication, functions of the lubrication system, introduction to design of a lubricating system.

UNIT III LUBRICANTS 9
Specific requirements for automotive lubricants, oxidation deterioration and degradation of lubricants, additives and additive mechanism, synthetic lubricants, classification of lubricating oils, properties of lubricating oils, tests on lubricants. Grease, classification, properties, test used in grease.

UNIT IV PROPERTIES AND TESTING OF FUELS 9
Properties and testing of fuels- density, calorific value, flash point, fire point, distillation, vapour pressure, spontaneous ignition temperature, viscosity, pour point, flammability, ignitability, diesel index, API gravity, aniline point, carbon residue, copper strip corrosion.
UNIT V  FUEL RATING  9

OUTCOMES
Student would have basic understanding of
- Various refinery processes
- Theory of lubricants
- Properties and testing of fuels
- Fuel ratings

TEXT BOOKS:

REFERENCES

PR7451  KINEMATICS AND DYNAMICS OF MACHINES  L T P C
4 0 0 4

OBJECTIVE:
- To understand the basic concepts of mechanisms and machinery.

UNIT I  MECHANISMS  12

UNIT II  FRICTION  12
Types of friction – friction in screw and nut – screw jack – pivot, collar and thrust bearings – plate and cone clutch – belt (Flat and V) and rope drives – creep in belts – open and crossed belt drives – Ratio of tensions – Effect of centrifugal and initial tensions – condition for maximum power transmission.
UNIT III  GEAR AND CAMS  12

UNIT IV  VIBRATION  12

UNIT V  BALANCING  12
Static and dynamic balancing – single and several masses in different planes – primary and secondary balancing of reciprocating masses – Balancing of single and multi cylinder engines – Governors and Gyroscopic effects.

OUTCOME:
The student shall be able to apply the kinematics and dynamics of machinery in design and analysis of engineering problems.

TEXT BOOKS:

REFERENCES:

AU7411  AUTOMOTIVE ENGINE AND CHASSIS  COMPONENTS LABORATORY  L T P C  0 0 4 2

OBJECTIVES:
- To familiarize and train the students on the constructional arrangements of different engine system.
- Study of the following engines and its components by dismantling, comparing with recent engine components and assembling various parts.
- To familiarize and train the students on the constructional arrangements of different engine system.

LIST OF EXPERIMENT FOR AUTOMOTIVE ENGINE
1. Study the layout of chassis system
2. Study the layout of steering systems with different Steering gearboxes
3. Dismantling, study and Assembling of Transfer case
4. Dismantling, study and Assembling of Constant Velocity Joint(Front Axles )
5. Dismantling, study and Assembling of Clutch.
6. Dismantling, study and Assembling of sliding mesh gear box
7. Dismantling, study and Assembling of Constant mesh gear box
8. Dismantling, study and Assembling of Syncro mesh gear box
10. Study the Layout of Rear Axle.
11. Study the Layout of Braking system.
12. Study of different types of suspension system.
13. Study the Automatic transmission system.

STUDY OF THE FOLLOWING ENGINES AND ITS COMPONENTS:
1. Single Cylinder Four Stroke Diesel Engine
2. Two wheeler Two stroke Petrol engines
3. Two wheeler Four Stroke Petrol Engine
4. Three wheeler Engine
5. Multi cylinder inline diesel engine
6. Multi cylinder inline Petrol engine
7. Multi cylinder V type diesel Engine
8. MPFI engine
9. CRDI engine

TOTAL: 60 PERIODS

OUTCOMES
- Dismantle and Assemble the automobile chassis and Engine components
- Identify & differentiate components of SI & CI engines
- Understand working of braking, steering, clutch, transmission, Suspension systems.
- Differentiate various subsystems of two, three & Four wheeler vehicles
- Train on various types of frames.
- Develop skills in Dismantling and assembling of chassis components.
- Correct minor repairs and trouble shoots the breakdowns.

AU7412 FUELS AND LUBRICANTS LABORATORY L T P C 0 0 4 2

OBJECTIVE
- To impart basic knowledge on properties testing procedure for fuels and Lubricants.

LIST OF EXPERIMENTS:
1. Temperature dependence of viscosity of lubrication oil by Redwood Viscometer.
2. Viscosity Index of lubricating oil by Saybolt Viscometer
3. Flash and Fire points of fuels.
4. Flash and Fire points of lubricants.
5. Cloud and pour point of fuels.
6. ASME distillation test of fuels (gasoline / diesel).
7. Carbon residue test of lubrication oil.
10. Penetration test on grease.
11. Copper strip corrosion test
12. Density test on different fuels

TOTAL : 60 PERIODS
OUTCOMES
Student would have basic understanding of various testing methods adopted to assess quality of fuels and lubricants like

- Temperature dependence of Viscosity
- Importance of flash, fire point and various properties

AU7501  AUTOMOTIVE COMPONENTS DESIGN  L T P C
3 0 0 3

OBJECTIVE:
To familiarize the various steps involved in the design process and understand the principles involved in design.

UNIT I  INTRODUCTION

UNIT II  DESIGN OF SHAFTS AND SPRINGS

UNIT III  DESIGN OF FLYWHEELS

UNIT IV  DESIGN OF BEARINGS
Types of bearings – Sliding contact bearings – Rolling contact bearings. Bearing life – Static load capacity – Dynamic load capacity – Bearing material – Boundary lubrication – Oil flow and temperature rise. Design of journal bearings - Ball and Roller bearings

UNIT V  GEAR DESIGN

OUTCOMES:
The students will be able

- To identify the design requirements for any specific components.
- To design transmission parts.
- To explain the requirements of flywheel.

TEXT BOOK
AU7502 AUTOMOTIVE ELECTRICAL AND ELECTRONICS SYSTEMS  

OBJECTIVES

- Knowledge in vehicle electrical and electronics components for engine operation.
- Enhancing the knowledge of reversor and microprocessor applications in vehicle control systems.
- Gaining informations on modern safety system in vehicle braking.

UNIT I BATTERIES AND STARTING SYSTEM  
Different types of Batteries – principle, rating, testing and charging. Starter motors characteristics, capacity requirements. Drive mechanisms. Starter switches.

UNIT II CHARGING SYSTEM LIGHTING AND ACCESSORIES  

UNIT III ELECTRONIC IGNITION AND INJECTION SYSTEM  
Spark plugs. Advance mechanisms. Different types of ignition systems. Electronic fuel injection systems.

UNIT IV SENSORS AND MICROPROCESSORS IN AUTOMOBILES  
Basic sensor arrangements. Types of sensors – oxygen sensor, hot wire anemometer sensor, vehicle speed sensor, detonation sensor, accelerometer sensor, crank position sensor. Microprocessor and microcomputer controlled devices in automobiles such voice warning system, travel information system, keyless entry system, automatic transmission system, electronic steering system.

UNIT V SAFETY SYSTEMS  
Antilock braking system, air bag restraint system, voice warning system, seat belt system, road navigation system, anti-theft system.

TOTAL: 45 PERIODS

OUTCOMES:

- The student will have to know about all automotive electrical and electronic components used in a vehicle.

REFERENCES:

OBJECTIVES:
- The main objective of this course is to impart knowledge in detailed concept, construction and principle of operation of various types of mechanical transmission components, hydrodynamic devices, hydrostatic devices, automatic transmission system and electric drive used in road vehicles. At the end of course the students will have command over both mechanical transmission system, automatic transmission systems and their applications.

UNIT I  CLUTCH  9
Requirement of transmission system, Types of transmission system, Clutches – Functions-Types of clutches, construction and operation of Single plate, multi plate and Diaphragm spring clutches.

UNIT II  GEAR BOX  9
Purpose of gear box. Construction and working principle of sliding, constant and synchromesh gear boxes. Problems on performance of automobile such as Resistance to motion, Tractive effort, Engine speed & power and acceleration. Determination of gear box ratios for different vehicle applications.

UNIT III  HYDRODYNAMIC TRANSMISSION  9

UNIT IV  AUTOMATIC TRANSMISSION  9

UNIT V  HYDROSTATIC DRIVE AND ELECTRIC DRIVE  9

OUTCOMES:
Upon completion of the course, students will
- acquire knowledge in the construction and working principle of different types of mechanical transmission system, hydrodynamic, hydrostatic devices and electric drives.
- design the mechanical transmission system namely clutches and Gearboxes.
- have command over automotive transmission concepts and its applications in modern vehicles.

TEXT BOOKS:

REFERENCES:
1. SAE Transactions 900550 & 930910.
OBJECTIVE

- The objective of the course is to make the student understand the need, role, components, control strategies used in an engine management system. The student will be familiarized in the fundamentals, operation, function of various sensors and actuators in an engine. The student will gain knowledge on various systems related to ignition and injection system, and various engine control algorithm used during engine operation.

UNIT I  FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS  9
Components for electronic engine management system, open and closed loop control strategies, PID control, Look up tables, introduction to modern control strategies like Fuzzy logic and adaptive control. Switches, active resistors, Transistors, Current mirrors/amplifiers, Voltage and current references, Comparator, Multiplier. Amplifier, filters, A/D and D/A converters.

UNIT II  SENSORS AND ACTUATORS  9
Working principles, construction and location of sensors to measure speed, load, air flow, temperature, pressure, lambda, throttle position, knock, etc. Working principles, construction and location of actuators viz. Solenoid, relay, stepper motor etc. Design constraints.

UNIT III  SI ENGINE MANAGEMENT  9
Layout, types and working of SI engine management systems (K, KE, Mono Jetronic, L, LH, Motronic). GDI. Development of ignition system – Transistor assisted, Contactless, Distributor less, CDI, Ignition Map, Knock control. Flowcharts for combined fuel injection and ignition control. Introduction to LASER Ignition system.

UNIT IV  CI ENGINE MANAGEMENT  9

UNIT V  DIGITAL ENGINE CONTROL SYSTEM  9

TOTAL : 45 PERIODS

OUTCOMES

At the end of the course, the student should be able to
- Describe basic electronic engine management theory
- Define the function, construction and operation of various sensors and actuators
- Demonstrate the principles and application of computerized engine control devices and electronic fuel and ignition management systems in the modern automobile.

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
The main objective of this course is to impart practical knowledge in various automobile electrical and electronic components by testing, checking and programming.

LIST OF EXPERIMENTS:
1. Testing and checking of battery
2. Testing and checking of starting systems
3. Testing and checking of charging systems
4. Testing and checking of ignition systems
5. Study of automotive lighting system
6. Adjustment of head lights beam
7. Testing and checking of body controller systems
8. Logic gates, Adders, Flip flops
9. SCR and IC Timers
10. Interface circuit like amplifier, filter, Multiplexer and De Multiplexer
11. Interfacing seven segment displays
12. Basic microprocessor and microcontroller programming like arithmetic and Logic operation, code conversion, waveform generation, look up table etc
13. Interfacing ADC and DAC for Data Acquisition and Control Application
14. Interfacing Sensors for Measurements of position, displacement, velocity, force, temperature, proximity/range etc
15. Display, Keyboard, Stepper Motor and DC Motor interface using microcontroller.
16. EPROM Programming
17. Study of Virtual Instrumentation

TOTAL : 60 PERIODS

OUTCOMES:
• Students will gain an understanding of the automobile electrical and electronic components.
• Student will read and analyse electrical and electronic circuits.
• Students will study the sensor and actuators interface through programming

OBJECTIVE:
• To import the knowledge in the area of design and analysis of automotive engine components and Chassis Components.

LIST OF EXPERIMENTS:
Design, model and analysis of the following components
1. Engine Cylinder
2. Piston
3. Connecting rod Assembly
4. Valve train
5. Crank shaft
6. Cam shaft
7. Clutch components
8. Gear Box
9. Front Axle
10. Propeller Shaft
11. Rear Axle
12. Final Drive

TOTAL: 60 PERIODS

OUTCOME:
- At the end of the course the students will be able to have a complete knowledge in design and analysis of automotive engine components

REFERENCES:

AU7601 AUTOMOTIVE POLLUTION AND CONTROL

OBJECTIVES:
- The main objective of this course is to impart knowledge in automotive pollution control.
- The detailed concept of formation and control techniques of pollutants like UBHC, CO, NOx, particulate matter and smoke for both SI and CI engine will be taught to the students. The instruments for measurement of pollutants and emission standards will also be introduced to the students. At the end of the course the students will have command over automotive pollution and control.

UNIT I INTRODUCTION

UNIT II EMISSION FROM SPARK IGNITION ENGINE AND ITS CONTROL
Emission formation in SI Engines- Carbon monoxide- Unburned hydrocarbon, NOx, Smoke - Effects of design and operating variables on emission formation – controlling of pollutants - Catalytic converters — Charcoal Canister — Positive Crank case ventilation system, Secondary air injection, thermal reactor, Laser Assisted Combustion.

UNIT III EMISSION FROM COMPRESSION IGNITION ENGINE AND ITS CONTROL
Formation of White, Blue, and Black Smokes, NOx, soot, sulphur particulate and Intermediate Compounds – Physical and Chemical delay — Significance Effect of Operating variables on Emission formation — Fumigation, EGR, HCCI, Particulate Traps, SCR — Cetane number Effect.
UNIT IV  NOISE POLLUTION FROM AUTOMOBILES  9

UNIT V TEST PROCEDURES AND EMISSION MEASUREMENTS 10
Constant Volume Sampling I and 3 (CVSI &CVS3) Systems- Sampling Procedures — Chassis dyno - Seven mode and thirteen mode cycles for Emission Sampling — Sampling problems - Emission analyzers —NDIR, FID, Chemiluminescent, Smoke meters, Dilution Tunnel, SHED Test, Sound level meters.

OUTCOMES:
By the end of this course, students will be able to
- Understand the various emissions formed in IC engines
- Understand the effects of pollution on human health and environment
- Understand the control techniques
- Understand the emission norms

TEXT BOOKS:

REFERENCES:
3. SAE Transactions, Vehicle emission, 1982 (3 volumes).

AU7602 HYBRID AND ELECTRIC VEHICLES  L T P C  3 0 0 3
OBJECTIVE:
- To understand the basic concept of Hybrid, Electric Vehicles, energy Storage devices and controls.

UNIT I INTRODUCTION TO NEED FOR ALTERNATIVE SYSTEM  9

UNIT II ENERGY STORAGE DEVICES AND FUELL CELLS  9
Electromechanical batteries- types of batteries –lead acid batteries, nickel based batteries, lithium based batteries, electrochemical reactions, thermodynamic voltage, specific energy, specific power, energy efficiency and ultra-capacitors.
Fuel Cell- Fuel cell characteristics- Fuel cell types-Hydrogen fuel cell- Connecting cell in series-water management in the PEM fuel cell- Thermal Management of the PEM fuel cell
UNIT III  ELECTRIC VEHICLES  
Electric vehicle layout, performance of electric vehicles – traction motor characteristics, tractive effort, transmission requirements, vehicle performance, energy consumption, advantage and limitations, specifications, system components, electronic control system, safety and challenges in electric vehicles.

UNIT IV  HYBRID VEHICLES
Concepts of hybrid electric drive train, types, architecture of series and parallel hybrid electric drive train, merits and demerits, hybrid electric drive train design, mild and full hybrids, plug-in hybrid electric vehicles and range extended hybrid electric vehicles.

UNIT V  PROPULSION MOTORS AND CONTROLLERS
Types of electric motors – working principle of AC and DC motors. Characteristic of shunt, series and compound type of DC motors- permanent magnet and separately exited DC motors. AC single phase and 3-phase motor – inverters – DC and AC motor speed controllers.

OUTCOMES
End of the course student would have deep knowledge on
- Basic of hybrid and electric vehicles
- Different energy storage devices
- Concepts of hybrid electric drive train
- Electric motors and controllers

TEXT BOOKS:

REFERENCES:

AU7603  VEHICLE BODY ENGINEERING

OBJECTIVES:
- The main objective of this course is to impart knowledge in the construction of vehicle, aerodynamics, paneling of passenger car and commercial vehicle body design. At the end of the course the student will be well versed in the design and construction of external body of all types of vehicles such as car, light commercial vehicles and heavy commercial vehicles.

UNIT I  CAR BODY DETAILS
Types of Car body - Saloon, convertibles, Limousine, Estate Van, Racing and Sports car – Visibility- regulations, driver’s visibility, improvement in visibility and tests for visibility. Driver seat design -Car body construction-Various panels in car bodies. Safety: Safety design, safety equipment for cars.
UNIT II  BUS BODY DETAILS  9
Types of bus body: based on capacity, distance travelled and based on construction – Bus body lay out, floor height, engine location, entrance and exit location. Types of metal sections used – Regulations – Constructional details: Conventional and integral.

UNIT III  COMMERCIAL VEHICLE DETAILS  8
Types of commercial vehicle bodies - Light commercial vehicle body. Construction details of Flat platform body, Tipper body and Tanker body – Dimensions of driver’s seat in relation to controls – Drivers cab design.

UNIT IV  VEHICLE AERODYNAMICS  9
Objectives, Vehicle drag and types. Various types of forces and moments. Effects of forces and moments. Side wind effects on forces and moments. Various body optimization techniques for minimum drag. Wind tunnels – Principle of operation, Types. Wind tunnel testing such as: Flow visualization techniques, Airflow management test – measurement of various forces and moments by using wind tunnel.

UNIT V  BODY MATERIALS, TRIM, MECHANISMS AND BODY REPAIR  9
Types and properties of materials used in body construction-Such as steel sheet, timber, plastics and GRP. Body trim items-body mechanisms. Hand tools-power tools for body repair. Vehicle corrosion-Anticorrosion methods-Modern painting process procedure.

OUTCOMES:
Upon completion of the course, students will
- Know about different aspects of car body, bus body and commercial vehicle bodies.
- Role of various aerodynamic forces and moments, measuring instruments in vehicle body design.
- Knowledge about the material used in body building, tools used in body repairs and command over vehicle body engineering applications.

TEXT BOOKS:

REFERENCES:

AU7604  VEHICLE CONTROL SYSTEM  L T P C
3 0 0 3

OBJECTIVE:
- The main objective of this course is to impart knowledge in the selection of various control related variables in automobile sub systems, review of various control schemes, control oriented modeling and dynamic response of automotive system.

UNIT I  INTRODUCTION TO VEHICLE CONTROL SYSTEM  9
Trends, overview and examples of vehicle control system- Sensors , actuators and controller modules- Vehicle communication Network- System Engineering V- diagram- Algorithm
Development Steps in vehicle control system design- Degree of freedom for vehicle control- selection of controlled, manipulated, measured disturbance variables- classification of the variables in various automotive systems like engines, suspension, braking, air conditioning – General types of vehicle controller configurations- Feedback, Inferential, Feed-Forward, Ratio control

UNIT II CONTROL SCHEMES, CRUISE AND HEADWAY CONTROL
Feed-Forward control- Cascade control- Design considerations for cascade control, Time delay compensation, Inferential control- Nonlinear control- Adaptive control etc.

UNIT III DRIVER MODELING AND POWERTRAIN CONTROL SYSTEMS

UNIT IV CONTROL OF HYBRID AND FUEL CELL VEHICLES
Series-Parallel- Split Hybrid Configurations- Hybrid Vehicle Control Hierarchy- Control Concepts Of Series Hybrids- Equivalent Consumption minimization strategy- control concepts for split hybrid- modeling of fuel cell systems- fuel stack model- control of fuel cell system

UNIT V HUMAN FACTORS AND INTELLIGENT TRANSPORT SYSTEM
Human factors in vehicle automation- cross over model principle- Risk- Homeostatic Theory- Driving simulators- percentage of road departure Advanced traffic management system- Advanced traveler information system- commercial vehicle operation- Advanced vehicle control system- Preventing collisions- Longitudinal motion control and platoons- Site specific information-comparison of longitudinal control approaches- String stability- Automated steering and lateral control – Lane sensing- automated lane change and follow control

TOTAL : 45 PERIODS

OUTCOMES:
- Students will gain understanding on automotive-control problem considering the physics and underlying principles behind the control-system concept and design
- Student will read and analyze automotive control systems and a review of background material on Power train control, electric and hybrid vehicle fuel cell control and human factors.
- Students will understand the concept of intelligent vehicle technologies, collision detection and avoidance systems, automated highways, platooning, and automated steering.

TEXT BOOKS:

REFERENCES:
AU7611  CREATIVE AND INNOVATIVE PROJECT  L  T  P  C
0  0  4  2

The goal of this course is to help students to identify innovative projects that promotes and inhibit creativity to explore the variables that affect creativity and innovation. By the end of the period, students should be familiar with current thinking in their field, and able to apply the concepts to relevant research problems or practical applications.

The goal of this course is to drive them to learn concepts, models, frameworks, and tools that engineering graduates’ need in a world where creativity and innovation is fast becoming a precondition for competitive advantage.

Each student will choose a nagging workplace problem or socially relevant problems that have been difficult for them to "solve." At the end of the semester, each or group of students have to submit a report for evaluation.

TOTAL : 60 PERIODS

AU7612  ENGINE TESTING AND EMISSION MEASUREMENT LABORATORY  L  T  P  C
0  0  4  2

OBJECTIVE:
• The main objective of this course is to impart knowledge in automotive Emission measurement and methods of testing engines. The detailed measuring techniques of pollutants like UBHC, CO, NOx, CO₂ and smoke for both SI and CI engines will be taught and compared with the emission standards. The knowledge about the instruments used for measurement of pollutants, engine performance and combustion parameters are to be explained with live example. At the end of the course the students will have knowledge about methods to test the engine and emission.

LIST OF EXPERIMENTS:
1. Study and use of IC engine testing Dynamometers.
2. Study and use of Pressure pickups, charge amplifier, storage oscilloscope and signal analyzers used for IC engine testing.
3. Performance study on petrol engine.
4. Performance study on diesel engine.
5. Determine the Frictional power on petrol engines.
7. Study of NDIR Gas Analyzer and FID.
8. Study of Chemiluminescent NOₓ analyser.
10. Diesel smoke measurement.

TOTAL : 60 PERIODS

OUTCOMES:
By the end of this course, students will be able to
• Understand the various emission measuring instruments
• Understand the various engine testing instruments
• Understand the procedure to measure the emission
• Understand the procedure for measuring the engine performance and combustion parameters
• Understand the emission norms

TEXT BOOK:

REFERENCES:
# HYDRAULIC AND PNEUMATICS SYSTEMS

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## OBJECTIVE:

- To understand the hydraulic and pneumatic principles, involved and their components as well as its selection.

## UNIT I  INTRODUCTION TO FLUID POWER

9

Introduction to fluid power control- Hydraulic and pneumatics- Selection criteria, application of fluid power, application of pascal’s law, equation, Transmission and multiplication of force pressure losses- fluids, selection and properties- ISO symbols

## UNIT II  FLUID POWER DRIVES

9

Fluid power drives- Pumps- working principle and construction details of gear, vane and piston pumps, hydraulic motor, Hydrostatic transmission drives and characteristics - Hydraulic supply Components- Pneumatic power supply- Compressor, air distribution, air motors. Case study related to automotive application.

## UNIT III  FLUID POWER ELEMENTS

9


## UNIT IV  HYDRAULIC AND PNEUMATIC CIRCUITS DESIGN

9


## UNIT V  ELECTRO PNEUMATICS AND PLC CIRCuits

9

Use of electrical timers, switches, solenoid, relay, proximity sensors etc. Electro pneumatic sequencing Ladder diagram- PLC: – elements, function and selection- PLC programming- Ladder and different programming methods- Sequencing circuits. Case study related to automotive application.

## TOTAL: 45 PERIODS

## OUTCOMES:

- Students will be able to design a hydraulic system circuit that can be incorporated in an automotive application.
- Students will gain ability to design Pneumatic circuit for an automotive component that meets desired specifications and requirements.

## TEXT BOOKS:


## REFERENCES:

OBJECTIVE:

- The objective of this course is to provide fundamental knowledge of the dynamics of ground vehicles, knowledge of suspension design and function, basic concepts on concerning stability and control and to study about basic analysis of vehicle dynamics in performance, handling and ride modes.

UNIT I CONCEPT OF VIBRATION

UNIT II TYRES

UNIT III VERTICAL DYNAMICS

UNIT IV LONGITUDINAL DYNAMICS AND CONTROL

UNIT V LATERAL DYNAMICS
Steady state handling characteristics. Steady state response to steering input – Yaw velocity gain, Lateral acceleration gain, curvature response gain. Testing of handling characteristics. Transient response characteristics, Direction control of vehicles. Roll center, Roll axis, Vehicle under side forces. Stability of vehicle on banked road, during turn. Effect of suspension on cornering. Minuro Plot for Lateral Transient Response,

OUTCOMES:
At the end of the courses, the students can able to
- Develop physical and mathematical models to predict the dynamic response of vehicles;
- Apply vehicle design performance criteria and how to use the criteria to evaluate vehicle dynamic response;
- Use dynamic analyses in the design of vehicles.

TEXT BOOKS:
REFERENCES:

GE7351 ENGINEERING ETHICS AND HUMAN VALUES L T P C
3 0 0 3

OBJECTIVES
• To emphasise into awareness on Engineering Ethics and Human Values.
• To understand social responsibility of an engineer.
• To appreciate ethical dilemma while discharging duties in professional life.

UNIT I HUMAN VALUES

UNIT II ENGINEERING ETHICS

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION
Engineering as experimentation - engineers as responsible experimenters - codes of ethics – Importance of Industrial Standards - a balanced outlook on law – anticorruption- occupational crime -the challenger case study.

UNIT IV ENGINEER’S RIGHTS AND RESPONSIBILITIES ON SAFETY

UNIT V GLOBAL ISSUES
Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-Sample code of conduct.

OUTCOMES
• Students will have the ability to perform with professionalism, understand their rights, legal, ethical issues and their responsibilities as it pertains to engineering profession with engaging in life-long learning with knowledge of contemporary issues.

TOTAL : 45 PERIODS
TEXT BOOKS

REFERENCES

AU7711 VEHICLE TESTING LABORATORY

OBJECTIVES:
- To impart the knowledge on testing of vehicle and subsystems.

LIST OF EXPERIMENTS:
1. Minor and major tune up of gasoline and diesel engines
2. Calibration of Fuel pump
3. Engine fault diagnosis using scan tool
4. Fault diagnosis and service of transmission system
5. Fault diagnosis and service of braking system
6. Fault diagnosis and service of suspension system
7. Fault diagnosis and service of steering system
8. Fault diagnosis and service of Electrical system like battery, starting system, charging system, lighting system etc.
9. Vehicle testing on chassis dynamometer
10. Practice the following:
   i. Adjustment of pedal play in clutch, brake, hand brake lever and steering wheel play.
   ii. Air bleeding from hydraulic brakes, air bleeding of diesel fuel system.
   iii. Wheel bearings tightening and adjustment.
   iv. Adjustment of head lights beam.
   v. Removal and fitting of tire and tube.

TOTAL : 60 PERIODS

OUTCOMES
- End of the course student would have deep practical knowledge on
OBJECTIVE:
- To give students a first-hand experience on industrial environment and to implement the theoretical knowledge in solving existing problems at industry. This course will also give students a thirst on entrepreneurship.

1. The students have to undergo practical industrial training for four weeks in recognized industrial establishments during their vacation periods.
2. At the end of the training they have to submit a report with following information:
   a. Profile of the industry
   b. Product specification
   c. Organizational chart
   d. Plant layout
   e. Processes/Machines/Equipment/Devices
   f. Personnel & social welfare schemes
   g. Details of the training undergone
   h. Projects undertaken during the training, if any
   i. Inference from training

3. The assessments will be based equally on the report in the prescribed format and viva-voce examination by a committee nominated by the Head of the Department

OUTCOMES:
- Aware of an industrial structure
- Expose to the sequence of developing a product

AU7811   PROJECT WORK

The project work may be assigned to a single student or to a group of student not exceeding 4 per group, on a project involving some design and fabrication work or theoretical and experimental studies related to the respective engineering discipline.

Every project work shall have a Guide who is a member of the faculty of the University. Twenty periods per week shall be allotted in the Time table for this important activity and this time shall be utilized by the students to receive directions from the Guide, on library reading, laboratory work, computer analysis, or field work as assigned by the Guide and also to present in periodical seminars or viva to review the progress made in the project.

Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details, estimation of cost and conclusions. This final report shall be in typewritten form as specified in the guidelines.

The continuous assessment and semester evaluation may be carried out as specified in the guidelines to be issued from time to time.

TOTAL: 300 PERIODS
OBJECTIVES

- To impart knowledge in modern trends and developments in internal combustion engines.
- To develop knowledge in non conventional engines and their operation in detail and to acquire complete knowledge in engine modeling and combustion analysis of internal combustion engines.

UNIT I  COMBUSTION OF FUELS


UNIT II  ENGINE CYCLE ANALYSIS

Ideal air, fuel air cycle and actual cycle analysis. Progressive combustion analysis in SI engines. Parametric studies on work output, efficiency and other engine performance.

UNIT III  COMBUSTION MODELLING


UNIT IV  NON CONVENTIONAL IC ENGINES


UNIT V  COMBUSTION ANALYSIS IN IC ENGINES

Photographic studies of combustion processes – Analysis of Pressure crank angle diagrams in SI and CI engines. Knock study for Pressure crank angle histories. Apparent heat release rate and Wiebe’s law analysis for combustion. Calculation of Ignition delay and combustion duration. – Hot wire and laser Doppler anemometry and velocimetry for flow and combustion analysis in IC engines.

TOTAL : 45 PERIODS

OUTCOMES:

- Students will understand the recent developments and trends in internal combustion engines. They will be able to apply their knowledge in making changes in engine design for better engine performance.
- Students will become familiar with the non conventional engines and their importance, difficulties involved in using them for power generation
- They will also get familiarized with the equipment used for flow and combustion analysis.

TEXT BOOKS


REFERENCES

OBJECTIVES

- The course should enable the students to know about the basics about the vehicle and to understand the safety aspects in the vehicle. It also enables to acquire knowledge in sensors provided in the vehicle to avoid the crash and to detect the defects in the vehicle and to know about the comfort and convenience system.

UNIT I MODERN POWER PLANT AND POWER TRAIN

Modern Engine Technology like DTS – i, DTS – Fi, DTS – Si, VVT, Camless Engine, GDi, CRDI , Hybrid / Electric and Future Cars, Fuel Cell.

UNIT II PASSIVE SAFETY EQUIPMENTS AND CONVENIENCE SYSTEM

Seat belt, Seat belt tightener system and importance , collapsible steering column. Air bags and its activation .Designing aspcets of automotive bumpers and materials for bumpers. Steering And mirror adjustment, central locking system, Tire pressure control system, rain sensor system, automated wiper system.

UNIT III ACTIVE SAFETY

Antilock braking system, Stability Control. Adaptive cruise control, Lane Keep Assist System, Collision warning, avoidance system, Blind Spot Detection system, Driver alertness detection system.

UNIT IV VEHICLE INTEGRATION

Vision enhancement, road recognition system, Looking out sensors and Looking in sensors, intelligent vision system, Vehicle Integration system. Anti theft technologies, smart card system, number plate coding. Locking system- Central locking system- acoustic signaling devices.

UNIT V VEHICLE NAVIGATION SYSTEM


OUTCOMES:

The students should be able to:
- Know about the design of the bumper for safety.
- Know about the concept of crumble zone, and also the effect of acceleration and deceleration of the vehicle in the compartment of the vehicle.
- Know the various types of safety aspects such as active and passive safety, the active safety components and the working passive safety components such as air bags, seat belts
- Know the working of the compartment while moving of the vehicle, about the collapsible steering and tiltable steering column, about the collision avoidance system, front and rear object detection.
- Know about the rear vehicle detection system, and the braking system, the comfort and convenience system for the vehicle such as central
TEXT BOOKS:

REFERENCES:
4. ARAI Safety standards

AU7003 ALTERNATIVE FUELS AND ENERGY SYSTEMS L T P C 3 0 0 3

OBJECTIVES
- To acquire complete knowledge on availability of possible alternate fuels and their properties to use as fuel in CI and SI engines. To develop knowledge in changing the engine system, modifying the fuel for efficient use in the internal combustion engines and to understand the challenges and difficulties in using alternative fuels in internal combustion engines

UNIT I INTRODUCTION TO ALTERNATIVE FUELS 9
Need for alternative fuels. World and Indian energy scenario on alternative fuels. Availability of different alternative fuels for SI and CI engines. Production technologies for biofuels for internal combustion engines- Pyrolysis, gasification, digestion.

UNIT II ALCOHOLS AS FUELS 9

UNIT III VEGETABLE OILS AS FUELS 9
Various vegetable oils and their important properties. Different methods of using vegetable oils engines – Blending, preheating Transesterification and emulsification of Vegetable oils - Performance in engines – Performance, Emission and Combustion Characteristics in diesel engines. Role of Nano fluids, additives and cetane improvers for performance improvement of vegetable oils as fuel.

UNIT IV HYDROGEN AS ENGINE FUEL 9
UNIT V  BIOGAS, LPG AND NATURAL GAS AS FUELS
Production methods of Biogas, Natural gas and LPG. Properties studies, CO₂ and H₂S scrubbing in Biogas., Modification required to use in SI and CI Engines- Performance and emission characteristics of Biogas, NG and LPG in SI and CI engines.

OUTCOMES
- Upon completion the course the students will have the complete knowledge on bio fuel production methods and their properties in detail.
- They will be able to apply their knowledge in making changes in engine design and fuel modification for the utilizing the alternative fuels effectively in the engines.

TEXT BOOKS

REFERENCES
3. Technical papers of SAE on Biofuels (Alcohols, vegetable oils, CNG, LPG, Hydrogen, Biogas etc.).

AU7004  AUTOMOTIVE AERODYNAMICS

OBJECTIVE
- To learn the basics of fluid mechanics on vehicle motion and expose to the optimization techniques followed in automotive industry in reducing aerodynamics drag, fuel consumption and improving vehicle stability. This course will also expose the students to testing techniques practiced in industry.

UNIT I  BASICS OF FLUID DYNAMICS ON VEHICLE MOTION
Importance of study - timeline developments - basics of fluid mechanics - flow phenomenon related to vehicles - external flow problem - various resistances to vehicle motion - performance, fuel consumption and traction force diagram of a passenger car.

UNIT II  DRAG FRACTIONS AND LOCAL ORIGINS IN A PASSENGER CAR
Car as a bluff body - generation & transportation of vortices around car - types of aerodynamic drag forces & its contribution to total drag - analysis of aerodynamic drag at local origins - shape and detail optimization techniques with case studies.

UNIT III  VEHICLE HANDLING
The origin of forces and moments on a vehicle - lateral stability problems - methods to calculate forces and moments – vehicle dynamics under side winds - the effects of forces and moments, dirt accumulation on the vehicle, wind noise. Add-ons to improve stability of road vehicles.
UNIT IV COMMERCIAL VEHICLE AERODYNAMICS
Tractive resistance & fuel consumption – Drag coefficients of various commercial Vehicles – Scope for reducing drag on commercial vehicles (Trucks with trailers and buses), Advantages of commercial vehicles aerodynamics & its effects – Vehicle soiling & its effects on driving.

UNIT V WIND TUNNELS FOR ROAD VEHICLES AERODYNAMICS
Need of a wind tunnel, principle of wind tunnel technology, problems with reduced scale models, full scale wind tunnels examples and case studies, instrumentation& measurement techniques, Introduction to numerical analysis (CFD).

OUTCOMES:
- Know the forces & moments influencing drag
- Solve simple numericals related to fuel economy & drag
- Learn the techniques of optimization practiced in industry
- Learn the relation between drag, stability & fuel economy
- Expose to fundamentals of numerical & experimental testing

TEXT BOOKS:
1. R.H.Barnard - “Road vehicle aerodynamic design, An Introduction”, Mechaero publications, Third edition

REFERENCES:

AU7005 AUTOMOTIVE AUTOMATION

OBJECTIVE:
- To understand the various automated Automobile manufacturing activities and study the application of computer technology in the Automobile manufacturing activities.

UNIT I AUTOMATION IN AUTOMOBILE MANUFACTURING

UNIT II AUTOMATED MATERIAL HANDLING SYSTEMS
Automated assembly systems- Design principles and types – part feeding devices, automated material handling devices – conveyor systems- types and applications, AGVs – types and control applications ,rail guided vehicles-automated storage/retrieval systems-industrial robots- basic components-special features-applications.

UNIT III GROUP TECHNOLOGY AND FMS
Part families-visual-part classification and coding-production flow analysis, benefits of GT-FMS-workstations-FMS layouts configurations-computer control systems- planning the FMS- machine cell design-FMS application and benefits – automated work flow-automated flexible assembly systems.
UNIT IV AUTOMATED ASSEMBLY AND INSPECTION
Automated chassis assembly-car body assembly-engine assembly-transfer lines-visual inspection-machine visions application-CMM-types-principle and applications, industrial robots for assembly of automobile components-applications.

UNIT V SHOP FLOOR AND COMPUTER AIDED QUALITY CONTROL
Automated chassis assembly-car body assembly-engine assembly-transfer lines-visual inspection-machine visions application-CMM-types-principle and applications, industrial robots for assembly of automobile components-applications.

OUTCOMES:
- Students will have a sound knowledge in the various automated manufacturing process.
- Students will be familiar in modern engineering manufacturing process and will have an update in recent scenario

TEXT BOOKS:

REFERENCES:

OBJECTIVES
- Knowledge on properties of engineering materials
- To select suitable materials for design
- Materials selection criteria for engine and transmission systems
- Different materials used for automotive structures.
- Different electronic materials for automotive applications

UNIT I ENGINEERING MATERIALS AND THEIR PROPERTIES
Classes of engineering materials - the evolution of engineering materials, Definition of materials properties, Displaying material properties using materials selection charts, Forces for change in materials selection and design, Materials and the environment-selection of materials for automotive, aerospace, marine and defence applications.

UNIT II BASIS OF MATERIAL SELECTION
UNIT III MATERIALS FOR ENGINES AND TRANSMISSION SYSTEMS
Materials selection for IC engines: Piston, piston rings, cylinder, Engine block, Connecting rod, Crank shaft, Fly wheels, Gear box, Gears, Splines, Clutches.

UNIT IV MATERIALS FOR AUTOMOTIVE STRUCTURES
Materials selection for bearings, leaf springs, chasis & frames, Bumper, shock absorbers, wind screens, panels, brake shoes, Disc, wheels, differentials, damping and antifriction fluids, Tyres and tubes.

UNIT V ELECTRONIC MATERIALS FOR AUTOMOTIVE APPLICATIONS
Materials for electronic devices meant for engine control, ABS, Steering, Suspension, Sensors, anti-collision, Anti-fog, Head lamps.

OUTCOMES
- Discuss different materials used for automotive component manufacturing.
- Select proper material for Automobile applications

TEXT BOOKS

REFERENCES

AU7007 AUTOMOTIVE TEST INSTRUMENTATION

OBJECTIVES
- To develop complete knowledge in using sensors, actuators and instruments in automobiles. To understand their necessities, working principles and performance characteristics in detail and to impart knowledge in modern laboratory experimental techniques for testing automobiles

UNIT I MEASUREMENT SYSTEMS
Introduction to Measurement systems-static and dynamic measurement –closed and open loop system - Requirements and characteristics – Analysis of experimental detail. Error analysis

UNIT II TRASDUCERS, MODIFIERS AND TERMINATING DEVICES
Transducers for Automotive Applications – Amplifiers- filters –data Acquisition- Indicators, Printers and displays –Signal Analyzing.
UNIT III MECHANICAL MEASUREMENT
Instrumentation for measuring Weight, Force, torque, pressure power, temperature, fluid flow, vibration, rotational speed, velocity, acceleration and angular motion.

UNIT IV ENGINE EXPERIMENTAL TECHNIQUES

UNIT V VEHICLE EXPERIMENTAL TECHNIQUES
Laboratory tests- Study of chassis dynamometer- test tracks - Endurance Tests- crash tests- Vehicle performance test – Brake tests.

TOTAL: 45 PERIODS

OUTCOMES
- Upon completion of the course the students will be able to apply their knowledge in using all kind of sensors, actuators and instruments used in automobile testing
- They will be able to apply their knowledge in conducting different types of experiments in automobiles

TEXT BOOKS

REFERENCES
2. T.G. Beckwith and Buck, Mechanical Measurements, Oxford and IBH Publishing House, New Delhi, 1995

AU7008 COMBUSTION THERMODYNAMICS AND HEAT TRANSFER

OBJECTIVES
- To make the students understand the principle of general and engine combustion.
- To understand engine heat release rate and various heat transfer models and to study the experimental methods for combustion and heat transfer in engines.

UNIT I THERMODYNAMICS OF COMBUSTION
Premixed and diffusion combustion process in IC engines. First and Second Law of Thermodynamics applied to combustion- combustion Stoichiometry- chemical equilibrium, spray formation and droplet combustion.

UNIT II CHEMICAL KINETICS OF COMBUSTION
UNIT III  FLAMES  9
Laminar premixed – flame speed correlations- quenching, flammability, and ignition, flame stabilization, laminar diffusion flames, turbulent premixed flames-Reynolds and Damköhler numbers and their significance.

UNIT IV  HEAT TRANSFER IN IC ENGINES  9

UNIT V  EXPERIMENTS IN IC ENGINES  9
Cylinder pressure measurement. Rate of heat release calculation – hot wire and laser Doppler anemometry and velocimetry for flow and combustion analysis in IC engines.

TOTAL : 45 PERIODS

OUTCOMES
- Upon completion the students will understand the principle of engine combustion and the various heat transfer models and measuring methods of engine heat transfer in detail.
- They will understand thermodynamics of combustion, grasp the basics of normal, abnormal combustion and heat transfer in engines.
- They also understand experimental techniques in investigating the combustion and heat transfer processes in IC engines.

TEXT BOOK

REFERENCES

AU7009  COMPUTATIONAL FLUID MECHANICS  L T P C  3 0 0 3

OBJECTIVE:
- To develop finite difference and finite volume discretized forms of the CFD equations and formulate explicit & implicit algorithms for solving the Euler Equations & Navier Strokes Equations.

UNIT I  GOVERNING DIFFERENTIAL EQUATIONS AND FINITE DIFFERENCE METHOD  10
Classification, Initial and Boundary conditions – Initial and Boundary Value problems – Finite difference method, Central, Forward, Backward difference, Uniform and non-uniform Grids, Numerical Errors, Grid Independence Test.

UNIT II  CONDUCTION HEAT TRANSFER BY FINITE DIFFERENCE METHOD AND FINITE VOLUME METHOD  10
Steady one-dimensional conduction, Two and three dimensional steady state problems, Transient one-dimensional problem, Two-dimensional Transient Problems.
UNIT III CONVECTION HEAT TRANSFER BY FINITE DIFFERENCE METHOD AND FINITE VOLUME METHOD


UNIT IV INCOMPRESSIBLE FLUID FLOW BY FINITE DIFFERENCE METHOD AND FINITE VOLUME METHOD

Governing Equations, Stream Function – Vorticity method, Determination of pressure for viscous flow, SIMPLE, Computation of Boundary layer flow - Finite difference approach.

UNIT V FINITE ELEMENT METHOD AND TURBULENCE MODELS


TOTAL: 45 PERIODS

OUTCOMES:

- The student will demonstrate an ability to recognize the type of fluid flow that is occurring in a particular physical system and to use the appropriate model equations to investigate the flow.
- The student will gain the confidence to simplify a real fluid-flow system into a simplified model problem, and select the proper governing equations involved in the system.
- The student will analyze and interpret data obtained from the numerical solution of fluid flow problems.

TEXT BOOKS:


REFERENCES:

OBJECTIVE:
- The objective of the course is to make the students understand the general steps of finite element methods, FEM formulation, be able to derive equations in finite element methods for 1D, 2D and 3D problems and its application solid mechanics and heat transfer.

UNIT I INTRODUCTION
Review of various approximate methods – Raleigh Ritz’s, Galerkin and finite difference methods – Steps in FEM Analysis – Governing equation and convergence criteria of finite element method.

UNIT II DISCRETE ELEMENTS

UNIT III CONTINUUM ELEMENTS
Plane stress, Plane strain and axisymmetric problems, constant and linear strain, triangular elements, stiffness matrix, axisymmetric load vector. Computer codes for CST and LST elements.

UNIT IV ISOPARAMETRIC ELEMENTS
Definitions, Shape function for 4, 8 and 9 nodal quadrilateral elements, Stiffness matrix and consistent load vector, Gaussian integration

UNIT V FIELD PROBLEM

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the students can able to
- Understand and perform engineering analysis of structural members using FEM.
- Demonstrate the ability to evaluate and interpret FEA analysis results for design and evaluation purposes
- Develop computer codes for FEM Elements.

TEXT BOOKS:

REFERENCES:
AU7011  MANUFACTURING OF AUTOMOTIVE COMPONENTS

OBJECTIVE:
- To study in detail about the modern casting, forging, molding and machining processes followed in automotive components. To enhance the knowledge of the students in the field of non-ferrous materials, emerging metallic and non-metallic materials like polymers, fiber reinforced plastics (FRP), engineering ceramics, metal matrix composites (MMCs) and its manufacturing methods, selection criteria, properties and applications for automotive components.

UNIT I  ENGINE COMPONENTS 9

UNIT II  TRANSMISSION COMPONENTS 9

UNIT III  BODY COMPONENTS 9

UNIT IV  CHASSIS COMPONENTS 9
UNIT V TYRES AND ADVANCED MATERIALS MANUFACTURING

Tire and tube manufacturing, spray painting, powder coating, Prototype Manufacturing - RPT, 3-D Printing, chemical vapour deposition, physical vapour deposition, cryogenic grinding of powders, sealants, sound proof materials, structural adhesives, MMC liners – Selection of materials for Auto components.

OUTCOMES:
At the end of this course the student should
- Will be able to select an appropriate manufacturing process for particular Automotive Components.
- Have in-depth knowledge of various engineering materials used in automobile engineering and the corresponding manufacturing processes for the same.

TEXT BOOKS:

REFERENCES:

AU7012 NOISE, VIBRATION AND HARSHNESS

OBJECTIVE:
- To provide introduction to students the fundamentals of noise and vibration related to generation, transmission, control techniques and the effect of human sensitivity. To enable the students acquaint with principles and fundamentals in NVH instrumentation and signal analysis techniques.

UNIT I FUNDAMENTALS OF NOISE, VIBRATION AND HARSHNESS


UNIT II EFFECTS OF NOISE, BLAST, VIBRATION AND SHOCK ON HUMANS

UNIT III TRANSPORTATION NOISE AND VIBRATION – SOURCES, PREDICTION AND CONTROL


UNIT IV ACOUSTICAL DESIGN OF MUFFLERS AND SILENCERS


UNIT V NOISE AND VIBRATION TRANSDUCERS ANALYSIS EQUIPMENT, SIGNAL PROCESSING, AND MEASURING TECHNIQUES.


TOTAL : 45 PERIODS

OUTCOMES:
At the end of this course the student should
- Identify sources of noise and vibration from an automobile.
- Solve complicated problems in Noise and Vibration.
- Able to design and select the appropriate Muffler/Silencer for the control of tail pipe noise from an IC engine.
- Demonstrate the knowledge of noise, vibration and physiological effects on Humans.
- Exposed to acoustic instrumentation and noise control techniques

TEXT BOOKS:

REFERENCES:
3. Randall F Barron, "Industrial Noise Control and Acoustics", Marcel Dekker, Inc. 2003
# AU7013 OFF HIGHWAY VEHICLES

## OBJECTIVE:
- The main objective of this course is to introduce the concept and principle of operation of special vehicles such as Bulldozers, Ditchers, Bucket excavators, farm equipments, military vehicles etc. At the end of the course, the students can have a better understanding of the application of the Off Highway Vehicle in the excavation of earth.

## UNIT I EARTH MOVING EQUIPMENTS 9
Construction layout, capacity and applications of earthmovers like dumpers, front-end loaders, bulldozers, backhoe loaders, scrapers, hydraulic shovels, Bucket conveyors etc. Selection criteria of prime mover for dumpers and front end loaders based on vehicle performance characteristics. Surface Miners – Highwall Miners, Off-Highway Mining Trucks.

## UNIT II CONSTRUCTIONAL EQUIPMENTS 9

## UNIT III FARM EQUIPMENTS 9

## UNIT IV INDUSTRIAL APPLICATIONS 9

## UNIT V MILITARY AND COMBAT VEHICLES 9
Ride and stability characteristics, power take off, special implementations. Special features and constructional details of Main Battle tankers, gun carriers and transport vehicles, bridge builders, communication vehicles.

## TOTAL: 45 PERIODS

## OUTCOMES:
- At the end of this course the student should
  - Know the concept and principle of operation of special vehicles such as bull dozers, ditchers bucket excavators far equipments military vehicles etc
  - Have better understanding of the application of the Off Highway Vehicle in the excavation.
  - Understand earth moving and constructional equipments
  - Learn the basics of power train concepts for special vehicles

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2007
Grasp the maintenance of farm equipments, military and combat vehicles

TEXT BOOKS:
2. SAE Handbook Volume III

REFERENCES:
1. B. Geleman and M. Moskovin, Farm tractors, MIR publishers, Moscow.

OBJECTIVE:
To make the students to understand the requirements related to polymers used in various automotive parts and to make the students to identify polymers for specific parts based on the usage.

UNIT I INTRODUCTION

UNIT II STRUCTURE PROPERTY RELATIONSHIPS IN RUBBERS
Resilience, creep, hysteresis and damping, stability, set and stress relaxation, behavior in dynamic applications.

UNIT III VIBRATION AND RUBBER SPRING

UNIT IV FLUID SEALINGS, FLEXIBLE COUPLINGS AND HOSES

UNIT V COMPOUND AND MANUFACTURE
Types of couplings – specification and selection – torque vs. deflection relationship – brake fluid / hydraulic hoses, materials and manufacture.

TOTAL : 45 PERIODS
OUTCOMES:
- The students will be able to identify the polymers used in specific parts
- The students will be able to find the polymers for a part
- Understand the step by step procedure for manufacturing vehicle components
- Understand the advanced techniques used for manufacturing Automobile components

REFERENCES
2. Hobel. E.F., Rubber Springs Design

AU7015 PRINCIPLES OF CONTROL SYSTEMS

OBJECTIVES:
The student should be able to state, explain and illustrate a set of key concepts related to Control Systems qualitatively in the context of an engineering application.

UNIT I SYSTEM AND THEIR REPRESENTATION
9
Basic elements in control systems- Open loop and Closed loop system- Feedback characteristics- Effects of feedback- mathematical modeling of physical systems- mechanical, Thermal, hydraulic and Pneumatic systems- Transfer function- AC and DC servomotor- Block diagram reduction techniques- signal flow graph- control system components – computer simulation.

UNIT II TIME RESPONSE ANALYSIS
9
Time response- Types of test inputs- First and Second order responses- Error coefficient- Generalized error series- Steady state error- Time domain specifications- Problems related to automotive domain- Computer simulation.

UNIT III FREQUENCY RESPONSE ANALYSIS
12
Frequency response- Frequency domain specifications- Bode plot- Polar plot- Determination of phase margin and gain margin- Constant M and N circles- Nichols chart- Determination of closed loop responses from open loop response- Problems related to automotive domain Computer simulation.

UNIT IV STABILITY OF CONTROL SYSTEM
6

UNIT V CONTROL SYSTEM DESIGN
9
PID controllers- Performance criteria- Selection of controller modes- lag, Lead, and lag-Lead networks- Compensator design for desired response using root locus and Bode diagrams- Problems related to automotive domain - Computer simulation

TOTAL: 45 PERIODS

OUTCOMES:
- To understand the methods of representation of system and their transfer function models
- To provide adequate knowledge in the time response of systems and steady state error analysis
- To give basic knowledge in obtaining the open loop and closed loop frequency responses of systems
• To understand the concept of stability of control system and methods of stability analysis
• To study the three ways of designing compensators for a control system

TEXT BOOKS:

REFERENCES:
2. Dorf Bishop, “Modern Control System”, Prentice Hall, 2004

AU7016 QUALITY CONTROL AND RELIABILITY L T P C
3 0 0 3

OBJECTIVE:
• Teach the essentiality of Quality Control, sampling and reliability engineering. Study on various types of control charts, six sigma and process capability to help the students understand various quality control techniques. Reliability engineering focuses on the dependability, failure mode analysis, reliability prediction and management of a system.

UNIT I STATISTICAL PROCESS CONTROL

UNIT II ACCEPTANCE SAMPLING

UNIT III EXPERIMENTAL DESIGN AND TAGUCHI METHOD

UNIT IV RELIABILITY AND ITS PREDICTION

UNIT V FAILURE DATA ANALYSIS
Real time distribution, exponential, normal, log normal, gamma and weibull – reliability data requirements – Graphical evaluation.

TOTAL : 45 PERIODS

OUTCOMES:
At the end of this course the student should
• Will be able to select an appropriate SPC and Sampling process for the Quality Control in particularly for manufacturing Automotive Components.
- Have in-depth knowledge of the Reliability and Failure Data Analysis.
- Will be able to design the experiment based on Taguchi methods

**TEXT BOOKS:**

**REFERENCES:**

**AU7017 SIMULATION OF IC ENGINES**

**OBJECTIVES**
- To impart knowledge in simulating IC engine processes. The detailed concept of air standard, fuel air cycle, progressive and actual cycle simulation of SI engine will be taught to the students. At the end of the course the students will have command over simulation of IC engine process.

**UNIT I INTRODUCTION TO SIMULATION**


**UNIT II STOICHIOMETRY AND ADIABATIC FLAME TEMPERATURE**

Reactive processes, Heat of reaction, measurement of URP, measurement of HRP. Introduction - combustion equation for hydrocarbon fuels. Calculation of minimum air, excess air and stoichiometric air required for combustion. Introduction, complete combustion in C-H-N-O systems, constant volume adiabatic combustion, constant pressure adiabatic combustion, calculation of adiabatic flame temperature, isentropic changes of state.

**UNIT III SI ENGINE SIMULATION**

SI Engine simulation with air as working medium, deviation between actual and ideal cycle. Fuel air cycle analysis - Temperature drop due to fuel vaporization, full throttle operation, work output and efficiency calculation, part-throttle operation, engine performance at part throttle, super charged operation. SI Engines simulation with progressive combustion. Models for mass burnt fraction.

**UNIT IV SI ENGINE SIMULATION WITH GAS EXCHANGE PROCESS**

Introduction, gas exchange process, Heat transfer process, friction calculations, compression of simulated values, validation of the computer code, engine performance simulation, pressure crank angle diagram, brake power, brake thermal efficiency, effect of speed on performance.
UNIT V  CI ENGINE SIMULATION


TOTAL : 45 PERIODS

OUTCOMES

- Students will understand the classifications and applications of engine cycle simulation model and grasp the major modeling and simulation methods and the influence of model parameters on engine performance.
- Students will become familiar with the modeling of progressive combustion and gas exchange processes and ability to build up control-oriented simulation model of internal combustion engines.
- They will get familiarized with the essential models of engine cycle simulation and theoretical knowledge to control the calculation accuracy and calculation efficiency of engine performance, combustion and emission.

TEXT BOOK


REFERENCES


AU7018 TWO AND THREE WHEELER TECHNOLOGY

OBJECTIVE:

- To develop the basic knowledge of the students in constructional details of two and Three Wheelers. Dissect the skills of the students in the operating principles.

UNIT I  POWER UNIT


UNIT II  FUEL AND IGNITION SYSTEM

Fuel system – Different circuits in two wheeler fuel systems, fuel injection system. Lubrication system, Ignition systems - Magneto coil and battery coil spark ignition system, Electronic ignition System, and starting system - Kick starter system – Self starter system. Recent technologies.

UNIT III  CHASSIS AND SUB – SYSTEMS

Main frame for two and three wheelers, its types, Chassis and different drive systems for two wheelers, Single, multiple plates and centrifugal clutches, Gear box and its and various gear controls in two wheelers. Front and rear suspension systems. Shock absorbers. Panel meters and controls on handle bar, Freewheeling devices.
UNIT IV  BRAKES AND WHEELS  

UNIT V  TWO & THREE WHEELER CASE STUDY  
Case study of Sports bike, Motor cycles, Scooters and Mopeds - Auto rickshaws, Pick up van, Delivery van and Trailer. Importance of maintenance – general maintenance schedule – Servicing of two and three wheeler – period checkups. Recent developments.

TOTAL: 45 PERIODS

OUTCOMES  
On successful completion of this course students will be able to:
- Explain the working of two and four stroke engines.
- Illustrate the functioning of clutch and gear box.
- Demonstrate the wheels, tyres, suspensions and braking systems.
- Identify the latest models of two wheelers.
- Define the operations of three wheelers and latest models of three wheelers.

TEXT BOOK:

REFERENCES:

AU7019  VEHICLE AIR-CONDITIONING  
L T P C  3 0 0 3

OBJECTIVES:
- The objective of the course is to impart knowledge in the area of pychrometry, refrigerant and to understand the various components of vehicle air conditioning. Also the Servicing and repairing aspects of vehicle air conditioning will be covered.

UNIT I  AUTOMOTIVE AIRCONDITIONING FUNDAMENTALS  
Purposes of Heating, Ventilation and Air Conditioning- Environmental Concerns- Ozone layer depletion- Location of air conditioning components in a car – Schematic layout of a vehicle refrigeration system. Psychrometry – Basic terminology and Psychrometric mixtures- Psychrometric Chart- Related problems

UNIT II  AUTOMOTIVE COOLING AND HEATING SYSTEM  
Vehicle Refrigeration System and related problems- Fixed thermostatic and Orifice tube system- Variable displacement thermostatic and Orifice tube system- Vehicle air conditioning operation Types of compressor- Compressor Clutches- Compressor Clutch electrical circuit- Compressor lubrication- Condensers- Evaporators- Expansion devices- Evaporator temperature and pressure controls- receiver-drier- Accumulators- refrigerant hoses, Connections and other assemblies- Heating system
UNIT III AIR-CONDITIONING CONTROLS, DELIVERY SYSTEM AND REFRIGERANTS
Types of Control devices- Preventing Compressor damage- Preventing damage to other systems- Maintaining drive ability- Preventing Overheating Ram air ventilation- Air delivery Components- Control devices- Vacuum Controls Containers – Handling refrigerants – Discharging, Charging & Leak detection – Refrigeration system diagnosis – Diagnostic procedure – Ambient conditions affecting system pressures.

UNIT IV AUTOMATIC TEMPERATURE CONTROL
Different types of sensors and actuators used in automatic temperature control- Fixed and variable displacement temperature control- Semi Automatic- Controller design for Fixed and variable displacement type air conditioning system

UNIT V SYSTEM SERVICING AND TESTING
Special tools for servicing vehicle air conditioning – Diagnosing components and air conditioning systems- Diagnosing cooling system- Air delivery system- Automatic temperature Control system diagnosis and service

TOTAL : 45 PERIODS

OUTCOMES:
- Student will understand the fundamental principles and operation of the heating, cooling, ventilation and air-conditioning system.
- Student will able to solve the simple problems related to pychrometry and refrigerant
- Enable the student to understand the operation of the individual components of the A/C
- System, sensors, actuators and electronic control
- Enable the reader to understand the range of techniques that can be used in diagnosing faults which affect system performance
- To provide adequate knowledge in safe working practice, understanding the correct procedures for A/C service and repair

TEXT BOOKS:

REFERENCES:

AU7020 VEHICLE MAINTENANCE

OBJECTIVE:
- To impart the knowledge on basics of vehicle maintenance and maintenance of engine subsystems and drive line components.

UNIT I MAINTENANCE, WORKSHOP PRACTICES, SAFETY AND TOOLS
UNIT II ENGINE AND ENGINE SUBSYSTEM MAINTENANCE 9
General Engine service- Dismantling of Engine components- Engine repair- Service of basic engine sub systems- cooling and lubricating system, fuel system, Intake and Exhaust system, electrical system - Electronic fuel injection and engine management service - fault diagnosis- servicing emission controls

UNIT III TRANSMISSION AND DRIVELINE MAINTENANCE 9
Clutch- general checks, adjustment and service- Dismantling, identifying, checking and reassembling transmission, transaxle- road testing- Removing and replacing propeller shaft, servicing of cross and yoke joint and constant velocity joints- Rear axle service points- removing axle shaft and bearings- servicing differential assemblies- fault diagnosis.

UNIT IV STEERING, BRAKE, SUSPENSION, WHEEL MAINTENANCE 9
Maintenance and Service of steering system-Inspection, Maintenance and Service of brake system- Drum brake, Disc brake, Parking brake. Bleeding of brakes. Inspection, Maintenance and Service of Mc person strut, coil spring, leaf spring, shock absorbers-Dismantling and assembly procedures. Wheel alignment and balance, removing and fitting of tyres, tyre wear and tyre rotation. Inspection,

UNIT V AUTO ELECTRICAL AND AIR CONDITIONING MAINTENANCE 9
Maintenance of batteries, starting system, charging system and body electrical -Fault diagnosis using Scan tools. Maintenance of air conditioning parts like compressor, condenser, expansion valve, evaporator - Replacement of hoses- Leak detection- AC Charging- Fault diagnosis Vehicle body repair like panel beating, tinkering, soldering, polishing, painting.

TOTAL : 45 PERIODS

OUTCOMES
End of the course student would have deep knowledge on
- Important of Vehicle maintenance
- Service procedure of engine and subsystems
- Service procedure of drive line
- Maintenance of electrical and air conditioning system

TEXT BOOKS

REFERENCES
2. Vehicle Service Manuals of manufacturers

AU7021 VEHICLE MULTIPLEXING L T P C
3 0 0 3

OBJECTIVE:
- The objective of the course is to impart knowledge in the areas of vehicle networking, various vehicle networking standards and multiplexing buses

UNIT I INTRODUCTION TO VEHICLE NETWORKING CONCEPTS 9
Historical Perspective- Multiplexing Paradox- Vehicle multiplexing comparison to industry- Why multiplexing – Popularity of multiplexing- SAE Classification- Intra Module Versus Intermodule communication- Examples of Vehicle Nodes – Terminology like : open architecture , Broad cast, Peer to peer, Baud rate versus Bit rate, protocol Synchronous and asynchronous protocol- On board Diagnostics- Encoding- Error Handling- Media Characteristics etc.
UNIT II  VARIOUS MULTIPLEXING LEVEL


UNIT III  MULTIPLEXING STANDARDS


UNIT IV  CAN: FROM CONCEPT TO REALITY

The CAN bus: general-CAN: its protocol, its properties, its novel features-The CAN physical layer-Medium, implementation and physical layers in CAN-Components, applications and tools for CAN-Event-triggered and time-triggered aspects-TTCAN – Time-triggered communication on CAN-Towards high-speed, X-by-Wire and redundant systems

UNIT V  NEW MULTIPLEXED BUS CONCEPTS


OUTCOMES :

- Students will acquire knowledge in multiplexing terminology and Standards relevant to vehicle
- Student can able to understand the current state of the CAN protocol, all the possible subdivisions of the physical layers and everything relating to conformity problems.
- Student can able to know the importance of various new multiplexed bus concepts

TEXT BOOKS:


TOTAL: 45 PERIODS

UNIT I  INTRODUCTION

Virtual Instrumentation-Definition and flexibility-Block diagram and Architecture of Virtual Instrumentation- Virtual instruments versus Traditional Instruments- Review of software in virtual Instrumentation- VI programming techniques- VI, sub VI, Loops and charts, Arrays, Clusters and Graphs, Case and Sequence Structures, Formula nodes, string and File Input / Output.

UNIT II  DATA ACQUISITION IN VI

A/D and D/A Converters, plug-in Analog input / Output cards- Digital Input and Output cards, Organization of the DAQ VI system- Opto Isolation- Performing analog input and analog output- Scanning multiple analog channels- issues involved in selection of data acquisition cards- Data acquisition modules with serial communication- Design of digital voltmeter with transducer input- Timers and Counters.
UNIT III COMMUNICATION NETWORKED MODULES 9

UNIT IV REAL TIME CONTROL IN VI 9
Design of ON/OFF controller and proportional controller for a mathematically described processes using VI software- Modeling and basic control of level and Reactor Processes- Case Studies on development of HMI, SCADA in VI.

UNIT V AUTOMOTIVE APPLICATIONS 9
PC based digital storage oscilloscope- Sensor technology and signal processing- virtual laboratory- spectrum analyzer- wave form generator- Data visualization and multiple locations:- Distributed monitoring and control-Vision and motion control. Case study related to automotive applications

TOTAL : 45 PERIODS

TEXT BOOKS:

REFERENCES:

GE7071 DISASTER MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:
- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

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 stake-
holders - 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.

TOTAL: 45 PERIODS

OUTCOMES:
The students will be able to
- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarios in the Indian context,
- Disaster damage assessment and management.

TEXT BOOKS:

REFERENCES
1. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005
OBJECTIVES:
- To learn about basis of nanomaterial science, preparation method, types and application

UNIT I
INTRODUCTION
Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II
GENERAL METHODS OF PREPARATION
Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III
NANOMATERIALS
Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, 92 Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO₂,MgO, ZrO₂, NiO, nanolumina, CaO, AgTiO₂, Ferrites, Nanoclays-functionlization and applications-Quantum wires, Quantum dotspreparation, properties and applications

UNIT IV
CHARACTERIZATION TECHNIQUES
X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS- Nanoindentation

UNIT V
APPLICATIONS

OUTCOMES:
Upon completing this course, the students
- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

TEXT BOOKS

REFERENCES
OBJECTIVES:
- To sensitize the Engineering students to various aspects of Human Rights.

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

OUTCOME:
- Engineering students will acquire the basic knowledge of human rights.

REFERENCES:
UNIT II TQM PRINCIPLES
Leadership--The Deming Philosophy, Quality council, Quality statements and Strategic planning--
Continuous process improvement –Juran Trilogy, PDSA cycle, 5s and Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating and Relationship development.

UNIT III TQM TOOLS & TECHNIQUES I
The seven traditional tools of quality – New management tools – Six-sigma Process Capability–

UNIT IV TQM TOOLS & TECHNIQUES II
Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM –
Concepts, improvement needs – Performance measures-- Cost of Quality - BPR.

UNIT V QUALITY MANAGEMENT SYSTEM
Documentation—Internal Audits—Registration—ENVIRONMENTAL MANAGEMENT SYSTEM:

TOTAL: 45 PERIODS

OUTCOMES:
- Ability to apply TQM concepts in a selected enterprise.
- Ability to apply TQM principles in a selected enterprise.
- Ability to apply the various tools and techniques of TQM.
- Ability to apply QMS and EMS in any organization.

TEXT BOOK:

REFERENCES:
OBJECTIVE:
- To introduce the various quantitative techniques and optimization techniques and to make the students apply these techniques for modeling and solving many engineering situations in general and manufacturing situations in particular.

UNIT I LINEAR PROGRAMMING

UNIT II REPLACEMENT MODELS AND GAME THEORY

UNIT III QUEUING MODELS AND SIMULATION

UNIT IV FORECASTING, SEQUENCING AND LINE BALANCING

UNIT V PROJECT NETWORK ANALYSIS AND DECISION TREE ANALYSIS
Network – CPM/PERT – Project time estimation – critical path – crashing of network, Decision tree analysis – applications

TOTAL: 60 PERIODS

OUTCOME:
- The students shall able to select and apply techniques for typical engineering and industrial situations.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To understand the global trends and development methodologies of various types of products and services
- 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
- To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them into design specification
- To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
- 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
- Introduction to Product Development Methodologies and Management: Overview of Products and Services - Types of Product Development - Overview of Product Development methodologies - Product Life Cycle - Product Development Planning and Management

UNIT II  REQUIREMENTS AND SYSTEM DESIGN
- Requirement Engineering: Types of Requirements - Requirement Engineering - traceability Matrix and Analysis - Requirement Management

UNIT III  DESIGN AND TESTING
- System Integration, Testing, Certification and Documentation

UNIT IV  SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT
- Introduction to Product verification processes and stages - Introduction to Product Validation processes and stages - Product Testing Standards and Certification - Product Documentation - Sustenance - Maintenance and Repair - Enhancements - Product EoL - Obsolescence Management - Configuration Management - EoL Disposal

UNIT V  BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY

TOTAL: 45 PERIODS

Attested

[Signature]

Director

Centre For Academic Courses
Anna University, Chennai -600 025
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.

REFERENCES: