PROGRAMME EDUCATIONAL OBJECTIVES (PEO)
1. Students will excel in their professional career in automobile industry and research with the highest professional and ethical standards in their activities by acquiring knowledge in basic engineering, mathematics, science and automobile engineering.
2. Students will exhibit professionalism, team work in their chosen profession and adapt to current trends, technologies and industrial scenarios by pursuing life-long learning.

PROGRAMME OUTCOMES (PO)
1. Graduates will demonstrate strong basics in Mathematics, Science and Engineering
2. Graduates will demonstrate the ability to design and conduct experiments, as well as to analyze and interpret data.
3. Graduates will demonstrate the ability to design a system, component or process to meet the desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.
4. Graduates will become familiar with modern engineering tools and analyse the problems within the domains of Automobile Engineering as members of multidisciplinary teams.
5. Graduates will acquire the capability to identify, formulate and solve complex engineering problems related to Automobile Engineering.
6. Graduates will demonstrate an understanding of professional and ethical responsibility with reference to their career in the field of Automobile Engineering.
7. Graduates will be able to communicate effectively both in verbal and non-verbal forms.
8. Graduates will be trained towards developing the impact of Automobile engineering in the global, economic environmental and societal contexts.
9. Graduates will be capable of understanding the value for life-long learning.
10. Graduates will demonstrate knowledge of contemporary issues focusing on the necessity to develop new material, design, and engineering practice in the field of Automobile Engineering.
11. Graduates will demonstrate the ability to use the techniques, skills and modern engineering tools necessary for engineering practice in the field of Automobile Engineering.
12. Graduates will have a firm scientific, technological and communication base that would help them either to find the desired placement or to become an entrepreneur and explore the knowledge in their field.
13. Graduates will be capable of doing higher studies and research in inter and multidisciplinary areas.

PEO / PO Mapping

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| Materials Science                         | ✓ | ✓ |   |   |   |   |   |   |   |   |   |   |   |
| Basic Electrical, Electronics and Instrumentation Engineering | ✓ | ✓ | ✓ | ✓ |   |   |   |   |   |   |   |   |   |
| Environmental Science and Engineering     |   |   | ✓ | ✓ | ✓ |   |   |   |   |   |   |   |   |
| Engineering Mechanics                     | ✓ | ✓ | ✓ | ✓ |   |   |   |   |   |   |   |   |   |
| Engineering Practices Laboratory          | ✓ | ✓ |   |   |   |   |   |   |   |   |   |   |   |
| Basic Electrical, Electronics and Instrumentation Engineering Laboratory | ✓ | ✓ |   |   |   |   |   |   |   |   |   |   |   |

<p>| Transforms and Partial Differential Equations | ✓ | ✓ |   |   |   |   |   |   |   |   |   |   |   |
| Engineering Thermodynamics                 | ✓ | ✓ | ✓ | ✓ |   |   |   |   |   |   |   |   |   |
| Strength of Materials for Mechanical Engineers | ✓ | ✓ |   |   |   |   |   |   |   |   |   |   |   |
| Spark Ignition Engines                      | ✓ |   |   |   |   |   |   |   |   |   |   |   |   |</p>
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**ANNA UNIVERSITY, CHENNAI**  
**AFFILIATED INSTITUTIONS**  
**B.E. AUTOMOBILE ENGINEERING**  
**REGULATIONS – 2017**  
**CHOICE BASED CREDIT SYSTEM**  
**I TO VIII SEMESTERS CURRICULA AND SYLLABI**

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#### SEMESTER VIII, ELECTIVE – V

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## EMPLOYABILITY ENHANCEMENT COURSES (EEC)

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## SUMMARY

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| 8     | Non Credit/ Mandatory |               |               |               |               |

Total: 185
OBJECTIVES:
- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop their listening skills, which will enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To help learners develop vocabulary of a general kind by developing their reading skills.

UNIT I  SHARING INFORMATION RELATED TO ONESELF/FAMILY & FRIENDS
12
Reading - short comprehension passages, practice in skimming-scanning and predicting

UNIT II  GENERAL READING AND FREE WRITING
12
Reading - comprehension-pre-reading-post reading - comprehension questions (multiple choice questions and/or short questions/open-ended questions)-inductive reading - short narratives and descriptions from newspapers including dialogues and conversations (also used as short Listening texts) - register - Writing - paragraph writing - topic sentence - main ideas - free writing, short narrative descriptions using some suggested vocabulary and structures - Listening - telephonic conversations. Speaking - sharing information of a personal kind - greeting - taking leave. Language development - prepositions, conjunctions. Vocabulary development - guessing meanings of words in context.

UNIT III  GRAMMAR AND LANGUAGE DEVELOPMENT
12
Reading - short texts and longer passages (close reading) Writing - understanding text structure - use of reference words and discourse markers - coherence-jumbled sentences Listening - listening to longer texts and filling up the table - product description - narratives from different sources. Speaking - asking about routine actions and expressing opinions. Language development - degrees of comparison - pronouns - direct vs indirect questions. Vocabulary development - single word substitutes - adverbs.

UNIT IV  READING AND LANGUAGE DEVELOPMENT
12
Reading - comprehension-reading longer texts - reading different types of texts - magazines Writing - letter writing, informal or personal letters - e-mails - conventions of personal email - Listening - listening to dialogues or conversations and completing exercises based on them. Speaking - speaking about oneself - speaking about one's friend. Language development - Tenses - simple present - simple past - present continuous and past continuous. Vocabulary development - synonyms - antonyms - phrasal verbs.

UNIT V  EXTENDED WRITING
12

TOTAL = 60 PERIODS
OUTCOMES:
At the end of the course, learners will be able to:
• Read articles of a general kind in magazines and newspapers.
• Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English.
• Comprehend conversations and short talks delivered in English
• Write short essays of a general kind and personal letters and emails in English.

TEXT BOOKS:

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

MA8151 ENGINEERING MATHEMATICS – I

OBJECTIVES:
The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus. The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modeling the engineering problems mathematically and obtaining solutions. This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

UNIT I DIFFERENTIAL CALCULUS 12
Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - 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
Double integrals – Change of order of integration – Double integrals in polar coordinates – Area
enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and
triple integrals.

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

TOTAL : 60 PERIODS

OUTCOMES :
After completing this course, students should demonstrate competency in the following skills:
• Use both the limit definition and rules of differentiation to differentiate functions.
• Apply differentiation to solve maxima and minima problems.
• Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of
  Calculus.
• Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in
  addition to change of order and change of variables.
• Evaluate integrals using techniques of integration, such as substitution, partial fractions and
  integration by parts.
• Determine convergence/divergence of improper integrals and evaluate convergent improper
  integrals.
• Apply various techniques in solving differential equations.

TEXT BOOKS :
   2014.
   2015. [For Units I & III - Sections 1.1, 2.2, 2.3, 2.5, 2.7(Tangents problems only), 2.8, 3.1 to 3.6,
   3.11, 4.1, 4.3, 5.1(Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 -
   7.4 and 7.8].

REFERENCES :
OBJECTIVES:

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

UNIT I  PROPERTIES OF MATTER


UNIT II  WAVES AND FIBER OPTICS


UNIT III  THERMAL PHYSICS


UNIT IV  QUANTUM PHYSICS


UNIT V  CRYSTAL PHYSICS

Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - crystal imperfections: point defects, line defects – Burger vectors, stacking faults – role of imperfections in plastic deformation - growth of single crystals: solution and melt growth techniques.

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of this course,

- the students will gain knowledge on the basics of properties of matter and its applications,
- the students will acquire knowledge on the concepts of waves and optical devices and their applications in fibre optics,
- the students will have adequate knowledge on the concepts of thermal properties of materials and their applications in expansion joints and heat exchangers,
- the students will get knowledge on advanced physics concepts of quantum theory and its applications in tunneling microscopes, and
- the students will understand the basics of crystals, their structures and different crystal growth techniques.
TEXT BOOKS:

REFERENCES:

CY8151 ENGINEERING CHEMISTRY L T P C
3 0 0 3

OBJECTIVES:
- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.

UNIT I WATER AND ITS TREATMENT

UNIT II SURFACE CHEMISTRY AND CATALYSIS

UNIT III ALLOYS AND PHASE RULE
UNIT IV  FUELS AND COMBUSTION


UNIT V  ENERGY SOURCES AND STORAGE DEVICES

Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant - breeder reactor - solar energy conversion - solar cells - wind energy. Batteries, fuel cells and supercapacitors: Types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells – H2-O2 fuel cell.

OUTCOMES:
- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

TEXT BOOKS:

REFERENCES:

GE8151  PROBLEM SOLVING AND PYTHON PROGRAMMING

OBJECTIVES:
- To know the basics of algorithmic problem solving
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures — lists, tuples, dictionaries.
- To do input/output with files in Python.
UNIT I ALGORITHMIC PROBLEM SOLVING  9
Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA, EXPRESSIONS, STATEMENTS  9
Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS  9
Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES  9
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram.

UNIT V FILES, MODULES, PACKAGES  9
Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

OUTCOMES:
Upon completion of the course, students will be able to
• Develop algorithmic solutions to simple computational problems
• Read, write, execute by hand simple Python programs.
• Structure simple Python programs for solving problems.
• Decompose a Python program into functions.
• Represent compound data using Python lists, tuples, dictionaries.
• Read and write data from/to files in Python Programs.

TOTAL : 45 PERIODS

TEXT BOOKS:

REFERENCES:
5. Charles Dierbach, “Introduction to Computer Science using Python: A Computational Problem-
6. Paul Gries, Jennifer Campbell and Jason Montojo, “Practical Programming: An Introduction to

GE8152 ENGINEERING GRAPHICS L T P C
2 0 4 4

OBJECTIVES:

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

CONCEPTS AND CONVENTIONS (Not for Examination) 1
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 FREEHAND SKETCHING 7+12
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- Freehand sketching of multiple views from pictorial views of
objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12
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 traces Projection of
planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object
method.

UNIT III PROJECTION OF SOLIDS 5+12
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is
inclined to one of the principal planes by rotating object method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF
SURFACES 5+12
Sectioning of above 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.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+12
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 - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual
ray method.

TOTAL: 90 PERIODS
OUTCOMES:
On successful completion of this course, the student will be able to
- familiarize with the fundamentals and standards of Engineering graphics
- perform freehand sketching of basic geometrical constructions and multiple views of objects.
- project orthographic projections of lines and plane surfaces.
- draw projections and solids and development of surfaces.
- visualize and to project isometric and perspective sections of simple solids.

TEXT BOOKS:

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.
OBJECTIVES:
- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.

LIST OF PROGRAMS
1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton’s method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

PLATFORM NEEDED
Python 3 interpreter for Windows/Linux

COURSE OUTCOMES:
Upon completion of the course, students will be able to
- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

TOTAL :60 PERIODS
OBJECTIVES:
- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids.

LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any 5 Experiments)
1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young’s modulus by non-uniform bending method
3. (a) Determination of wavelength, and particle size using Laser
   (b) Determination of acceptance angle in an optical fiber.
5. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6. Determination of wavelength of mercury spectrum – spectrometer grating
7. Determination of band gap of a semiconductor
8. Determination of thickness of a thin wire – Air wedge method

TOTAL: 30 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to
- apply principles of elasticity, optics and thermal properties for engineering applications.

CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

OBJECTIVES:
- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by viscometry.

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.
16. Conductometric titration of strong acid vs strong base.

TOTAL: 30 PERIODS
OUTCOMES:
- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

TEXT BOOK:

OBJECTIVES:
The Course prepares second semester engineering and Technology students to:
- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations, participate in group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialisation.

UNIT I  INTRODUCTION TECHNICAL ENGLISH 12
Listening- Listening to talks mostly of a scientific/technical nature and completing information-gap exercises-
Speaking – Asking for and giving directions-
Reading – reading short technical texts from journals- newspapers -
Writing- purpose statements – extended definitions – issue- writing instructions – checklists-recommendations-
Vocabulary Development- technical vocabulary
Language Development –subject verb agreement - compound words.

UNIT II  READING AND STUDY SKILLS 12
Listening- Listening to longer technical talks and completing exercises based on them-
Speaking – describing a process-
Reading – reading longer technical texts- identifying the various transitions in a text- paragraphing-
Writing- interpreting charts, graphs- Vocabulary Development-vocabulary used in formal letters/emails and reports
Language Development- impersonal passive voice, numerical adjectives.

UNIT III  TECHNICAL WRITING AND GRAMMAR 12
Listening- Listening to classroom lectures/ talks on engineering/technology -
Speaking – introduction to technical presentations-
Reading – longer texts both general and technical, practice in speed reading;
Writing-Describing a process, use of sequence words-
Vocabulary Development- sequence words-
Language Development- misspelled words.

UNIT IV  REPORT WRITING 12
Listening- Listening to documentaries and making notes.
Speaking – mechanics of presentations-
Reading – reading for detailed comprehension-
Writing- email etiquette- job application – cover letter-
Résumé preparation( via email and hard copy)-
analytical essays and issue based essays-
Vocabulary Development- finding suitable synonyms-paraphrasing-
Language Development-
clauses- if conditionals.
UNIT V GROUP DISCUSSION AND JOB APPLICATIONS

Listening- TED/Ink talks; Speaking –participating in a group discussion -Reading– reading and understanding technical articles Writing– Writing reports- minutes of a meeting- accident and survey-
Vocabulary Development- verbal analogies Language Development- reported speech

TOTAL : 60 PERIODS

OUTCOMES: At the end of the course learners will be able to:

- Read technical texts and write area- specific texts effortlessly.
- Listen and comprehend lectures and talks in their area of specialisation successfully.
- Speak appropriately and effectively in varied formal and informal contexts.
- Write reports and winning job applications.

TEXT BOOKS:


REFERENCES


Students can be asked to read Tagore, Chetan Bhagat and for supplementary reading.

MA8251 ENGINEERING MATHEMATICS – II

OBJECTIVES :
This course is designed to cover topics such as Matrix Algebra, Vector Calculus, Complex Analysis and Laplace Transform. Matrix Algebra is one of the powerful tools to handle practical problems arising in the field of engineering. Vector calculus can be widely used for modelling the various laws of physics. The various methods of complex analysis and Laplace transforms can be used for efficiently solving the problems that occur in various branches of engineering disciplines.

UNIT I MATRICES


UNIT II VECTOR CALCULUS

Gradient and directional derivative – Divergence and curl - Vector identities – 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 FUNCTIONS  12
Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions \( w = z + c, \frac{z}{z}, z^2 \) - Bilinear transformation.

UNIT IV  COMPLEX INTEGRATION  12

UNIT V  LAPLACE TRANSFORMS  12

TOTAL: 60 PERIODS

OUTCOMES:
After successfully completing the course, the student will have a good understanding of the following topics and their applications:

- Eigen values and eigenvectors, diagonalization of a matrix, Symmetric matrices, Positive definite matrices and similar matrices.
- Gradient, divergence and curl of a vector point function and related identities.
- Evaluation of line, surface and volume integrals using Gauss, Stokes and Green’s theorems and their verification.
- Analytic functions, conformal mapping and complex integration.
- Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.

TEXT BOOKS:

REFERENCES:
MATERIALS SCIENCE

PH8251

L T P C
3 0 0 3

OBJECTIVES:
- To introduce the essential principles of materials science for mechanical and related engineering applications.

UNIT I PHASE DIAGRAMS
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

UNIT III MECHANICAL PROPERTIES

UNIT IV MAGNETIC, DIELECTRIC AND SUPERCONDUCTING MATERIALS

UNIT V NEW MATERIALS

TOTAL : 45 PERIODS

OUTCOMES:
Upon completion of this course,
- the students will have knowledge on the various phase diagrams and their applications
- the students will acquire knowledge on Fe-Fe₃C phase diagram, various microstructures and alloys
- the students will get knowledge on mechanical properties of materials and their measurement
- the students will gain knowledge on magnetic, dielectric and superconducting properties of materials
- the students will understand the basics of ceramics, composites and nanomaterials.
TEXT BOOKS:

REFERENCES

BE8253 BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION ENGINEERING  
L T P C  
3 0 0 3  
OBJECTIVES:  
To impart knowledge on  
• Electric circuit laws, single and three phase circuits and wiring  
• Working principles of Electrical Machines  
• Working principle of Various electronic devices and measuring instruments

UNIT I ELECTRICAL CIRCUITS  

UNIT II AC CIRCUITS  
Introduction to AC circuits – waveforms and RMS value – power and power factor, single phase and three-phase balanced circuits – Three phase loads - housing wiring, industrial wiring, materials of wiring

UNIT III ELECTRICAL MACHINES  
Principles of operation and characteristics of ; DC machines, Transformers (single and three phase ) ,Synchronous machines , three phase and single phase induction motors.

UNIT IV ELECTRONIC DEVICES & CIRCUITS  

UNIT V MEASUREMENTS & INSTRUMENTATION  
Introduction to transducers - Classification of Transducers: Resistive, Inductive, Capacitive, Thermoelectric, piezoelectric, photoelectric, Hall effect and Mechanical - ,Classification of instruments - Types of indicating Instruments - multimeters –Oscilloscopes- – three-phase power measurements–instrument transformers (CT and PT )

TOTAL : 45 PERIODS
OUTCOMES:
Ability to
- Understand electric circuits and working principles of electrical machines
- Understand the concepts of various electronic devices
- Choose appropriate instruments for electrical measurement for a specific application

TEXT BOOKS

REFERENCES

GE8291 ENVIRONMENTAL SCIENCE AND ENGINEERING

OBJECTIVES:
- To study the nature and 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 – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-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

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 – solid 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

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


UNIT V HUMAN POPULATION AND THE ENVIRONMENT


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 infanl 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:

GE8292 ENGENEERING MECHANICS
L T P C
3 2 0 4

OBJECTIVES:
To develop capacity to predict the effect of force and motion in the course of carrying out the
design functions of engineering.

UNIT I STATIC OF PARTICLES 9+6
Introduction – Units and Dimensions – Laws of Mechanics – Lami’s theorem, Parallelogram and
triangular Law of forces – Vectorial representation of forces – Vector operations of forces -additions,
subtraction, dot product, cross product – Coplanar Forces – rectangular components – Equilibrium of
a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces –
Principle of transmissibility.

UNIT II EQUILIBRIUM OF RIGID BODIES 9+6
Free body diagram – Types of supports – Action and reaction forces – stable equilibrium – Moments
and Couples – Moment of a force about a point and about an axis – Vectorial representation of
moments and couples – Scalar components of a moment – Varignon’s theorem – Single equivalent
force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

UNIT III PROPERTIES OF SURFACES AND SOLIDS 9+6
Centroids and centre of mass – Centroids of lines and areas - Rectangular, circular, triangular
areas by integration – T section, I section, Angle section, Hollow section by using standard formula –
Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular
areas by integration – T section, I section, Angle section, Hollow section by using standard formula –
Parallel axis theorem and perpendicular axis theorem – Principal moments of inertia and plane areas –
Principal axes of inertia-Mass moment of inertia –moment of inertia for prismatic, cylindrical and
spherical solids from first principle – Relation to area moments of inertia.

UNIT IV DYNAMICS OF PARTICLES 9+6
Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion -
bodies.

UNIT V FRICTION AND RIGID BODY DYNAMICS 9+6
Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction –
Wedge priction-. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and
acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

TOTAL : 45+30=75 PERIODS
OUTCOMES:
On successful completion of this course, the student will be able to
• illustrate the vectorial and scalar representation of forces and moments
• analyse the rigid body in equilibrium
• evaluate the properties of surfaces and solids
• calculate dynamic forces exerted in rigid body
• determine the friction and the effects by the laws of friction

TEXT BOOKS:

REFERENCES:

GE8261 ENGINEERING PRACTICES LABORATORY

OBJECTIVES:
To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE

Buildings:
(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:
(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
(b) Study of pipe connections requirements for pumps and turbines.
(c) Preparation of plumbing line sketches for water supply and sewage works.
(d) Hands-on-exercise:
   Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
(e) Demonstration of plumbing requirements of high-rise buildings.
Carpentry using Power Tools only:
   (a) Study of the joints in roofs, doors, windows and furniture.
   (b) Hands-on-exercise:
       Wood work, joints by sawing, planing and cutting.

II               MECHANICAL ENGINEERING PRACTICE       18
Welding:
   (a) Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.
   (b) Gas welding practice
Basic Machining:
   (a) Simple Turning and Taper turning
   (b) Drilling Practice
Sheet Metal Work:
   (a) Forming & Bending:
   (b) Model making – Trays and funnels.
   (c) Different type of joints.
Machine assembly practice:
   (a) Study of centrifugal pump
   (b) Study of air conditioner
Demonstration on:
   (a) Smithy operations, upsetting, swaging, setting down and bending. Example –
       Exercise – Production of hexagonal headed bolt.
   (b) Foundry operations like mould preparation for gear and step cone pulley.
   (c) Fitting – Exercises – Preparation of square fitting and V – fitting models.

GROUP B (ELECTRICAL & ELECTRONICS)

III              ELECTRICAL ENGINEERING PRACTICE       13
1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
5. Measurement of energy using single phase energy meter.

IV               ELECTRONICS ENGINEERING PRACTICE       16
1. Study of Electronic components and equipments – Resistor, colour coding measurement
   of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EX-OR and NOT.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

TOTAL: 60 PERIODS

OUTCOMES:
On successful completion of this course, the student will be able to
   • fabricate carpentry components and pipe connections including plumbing works.
   • use welding equipments to join the structures.
- Carry out the basic machining operations
- Make the models using sheet metal works
- Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundry and fittings
- Carry out basic home electrical works and appliances
- Measure the electrical quantities
- Elaborate on the components, gates, soldering practices.

### LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

#### CIVIL

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings.  
   - 15 Sets.
2. Carpentry vice (fitted to work bench)  
   - 15 Nos.
3. Standard woodworking tools  
   - 15 Sets.
4. Models of industrial trusses, door joints, furniture joints  
   - 5 each
5. Power Tools:  
   - (a) Rotary Hammer  
     - 2 Nos
   - (b) Demolition Hammer  
     - 2 Nos
   - (c) Circular Saw  
     - 2 Nos
   - (d) Planer  
     - 2 Nos
   - (e) Hand Drilling Machine  
     - 2 Nos
   - (f) Jigsaw  
     - 2 Nos

#### MECHANICAL

1. Arc welding transformer with cables and holders  
   - 5 Nos.
2. Welding booth with exhaust facility  
   - 5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc.  
   - 5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.  
   - 2 Nos.
5. Centre lathe  
   - 2 Nos.
6. Hearth furnace, anvil and smithy tools  
   - 2 Sets.
7. Moulding table, foundry tools  
   - 2 Sets.
8. Power Tool: Angle Grinder  
   - 2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner  
   - One each.

#### ELECTRICAL

1. Assorted electrical components for house wiring  
   - 15 Sets
2. Electrical measuring instruments  
   - 10 Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp  
   - 1 each
4. Megger (250V/500V)  
   - 1 No.
5. Power Tools:  
   - (a) Range Finder  
     - 2 Nos
   - (b) Digital Live-wire detector  
     - 2 Nos

#### ELECTRONICS

1. Soldering guns  
   - 10 Nos.
2. Assorted electronic components for making circuits  
   - 50 Nos.
3. Small PCBs  
   - 10 Nos.
4. Multimeters  
   - 10 Nos.
5. Study purpose items: Telephone, FM radio, low-voltage power supply
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 generator
2. Load test on Single phase Transformer
3. Load test on Induction motor
4. Verification of Circuit Laws
5. Verification of Circuit Theorems
6. Measurement of three phase power
7. Load test on DC shunt motor.
8. Diode based application circuits
9. Transistor based application circuits
10. Study of CRO and measurement of AC signals
11. Characteristics of LVDT
12. Calibration of Rotometer
13. RTD and Thermistor

Minimum of 10 Experiments to be carried out :-

TOTAL: 60 PERIODS

OUTCOMES:
- Ability to determine the speed characteristic of different electrical machines
- Ability to design simple circuits involving diodes and transistors
- Ability to use operational amplifiers

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>D. C. Motor Generator Set</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>D.C. Shunt Motor</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Single Phase Transformer</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Single Phase Induction Motor</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>Ammeter A.C and D.C</td>
<td>20</td>
</tr>
<tr>
<td>6</td>
<td>Voltmeters A.C and D.C</td>
<td>20</td>
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<tr>
<td>7</td>
<td>Watt meters LPF and UPF</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>Resistors &amp; Breadboards</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>Cathode Ray Oscilloscopes</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>Dual Regulated power supplies</td>
<td>6</td>
</tr>
<tr>
<td>11</td>
<td>A.C. Signal Generators</td>
<td>4</td>
</tr>
<tr>
<td>12</td>
<td>Transistors (BJT, JFET)</td>
<td>-</td>
</tr>
</tbody>
</table>
OBJECTIVES:
- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I  PARTIAL DIFFERENTIAL EQUATIONS  12
Formation of partial differential equations – Singular integrals - Solutions of standard types of first order partial differential equations - Lagrange’s linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II  FOURIER SERIES  12

UNIT III  APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS  12
Classification of PDE – Method of separation of variables - Fourier Series Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction.

UNIT IV  FOURIER TRANSFORMS  12

UNIT V  Z-TRANSFORMS AND DIFFERENCE EQUATIONS  12

TOTAL : 60 PERIODS

OUTCOMES:
Upon successful completion of the course, students should be able to:
- Understand how to solve the given standard partial differential equations.
- Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
- Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
- Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
- Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.
TEXT BOOKS:

REFERENCES:

ME8391 ENGINEERING THERMODYNAMICS

OBJECTIVE:
- To familiarize the students to understand the fundamentals of thermodynamics and to perform thermal analysis on their behavior and performance.
  (Use of Standard and approved Steam Table, Mollier Chart, Compressibility Chart and Psychrometric Chart permitted)

UNIT I BASIC CONCEPTS AND FIRST LAW

UNIT II SECOND LAW AND AVAILABILITY ANALYSIS

UNIT III PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE
UNIT IV IDEAL AND REAL GASES, THERMODYNAMIC RELATIONS 9 + 6

Properties of Ideal gas- Ideal and real gas comparison- Equations of state for ideal and real gases-
Reduced properties. Compressibility factor-.Principle of Corresponding states. -Generalised
Compressibility Chart and its use-. Maxwell relations, Tds Equations, Difference and ratio of
heat capacities, Energy equation, Joule-Thomson Coefficient, Clausius Clapeyron equation,
Phase Change Processes. Simple Calculations.

UNIT V GAS MIXTURES AND PSYCHROMETRY 9 + 6

Mole and Mass fraction, Dalton’s and Amagat's Law. Properties of gas mixture – Molar mass, gas
constant, density, change in internal energy, enthalpy, entropy and Gibbs function. Psychrometric
properties, Psychrometric charts. Property calculations of air vapour mixtures by using chart and
expressions. Psychrometric process – adiabatic saturation, sensible heating and cooling,
humidification, dehumidification, evaporative cooling and adiabatic mixing. Simple Applications

TOTAL : 75 PERIODS

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

CO1 Apply the first law of thermodynamics for simple open and closed systems under steady
and unsteady conditions.
CO2 Apply second law of thermodynamics to open and closed systems and calculate entropy
and availability.
CO3 Apply Rankine cycle to steam power plant and compare few cycle improvement methods
CO4 Derive simple thermodynamic relations of ideal and real gases
CO5 Calculate the properties of gas mixtures and moist air and its use in psychometric
processes

TEXT BOOKS :

REFERENCES:
   Edition.

CE8395 STRENGTH OF MATERIALS FOR
MECHANICAL ENGINEERS L T P C

OBJECTIVES:

• To understand the concepts of stress, strain, principal stresses and principal planes.
• To study the concept of shearing force and bending moment due to external loads in
determinate beams and their effect on stresses.
• To determine stresses and deformation in circular shafts and helical spring due to torsion.
• To compute slopes and deflections in determinate beams by various methods.
• To study the stresses and deformations induced in thin and thick shells.
UNIT I  STRESS, STRAIN AND DEFORMATION OF SOLIDS  9
Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of
simple and compound bars – Thermal stresses – Elastic constants – Volumetric strains – Stresses
on inclined planes – principal stresses and principal planes – Mohr’s circle of stress.

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

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

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

UNIT V  THIN CYLINDERS, SPHERES AND THICK CYLINDERS  9
Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses
and deformation in thin and thick cylinders – spherical shells subjected to internal pressure –
Deformation in spherical shells – Lame’s theorem.

TOTAL: 45 PERIODS

OUTCOMES
Students will be able to
- Understand the concepts of stress and strain in simple and compound bars, the importance of
  principal stresses and principal planes.
- Understand the load transferring mechanism in beams and stress distribution due to shearing
  force and bending moment.
- Apply basic equation of simple torsion in designing of shafts and helical spring
- Calculate the slope and deflection in beams using different methods.
- Analyze and design thin and thick shells for the applied internal and external pressures

TEXT BOOKS:

REFERENCES:
   Series, 2010.
AIM

- This course aims to impart the knowledge about spark ignition engine like fuel supply and distribution, ignition, combustion and emission.

OBJECTIVES

- To impart knowledge on Gasoline fuel injection system, requirement, Components and types of ignition and combustion system.
- To impart knowledge on various Emissions and alternative fuels for S.I. Engines

UNIT I GASOLINE- AIR MIXTURE REQUIREMENT AND SUPPLY SYSTEM
Gasoline - air mixtures. Mixture requirements - Mixture formation - Carburettor, Choke, Carburettor systems for emission control- Secondary Air Injection.

UNIT II GASOLINE INJECTION AND IGNITION SYSTEMS

UNIT III COMBUSTION IN S.I. ENGINES
Stages of combustion, normal and abnormal combustion, knocking, Variables affecting Knock,Features and design consideration of combustion chambers. Flame structure and speed, Cyclic variations, Lean burn combustion, Stratified charge combustion systems. Heat release correlations.

UNIT IV LIQUID AND GASEOUS FUELS FOR S.I. ENGINES

Gaseous Fuel Utilisation of Hydrogen, Compressed Natural gas, Liquefied Petroleum gas, and Bio gas in SI engines.

UNIT V EMISSIONS FROM S.I ENGINES

OUTCOME

- On successful completion of this course the student will be able to understand the overall concepts of S.I engines.

TEXT BOOKS:

REFERENCES
OBJECTIVE:
- The automobile components such as piston, connecting rod, crankshaft, engine block, front axle, frame, body etc., are manufactured by various types of production processes involving casting, welding, machining, metal forming, power metallurgy etc. Hence B.E. Automobile Engineering students must study this course Production Technology.

UNIT I CASTERGING 8
Casting types, procedure to make sand mould, types of core making, moulding tools, machine moulding, special moulding processes – CO2 moulding; shell moulding, investment moulding, permanent mould casting, pressure die casting, centrifugal casting, continuous casting, casting defects.

UNIT II WELDING 8

UNIT III MACHINING 13
General principles (with schematic diagrams only) of working and commonly performed operations in the following machines: Lathe, Shaper, Planer, Horizontal milling machine, Universal drilling machine, Cylindrical grinding machine, Capstan and Turret lathe. Basics of CNC machines. General principles and applications of the following processes: Abrasive jet machining, Ultrasonic machining, Electric discharge machining, Electro chemical machining, Plasma arc machining, Electron beam machining and Laser beam machining.

UNIT IV FORMING AND SHAPING OF PLASTICS 7

UNIT V METAL FORMING AND POWDER METALLURGY 9
Principles and applications of the following processes: Forging, Rolling, Extrusion, Wire drawing and Spinning, Powder metallurgy – Principal steps involved advantages, disadvantages and limitations of powder metallurgy.

TOTAL: 45 PERIODS

OUTCOME:
- The Students can able to use different manufacturing process and use this in industry for component production

TEXT BOOKS
REFERENCES

CE8394 FLUID MECHANICS AND MACHINERY

OBJECTIVES:
• The properties of fluids and concept of control volume are studied
• The applications of the conservation laws to flow through pipes are studied.
• To understand the importance of dimensional analysis
• To understand the importance of various types of flow in pumps.
• To understand the importance of various types of flow in turbines.

UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS 12
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 12

UNIT III DIMENSIONAL ANALYSIS 12
Need for dimensional analysis – methods of dimensional analysis – Similitude – types of similitude - Dimensionless parameters- application of dimensionless parameters – Model analysis.

UNIT IV PUMPS 12

UNIT V TURBINES 12

TOTAL: 60 PERIODS
OUTCOMES:
Upon completion of this course, the students will be able to
- Apply mathematical knowledge to predict the properties and characteristics of a fluid.
- Can analyse and calculate major and minor losses associated with pipe flow in piping networks.
- Can mathematically predict the nature of physical quantities
- Can critically analyse the performance of pumps
- Can critically analyse the performance of turbines.

TEXT BOOK:

REFERENCES:

CE8381           STRENGTH OF MATERIALS AND FLUID MECHANICS L T P C
AND MACHINERY LABORATORY  0 0 4 2

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

STRENGTH OF MATERIALS
LIST OF EXPERIMENTS
1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinnell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
10. Tempering- Improvement Mechanical properties Comparison
    (i) Unhardened specimen
    (ii) Quenched Specimen and
    (iii) Quenched and tempered specimen.
11. Microscopic Examination of
    (i) Hardened samples and
    (ii) Hardened and tempered samples.
OUTCOME:
- Ability to perform Tension, Torsion, Hardness, Compression, and Deformation test on Solid materials.

**LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Universal Tensile Testing machine with double 1 shear attachment – 40 Ton Capacity</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Torsion Testing Machine (60 NM Capacity)</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Impact Testing Machine (300 J Capacity)</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Brinell Hardness Testing Machine</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Rockwell Hardness Testing Machine</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Spring Testing Machine for tensile and compressive loads (2500 N)</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Metallurgical Microscopes</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>Muffle Furnace (800 C)</td>
<td>1</td>
</tr>
</tbody>
</table>

**FLUID MECHANICS AND MACHINES LABORATORY**

**LIST OF EXPERIMENTS**

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump/ submersible pump.
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

**TOTAL: 60 PERIODS**

**OUTCOMES:**
Upon completion of this course, the students will be able to:
- Perform Tension, Torsion, Hardness, Compression, and Deformation test on Solid materials.
- Use the measurement equipments for flow measurement.
- Perform test on different fluid machinery.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
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<tbody>
<tr>
<td>1</td>
<td>Orifice meter setup</td>
<td>1</td>
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<tr>
<td>2</td>
<td>Venturi meter setup</td>
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<tr>
<td>3</td>
<td>Rotameter setup</td>
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<tr>
<td>4</td>
<td>Pipe Flow analysis setup</td>
<td>1</td>
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<tr>
<td>5</td>
<td>Centrifugal pump/submersible pump setup</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Reciprocating pump setup</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Gear pump setup</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Pelton wheel setup</td>
<td>1</td>
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<tr>
<td>9</td>
<td>Francis turbine setup</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>Kaplan turbine setup</td>
<td>1</td>
</tr>
</tbody>
</table>
OBJECTIVES:
- To make the students understand and interpret drawings of machine components
- To prepare assembly drawings both manually and using standard CAD packages
- To familiarize the students with Indian Standards on drawing practices and standard components
- To gain practical experience in handling 2D drafting and 3D modeling software systems.

UNIT I DRAWING STANDARDS & FITS AND TOLERANCES

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

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

TOTAL:60 PERIODS

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

OUTCOMES:
Upon the completion of this course the students will be able to
CO1 Follow the drawing standards, Fits and Tolerances
CO2 Re-create part drawings, sectional views and assembly drawings as per standards

TEXT BOOK:

REFERENCES:
OBJECTIVES:
The Course will enable learners to:
• Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
• Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
• improve general and academic listening skills
• Make effective presentations.

UNIT I
Listening as a key skill- its importance- speaking - give personal information - ask for personal information - express ability - enquire about ability - ask for clarification Improving pronunciation - pronunciation basics taking lecture notes - preparing to listen to a lecture - articulate a complete idea as opposed to producing fragmented utterances.

UNIT II
Listen to a process information- give information, as part of a simple explanation - conversation starters: small talk - stressing syllables and speaking clearly - intonation patterns - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

UNIT III
Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk - greet - respond to greetings - describe health and symptoms - invite and offer - accept - decline - take leave - listen for and follow the gist- listen for detail

UNIT IV
Being an active listener: giving verbal and non-verbal feedback - participating in a group discussion - summarizing academic readings and lectures conversational speech listening to and participating in conversations - persuade.

UNIT V
Formal and informal talk - listen to follow and respond to explanations, directions and instructions in academic and business contexts - strategies for presentations and interactive communication - group/pair presentations - negotiate disagreement in group work.

OUTCOMES: At the end of the course Learners will be able to:
• Listen and respond appropriately.
• Participate in group discussions
• Make effective presentations
• Participate confidently and appropriately in conversations both formal and informal

TEXT BOOKS:
REFERENCES

MA8452 STATISTICS AND NUMERICAL METHODS

OBJECTIVES:
- This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT I TESTING OF HYPOTHESIS
Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means - Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

UNIT II DESIGN OF EXPERIMENTS
One way and two way classifications - Completely randomized design – Randomized block design – Latin square design - $2^2$ factorial design.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION
Lagrange’s and Newton’s divided difference interpolations – Newton’s forward and backward difference interpolation – Approximation of derivates using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson’s 1/3 rules.
UNIT V  NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS  12

TOTAL : 60 PERIODS

OUTCOMES :
Upon successful completion of the course, students will be able to:
• Apply the concept of testing of hypothesis for small and large samples in real life problems.
• Apply the basic concepts of classifications of design of experiments in the field of agriculture.
• Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.
• Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
• Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

TEXT BOOKS :

REFERENCES :

AT8401 COMPRESSION IGNITION ENGINES  L T P C
3 0 0 3

OBJECTIVES:
• To Understand the intake, exhaust, fuel injection system and combustion in diesel engines
• To impart knowledge on various alternative fuels for C.I Engines
• To identify the nature of pollutant formation and control in C I engines.

UNIT I  INTAKE AND EXHAUST MANIFOLDS  8
Intake system components, Air filter, Intake manifold, Turbochargers, Exhaust manifold and exhaust pipe, Exhaust mufflers and Resonators.

UNIT II  DIESEL INJECTION SYSTEMS  9
Direct and indirect injection systems, Inline injection pump, Rotary Pump and Injector– Construction and principle of operation, Electronic control, Common rail and unit injector systems – Construction and principle of operation.
UNIT III  COMBUSTION IN C.I. ENGINES

Stages of combustion, vapourisation of fuel droplets and spray formation, air motion, swirl measurement, knock and engine variables, Features and design considerations of combustion chambers, delay period correlations, heat release correlations, Influence of the injection system on combustion.

UNIT IV  LIQUID AND GASEOUS FUELS FOR C.I. ENGINES


UNIT V  EMISSIONS FORMATION AND CONTROL TECHNIQUES


OUTCOME:

• Upon completion of this course, the students can be able to understand the various systems and its operations, combustion, formation of emissions and alternative fuels used in CI engines.

TEXT BOOKS:


REFERENCES:


ME8491  ENGINEERING METALLURGY  

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<tr>
<th>L</th>
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<td>3</td>
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</tbody>
</table>

OBJECTIVE:

• To impart knowledge on the structure, properties, treatment, testing and applications of metals and non-metallic materials so as to identify and select suitable materials for various engineering applications.

UNIT I  ALLOYS AND PHASE DIAGRAMS

UNIT II HEAT TREATMENT

UNIT III FERROUS AND NON-FERROUS METALS

UNIT IV NON-METALLIC MATERIALS
Polymers – types of polymer, commodity and engineering polymers – Properties and applications of various thermosetting and thermoplastic polymers (PP, PS, PVC, PMMA, PET,PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE, Polymers – Urea and Phenol formaldehydes)- Engineering Ceramics – Properties and applications of Al2O3, SiC, Si3N4, PSZ and SIALON –Composites-Classifications-Metal Matrix and FRP - Applications of Composites.

UNIT V MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS

TOTAL: 45 PERIODS

OUTCOMES
Upon the completion of this course the students will be able to
CO1 Explain alloys and phase diagram, Iron-Iron carbide diagram and steel classification.
CO2 Explain isothermal transformation, continuous cooling diagrams and different heat treatment processes.
CO3 Summarize the mechanism of plastic deformation and testing mechanical properties.
CO4 Clarify the effect of alloying elements on ferrous and non-ferrous metals.
CO5 Differentiate different non-metallic materials.

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
- To enable the students to understand the fundamental concepts of Semi Conductors, Transistors, Rectifiers, Digital Electronics and 8085 Microprocessors

UNIT I SEMICONDUCTORS AND RECTIFIERS 9
Classification of solids based on energy band theory-Intrinsic semiconductors-Extrinsic semiconductors-P type and N type-PN junction-Zenor effect-Zenor diode characteristics- Half wave and full wave rectifiers -Voltage regulation

UNIT II TRANSISTORS AND AMPLIFIERS 12
Bipolar junction transistor- CB, CE, CC configuration and characteristics-Biasing circuits- Class A, B and C amplifiers- Field effect transistor-Configuration and characteristic of FET amplifier-SCR, Diac, Triac, UJT-Characteristics and simple applications-Switching transistors-Concept of feedback-Negative feedback-Application in temperature and motor speed control.

UNIT III DIGITAL ELECTRONICS 9
Binary number system - AND, OR, NOT, NAND, NOR circuits-Boolean algebra- Exclusive OR gate - Flip flops-Half and full adders-Registers-Counters-A/D and D/A conversion.

UNIT IV 8085 MICROPROCESSOR 9
Block diagram of microcomputer-Architecture of 8085-Pin configuration-Instruction set- Addressing modes-Simple programs using arithmetic and logical operations.

UNIT V INTERFACING AND APPLICATIONS OF MICROPROCESSOR 6
Basic interfacing concepts - Interfacing of Input and Output devices-Applications of microprocessor Temperature control, Stepper motor control, traffic light control.

TOTAL: 45 PERIODS

OUTCOMES:
- Ability to perform performing on 8085 Microprocessor to control devices
- Ability to use microcontroller and programming

TEXT BOOKS

REFERENCES
OBJECTIVE:

- Study of the Constructional details and Theory of important drive line, Structural, Steering, Braking and Suspension Systems of Automobiles. Problem–Solving in Steering Mechanism, Propeller Shaft, Braking and Suspension Systems are to be done.

UNIT I LAYOUT, FRAME, FRONT AXLE AND STEERING SYSTEM 9

UNIT II DRIVE LINE, FINAL DRIVE AND DIFFERENTIAL 9

UNIT III REAR AXLES, WHEELS, RIMS AND TYRES 9

UNIT IV SUSPENSION SYSTEM 9

UNIT V BRAKE SYSTEMS 9

TOTAL : 45 PERIODS

OUTCOME:

- The students will understand the constructional, working principle of various sub system of an automobile.

TEXT BOOKS

REFERENCES
OBJECTIVES:
- To understand the principles in the formation of mechanisms and their kinematics.
- To understand the effect of friction in different machine elements.
- To understand the importance of balancing and vibration.

UNIT I  KINEMATICS OF MACHINES  9

UNIT II  GEARS and GEAR TRAINS  9

UNIT III  FRICTION  9
Types of friction – Friction Drives -friction in screw threads – bearings – Friction clutches – Belt drives

UNIT IV  BALANCING AND MECHANISM FOR CONTROL  9
Static and Dynamic balancing – Balancing of revolving and reciprocating masses – Balancing machines -Balancing a single cylinder engine – Balancing of Multi-cylinder inline, V-engines – Partial balancing in engines- Governors and Gyroscopic effects..

UNIT V  VIBRATION  9

OUTCOMES:
Student will be able to
- Understand the principles in the formation of mechanisms and their kinematics.
- Understand the construction features of Gears and Gear Trains.
- Understand the effect of friction in different machine elements.
- Understand the importance of balancing.
- Understand the importance of Governors and Gyroscopic effects.
- Understand the importance of vibration.

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
- To train the Students to know the details of different components, dismantling and assembling them.

LIST OF EXPERIMENTS
1. Dismantling and study of Multi-cylinder Petrol Engine
2. Assembling of Multi-cylinder Petrol Engine
3. Dismantling and study of Multi-cylinder Diesel Engine
4. Assembling of Multi-cylinder Diesel Engine
5. Study of petrol engine fuel system
6. Study of diesel engine fuel system
7. Study and measurement of light and heavy commercial Vehicle Frame
8. Study, dismantling and assembling of front and rear Axles
9. Study, dismantling and assembling of differential
10. Study, dismantling and assembling of Clutch
11. Study, dismantling and assembling of Gear Box
12. Study of steering system

TOTAL: 60 PERIODS

OUTCOME:
- Ability to dismantle and assemble the automobile components

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S. No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Multi Cylinder Petrol Engine</td>
<td>2 No.</td>
</tr>
<tr>
<td>2</td>
<td>Multi Cylinder Diesel Engine</td>
<td>2 No.</td>
</tr>
<tr>
<td>3</td>
<td>Petrol and Diesel fuel systems</td>
<td>2 No. Each</td>
</tr>
<tr>
<td>4</td>
<td>Heavy duty vehicle chassis frame</td>
<td>1 No.</td>
</tr>
<tr>
<td>5</td>
<td>Light duty vehicle chassis frame</td>
<td>1 No.</td>
</tr>
<tr>
<td>6</td>
<td>Front axle</td>
<td>2 No.</td>
</tr>
<tr>
<td>7</td>
<td>Rear axle</td>
<td>2 No.</td>
</tr>
<tr>
<td>8</td>
<td>Differential</td>
<td>2 No.</td>
</tr>
<tr>
<td>9</td>
<td>Clutch and Gear box (light duty, heavy duty)</td>
<td>2 No. Each</td>
</tr>
<tr>
<td>10</td>
<td>Steering systems with different gearboxes</td>
<td>4 No.</td>
</tr>
</tbody>
</table>
OBJECTIVE:
- To supplement the theoretical knowledge with practical use of electronic components and programming and control using micro-processors

LIST OF EXPERIMENTS

ELECTRONICS
1. VI Characteristics of PN Junction Diode
2. VI Characteristics of Zener Diode
3. Characteristics of CE Transistor
4. Characteristics of JFET
5. Characteristics of Uni Junction Transistor
6. RC or Wein Bridge Oscillator
7. Study of Logic Gates (Basic Gates)
8. Half Adder and Full Adder
9. Shift Registers and Counters
10. Operational Amplifier (Adder, Subtractor, Differentiator, Integrator, Inverting and Non – Inverting

MICROPROCESSORS
1. Block Transfer
2. 8 bit Addition, Subtraction
3. Multiplication and Division
4. Maximum and Minimum of block of data
5. Sorting
6. Stepper Motor Interfacing

TOTAL : 60 PERIODS

OUTCOME:
- Ability to perform speed characteristic of different electronics and microprocessor machine

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S. No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Voltmeters</td>
<td>5 Nos.</td>
</tr>
<tr>
<td>2</td>
<td>Ammeters</td>
<td>5 Nos.</td>
</tr>
<tr>
<td>3</td>
<td>PN Diode, BJT, JFET, Logic Gates, Shift Registers and Counters</td>
<td>1 set.</td>
</tr>
<tr>
<td>4</td>
<td>Digital Logic Trainer Kits</td>
<td>1 No</td>
</tr>
<tr>
<td>5</td>
<td>Breadboards</td>
<td>1 No</td>
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<tr>
<td>6</td>
<td>Microprocessor Kits – 8085</td>
<td>5 Nos.</td>
</tr>
<tr>
<td>7</td>
<td>D/A Converter Interface</td>
<td>1 No</td>
</tr>
<tr>
<td>8</td>
<td>Stepper Motor Interface</td>
<td>1 No</td>
</tr>
<tr>
<td>9</td>
<td>CRO</td>
<td>1 No</td>
</tr>
<tr>
<td>10</td>
<td>Waveform Generator</td>
<td>1 No</td>
</tr>
<tr>
<td>11</td>
<td>Multimeter</td>
<td>1 No</td>
</tr>
</tbody>
</table>
OBJECTIVES

- To familiarize the various steps involved in the Design Process
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn to use standard practices and standard data
- To learn to use catalogues and standard machine components (Use of P S G Design Data Book is permitted)

UNIT I  STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS  9

UNIT II  SHAFTS AND COUPLINGS  9
Design of solid and hollow shafts based on strength, rigidity and critical speed – Keys, keyways and splines - Rigid and flexible couplings.

UNIT III  TEMPORARY AND PERMANENT JOINTS  9
Threaded fastners - Bolted joints including eccentric loading, Knuckle joints, Cotter joints – Welded joints, riveted joints for structures - theory of bonded joints.

UNIT IV  ENERGY STORING ELEMENTS AND ENGINE COMPONENTS  9
Various types of springs, optimization of helical springs - rubber springs - Flywheels considering stresses in rims and arms for engines and punching machines- Connecting Rods and crank shafts.

UNIT V  BEARINGS  9
Sliding contact and rolling contact bearings - Hydrodynamic journal bearings, Sommerfeld Number, Raimondi and Boyd graphs, -- Selection of Rolling Contact bearings.

OUTCOMES:

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

- CO1 Explain the influence of steady and variable stresses in machine component design.
- CO2 Apply the concepts of design to shafts, keys and couplings.
- CO3 Apply the concepts of design to temporary and permanent joints.
- CO4 Apply the concepts of design to energy absorbing members, bearings and connecting rod.
- CO5 Apply the concepts of design to bearings.

TEXT BOOKS:

REFERENCES:

AT8501 AUTOMOTIVE TRANSMISSION

Objective:

- To know about the various transmission and drive line units of automobiles.

UNIT I CLUTCH AND GEAR BOX

Requirement of transmission system, Different types of clutches, principle & Construction of Single plate coil spring and Diaphragm spring clutches., Need and Objectives of Gear box. Construction and operation of Sliding mesh, Constant mesh and Synchromesh gearboxes. – Determination of gear ratios for vehicles. Performance characteristics in different speeds. Problems on performance of automobile such as Resistance to motion, Tractive effort, Engine speed & Power and acceleration.

UNIT II HYDRODYNAMIC TRANSMISSION


UNIT III EPICYCLIC GEARBOXES USED IN AUTOMATIC TRANSMISSION


UNIT IV AUTOMATIC TRANSMISSION APPLICATIONS

Need for automatic transmission, Four speed longitudinally mounted automatic transmission - Chevrolet “Turboglide” Transmission, Continuously Variable Transmission (CVT) – Types – Operations of a typical CVT.

UNIT V HYDROSTATIC AND ELECTRIC DRIVE


Outcome

- The students will understand the constructional, working principle of various types of manual and automotive transmission of an automobile.
TEXT BOOKS:

REFERENCES:
1. SAE Transactions 900550 & 930910.

AT8502 AUTOMOTIVE ELECTRICAL AND ELECTRONICS SYSTEMS  L  T  P  C  3  0  0  3

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

UNIT I BATTERIES AND STARTING SYSTEM 10
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 9

UNIT III ELECTRONIC IGNITION AND INJECTION SYSTEM 9
Spark plugs. Advance mechanisms. Different types of ignition systems. Electronic fuel injection systems, mono and multi point fuel injection system (MPFI).

UNIT IV SENSORS AND MICROPROCESSORS IN AUTOMOBILES 9
Basic sensor arrangements. Types of sensors – oxygen sensor, hot wire anaemometer 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 8
Antilock braking system, air bag restraint system, voice warning system, seat belt system, road navigation system, anti theft system.

TOTAL : 45 PERIODS

OUTCOME:
- The student will have to know about all theoretical information and about electrical components used in a vehicle.
TEXT BOOK:

REFERENCES:

AT8503 VEHICLE DESIGN AND DATA CHARACTERISTICS

OBJECTIVE:
- Students have to collect important technical specifications of an automobile from Automobile Journals and keeping this, as a guide, they have to calculate and tabulate various vehicle performance parameters and design parameters and to draw curves using these data.

UNIT I INTRODUCTION
Assumptions to be made in designing a vehicle, Range of values for Gross Vehicle Weight, Frontal Area, maximum speed, maximum acceleration, gradability in different gears, Basics of Automobile Design.

UNIT II RESISTANCE TO VEHICLE MOTION
Calculation, Tabulation and Plotting of Curves for Air and Rolling Resistances at various vehicle speeds, Calculation and Plotting of Driving force, Power requirement for different loads and acceleration, Maximum Power calculation.

UNIT III PERFORMANCE CURVES – I
Calculation, Tabulation and Plotting of Torque and Mechanical Efficiency for different vehicle speeds, Interpolation of Pressure – Volume diagram, Calculation of frictional Mean Effective Pressure, Calculation of Engine Cubic Capacity, Bore and Stroke Length.

UNIT IV PERFORMANCE CURVES – II
Connecting rod length to Crank Radius Ratio, Plotting of Piston Velocity and Acceleration against Crank Angle, Plotting Gas force, inertia force and Resultant force against Crank Angle, Turning Moment and Side Thrust against Crank Angle.

UNIT V GEAR RATIOS
Determination of Gear Ratios, Acceleration and Gradability, Typical Problems on Vehicle performance

OUTCOME
- The students can able to understand the basic design principle of vehicle, able to draw the performance curves pertain to engine and chassis.

TEXT BOOKS

REFERENCE
OBJECTIVE:

- To understand the properties of fuels and lubricants for the design and operation of the I.C engines.

UNIT I MANUFACTURE OF FUELS AND LUBRICANTS

Structure of petroleum, refining process, fuels, thermal cracking, catalytic cracking, polymerization, alkylation, isomerisation, blending, products of refining process. Manufacture of lubricating oil base stocks, manufacture of finished automotive lubricants.

UNIT II THEORY OF LUBRICATION

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

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

Thermo-chemistry of fuels, properties and testing of fuels, relative 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 etc.

UNIT V COMBUSTION & FUEL RATING


TOTAL : 45 PERIODS

OUTCOME:

- At the end of the course, the student can understand the importance, manufacturing methods, testing methods, combustion methodology of automotive fuels and lubricants.

TEXT BOOKS:


REFERENCES:

OBJECTIVE:
- To introduce the testing procedure for electrical and electronics system in automobile.

LIST OF EXPERIMENTS
a. Electrical Laboratory
   1. Testing of batteries and battery maintenance
   2. Testing of starting motors and generators
   3. Testing of regulators and cut – outs
   4. Diagnosis of ignition system faults
   5. Study of Automobile electrical wiring

b. Electronics Laboratory
   6. Study of rectifiers and filters
   7. Study of logic gates, adder and flip-flops
   8. Study of SCR and IC timer
   9. Interfacing Sensors like RTD, LVDT, Load Cell etc.
   10. Interfacing ADC for Data Acquisition
   11. Interfacing DAC for Control Application
   12. Interfacing A/D converter and simple data acquisition
   13. Micro controller programming and interfacing
   14. Interfacing Actuators
   15. EPROM Programming
   16. Fault Diagnosis of various sensors

TOTAL: 60 PERIODS

OUTCOME:
- Ability to rectify and faults in electrical and electronics systems and maintain the same.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

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<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
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<tbody>
<tr>
<td>1</td>
<td>Battery, hydrometer, voltage tester</td>
<td>1 No. each</td>
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<td>2</td>
<td>Starter motor, regulator, cut-out</td>
<td>1 No. each</td>
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<tr>
<td>3</td>
<td>Distributor, ignition coil, spark plug</td>
<td>1 No. each</td>
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<tr>
<td>4</td>
<td>Auto electrical wiring system</td>
<td>1 No.</td>
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<tr>
<td>5</td>
<td>Rectifiers, filters</td>
<td>15 Nos. each</td>
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<tr>
<td>6</td>
<td>Bread board, Logic gates ICs,</td>
<td>15 Nos. each</td>
</tr>
<tr>
<td>7</td>
<td>Amplifier</td>
<td>15 Nos</td>
</tr>
<tr>
<td>8</td>
<td>IC timer</td>
<td>15 Nos</td>
</tr>
<tr>
<td>9</td>
<td>Data logger</td>
<td>1 No.</td>
</tr>
<tr>
<td>10</td>
<td>8085 trainer kit</td>
<td>10 Nos</td>
</tr>
<tr>
<td>11</td>
<td>ADC interface board</td>
<td>2 Nos</td>
</tr>
<tr>
<td>12</td>
<td>DAC interface board</td>
<td>2 Nos</td>
</tr>
<tr>
<td>13</td>
<td>Sensors like RTD, Load cell, LVDT</td>
<td>2 Nos</td>
</tr>
<tr>
<td>14</td>
<td>Actuators like stepper motor</td>
<td>2 Nos</td>
</tr>
</tbody>
</table>
OBJECTIVE:
- To study the characteristics of the fuels and Lubricants used in automobile

LIST OF EXPERIMENTS
2. Study of Octane and Cetane Number of fuels.
3. ASTM distillation test of liquid fuels
4. Aniline Point test of diesel
5. Calorific value of liquid fuel.
7. Reid vapour pressure test.
8. Flash and Fire points of petrol and diesel.
9. Copper strip Corrosion Test
10. Cloud & Pour point Test.
12. Viscosity Index of lubricants & Fuels by Saybolt Viscometer
13. Ash content and Carbon Residue Test
14. Drop point of grease and mechanical penetration in grease.

TOTAL: 60 PERIODS

OUTCOME:
- Ability to characteristic and chase the fuels and Lubricantes for the automobiles.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
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<tr>
<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Flash and fire point apparatus (for petrol)</td>
<td>1 No.</td>
</tr>
<tr>
<td>2</td>
<td>Aniline point Apparatus</td>
<td>1 No.</td>
</tr>
<tr>
<td>3</td>
<td>Reid vapor pressure test Apparatus</td>
<td>1 No.</td>
</tr>
<tr>
<td>4</td>
<td>Bomb and Gas Calorimeters</td>
<td>1 No.</td>
</tr>
<tr>
<td>5</td>
<td>Carbon Residue Test Apparatus</td>
<td>1 No.</td>
</tr>
<tr>
<td>6</td>
<td>Copper Strip Corrosion Test Apparatus</td>
<td>1 No.</td>
</tr>
<tr>
<td>7</td>
<td>Cloud and Pour point Apparatus</td>
<td>1 No.</td>
</tr>
<tr>
<td>8</td>
<td>Redwood Viscometer</td>
<td>1 No.</td>
</tr>
<tr>
<td>9</td>
<td>Saybolt Viscometer</td>
<td>1 No.</td>
</tr>
<tr>
<td>10</td>
<td>ASTM distillation test Apparatus</td>
<td>1 No.</td>
</tr>
<tr>
<td>11</td>
<td>Ash content Test Apparatus</td>
<td>1 No.</td>
</tr>
<tr>
<td>12</td>
<td>Drop point and penetration Apparatus for grease</td>
<td>1 No.</td>
</tr>
</tbody>
</table>
OBJECTIVES: The course aims to:

- Enhance the Employability and Career Skills of students
- Orient the students towards grooming as a professional
- Make them Employable Graduates
- Develop their confidence and help them attend interviews successfully.

UNIT I
Introduction to Soft Skills-- Hard skills & soft skills - employability and career Skills—Grooming as a professional with values—Time Management—General awareness of Current Affairs

UNIT II
Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice— presenting the visuals effectively – 5 minute presentations

UNIT III
Introduction to Group Discussion— Participating in group discussions – understanding group dynamics - brainstorming the topic -- questioning and clarifying –GD strategies- activities to improve GD skills

UNIT IV
Interview etiquette – dress code – body language – attending job interviews– telephone/skype interview - one to one interview & panel interview – FAQs related to job interviews

UNIT V
Recognizing differences between groups and teams- managing time-managing stress- networking professionally- respecting social protocols-understanding career management-developing a long-term career plan-making career changes

TOTAL : 30 PERIODS

OUTCOMES: At the end of the course Learners will be able to:

- Make effective presentations
- Participate confidently in Group Discussions.
- Attend job interviews and be successful in them.
- Develop adequate Soft Skills required for the workplace

Recommended Software
1. Globearena
2. Win English

REFERENCES:
OBJECTIVE:
- To facilitate the understanding of Quality Management principles and process.

UNIT I INTRODUCTION

UNIT II TQM PRINCIPLES
Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS AND TECHNIQUES I
The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Benchmarking - Reason to benchmark, Bench marking process - FMEA - Stages, Types.

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

UNIT V QUALITY MANAGEMENT SYSTEM

TOTAL: 45 PERIODS

OUTCOME:
- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

TEXT BOOK:

REFERENCES:
4. ISO 9001-2015 standards
OBJECTIVE:
- To make the students understand the design concept and principles of various engine components. These concepts and principles are familiarized for design of components.

UNIT I INTRODUCTION
Engineering materials - Introduction endurance limit, notch sensitivity. Tolerances, types of tolerances and fits, design considerations for interference fits, surface finish, surface roughness, Rankine's formula - Tetmajer's formula - Johnson formula- design of pushrods.

UNIT II DESIGN OF CYLINDER, PISTON AND CONNECTING ROD
Choice of material for cylinder and piston, design of cylinder, piston, piston pin, piston rings, piston failures, lubrication of piston assembly. Material for connecting rod, determining minimum length of connecting rod, small end design, shank design, design of big end cap bolts.

UNIT III DESIGN OF CRANKSHAFT
Balancing of I.C. engines, significance of firing order. Material for crankshaft, design of crankshaft under bending and twisting, balancing weight calculations, development of short and long crankarms. Front and rear-end details.

UNIT IV DESIGN OF FLYWHEELS
Determination of the mass of a flywheel for a given co-efficient of speed fluctuation. Engine flywheel - stresses on the rim of the flywheels. Design of hubs and arms of the flywheel, turning moment diagram.

UNIT V DESIGN OF VALVES AND VALVE TRAIN

TOTAL: 45 PERIODS

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

OUTCOME:
- Upon completion of the course, students will be able to impart knowledge in automotive engine. The detailed concept, construction and principle of operation of engine and various engine components, combustion, cooling and lubrication systems will be taught to the students. At the end of the course the students will have command over automotive engines and the recent development in the area of engines.

TEXT BOOK:

REFERENCES:
OBJECTIVE:
- The student will be able to understand the fundamental principles involved in design of components of automotive chassis, the complete design exercise and arrive at important dimensions of chassis components.

UNIT I  VEHICLE FRAME AND SUSPENSION  9
Study of loads-moments and stresses on frame members. Design of frame for passenger and commercial vehicle - Design of leaf Springs-Coil springs and torsion bar springs.

UNIT II  FRONT AXLE AND STEERING SYSTEMS  9

UNIT III  CLUTCH  9
Design of single plate clutch, multiplate clutch and cone clutch. Torque capacity of clutch. Design of clutch components, Design details of roller and sprag type of clutches.

UNIT IV  GEAR BOX  9
Gear train calculations, layout of gearboxes. Calculation of bearing loads and selection of bearings. Design of three speed and four speed gearboxes.

UNIT V  DRIVE LINE AND REAR AXLE  9
Design of propeller shaft. Design details of final drive gearing. Design details of full floating, semi-floating and three quarter floating rear shafts and rear axle housings and design aspects of final drive.

TOTAL: 45 PERIODS

OUTCOME:
- At the end of the course, the student can able to design the automotive components like frame, suspension systems, axles, clutch, gear box, drive line components etc

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
- The aim of this course is to make the students to know and understand the constructional details operating characteristics and vehicle design aspects.

UNIT I THE POWER UNIT
Two stroke and four stroke SI & CI engine Construction and Working, merits and demerits, Symmetrical and unsymmetrical valve & port timing diagrams. Scavenging process.

UNIT II FUEL AND IGNITION SYSTEMS
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, 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 WHEELERS – CASE STUDY
Case study of Sports bike, Motor cycles, Scooters and Mopeds - Auto rickshaws, Pick up van, Delivery van and Trailer. Servicing and maintenance. Recent developments.

TOTAL : 45 PERIODS

OUTCOME:
- The students can able to understand the various subsystem of two and three wheeler and also know how it is different from light motors and heavy motor vehicles.

TEXT BOOK:

REFERENCES:
1. Bryaut, R.V., Vespa "Maintenance and Repair series".
OBJECTIVE:
- To know about the application of basic mechanics principles for dynamic analysis of vehicles.

UNIT I  CONCEPT OF VIBRATION  9
Definitions, Modeling and Simulation, Global and Vehicle Coordinate System, Free, Forced,
Undamped and Damped Vibration, Response Analysis of Single DOF, Two DOF, Multi DOF,
Magnification factor, Transmissibility, Vibration absorber, Vibration measuring instruments, Torsional
vibration, Critical speed.

UNIT II  TIRES  9
Tire forces and moments, Tire structure, Longitudinal and Lateral force at various slip angles, rolling
resistance, Tractive and cornering property of tire. Performance of tire on wet surface. Ride property
of tires. Magic formulae tire model, Estimation of tire road friction. Test on Various road surfaces. Tire
vibration.

UNIT III  VERTICAL DYNAMICS  9
Human response to vibration, Sources of Vibration. Design and analysis of Passive, Semi-active and
Active suspension using Quarter car, half car and full car model. Influence of suspension stiffness,
suspension damping, and tire stiffness. Control law for LQR, H-Infinite, Skyhook damping. Air
suspension system and their properties.

UNIT IV  LONGITUDINAL DYNAMICS AND CONTROL  9
Aerodynamic forces and moments. Equation of motion. Tire forces, rolling resistance, Load
distribution for three wheeler and four wheeler. Calculation of Maximum acceleration, Reaction forces
control, Traction control.

UNIT V  LATERAL DYNAMICS  9
Steady state handling characteristics. Steady state response to steering input. 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.

TOTAL : 45 PERIODS

OUTCOME:
- The student will understand how passenger comfort is achieved along with vehicle stability.

TEXT BOOKS:
3. Thomas D. Gillespie, "Fundamentals of Vehicle Dynamics", Society of Automotive Engineers Inc,
   1992

REFERENCES:
   Inc, 1996
   Elsevier Limited, 2004
OBJECTIVE:
- To familiarise the students to use modeling software to model engine components and chassis design

LIST OF ENGINE DESIGN EXPERIMENTS
1. Design and drawing of piston, piston pin and piston rings and drawing of these components.
2. Design of connecting rod small end and big end, shank design, design of big end cap, bolts and drawing of the connecting rod assembly.
3. Design of crankshaft, balancing weight calculations.
4. Development of short and long crank arms, front end and rear end details, drawing of the crankshaft assembly.
5. Design and drawing of flywheel.
6. Ring gear design, drawing of the flywheel including the development of ring gear teeth.
7. Design and drawing of the inlet and exhaust valves.
8. Design of cam and camshaft, cam profile generation, drawing of cam and camshaft.

LIST OF CHASSIS DESIGN EXPERIMENTS
CLUTCH
10. Complete design of clutch components.
11. Assembly drawing of clutch using drafting software.

GEAR BOX
12. Gear train calculations.
13. Layout of gear box.
14. Calculation of bearing loads
15. Selection of bearings.
16. Assembly drawing of gear box using drafting software.

DRIVE LINE AND REAR AXLE
17. Design of propeller shaft.
18. Design details of final drive gearing.
19. Design details of full floating, semi-floating and three quarter floating rear shafts and rear axle housings
20. Design aspects of final drive.

TOTAL: 60 PERIODS

OUTCOME:
- Ability to use the drafty and modeling software for automobile components design

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S. No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Computer nodes</td>
<td>15 Nos.</td>
</tr>
<tr>
<td>2</td>
<td>Drafting and Modeling Softwares</td>
<td>15 licenses each</td>
</tr>
</tbody>
</table>
OBJECTIVES:
- To train the students to conduct performance test on two and three wheelers
- To train the students to dismantle and assemble the gear box, steering system etc.,

LIST OF EXPERIMENTS
1. Performance test of a two wheeler using chassis dynamometer.
2. Performance test on shock absorber
3. Performance test on coil spring.
4. Two wheeler chain test
5. Brake and Clutch adjustment as per specification.
6. Dismantling and assembling of two wheeler gear box and finding gear ratios
7. Dismantling and assembling of three wheeler box and finding gear ratios
8. Three wheeler brake and clutch play adjustment
9. Dismantling and assembling of three wheeler steering system.
10. Study of three wheeler chassis frame and power transmission system.

TOTAL: 60 PERIODS

OUTCOME:
1. Ability to assemble the engine components and conduct performance test on two and three wheelers.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S. No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Two wheeler chassis dynamometer</td>
<td>1 No.</td>
</tr>
<tr>
<td>2</td>
<td>Coil spring test rig</td>
<td>1 No.</td>
</tr>
<tr>
<td>3</td>
<td>Chain tension test rig</td>
<td>1 No.</td>
</tr>
<tr>
<td>4</td>
<td>Shock absorber test rig</td>
<td>1 No.</td>
</tr>
<tr>
<td>5</td>
<td>Two-wheeler gearbox</td>
<td>2 Nos.</td>
</tr>
<tr>
<td>6</td>
<td>Two-wheeler clutch</td>
<td>2 Nos.</td>
</tr>
<tr>
<td>7</td>
<td>Three-wheeler brake assembly</td>
<td>2 Nos.</td>
</tr>
<tr>
<td>8</td>
<td>Three-wheeler steering assembly</td>
<td>2 Nos.</td>
</tr>
<tr>
<td>9</td>
<td>Three-wheeler gear box</td>
<td>2 Nos.</td>
</tr>
</tbody>
</table>

AT8701 ENGINE AND VEHICLE MANAGEMENT SYSTEM

OBJECTIVE:
- To explain the principle of engines and vehicle electronic management system and different sensors used in the systems.

UNIT I FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS
Microprocessor architecture, open and closed loop control strategies, PID control, Look up tables, introduction to modern control strategies like Fuzzy logic and adaptive control. Parameters to be controlled in SI and CI engines and in the other parts of the automobile.
UNIT II SENSORS
Inductive, Hall effect, hot wire, thermistor, piezo electric, piezoresistive, based sensors. Throttle position, mass air flow, crank shaft position, cam position, engine and wheel speed, steering position, tire pressure, brake pressure, steering torque, fuel level, crash, exhaust oxygen level (two step and linear lambda), knock, engine temperature, manifold temperature and pressure sensors.

UNIT III SI ENGINE MANAGEMENT

UNIT IV CI ENGINE MANAGEMENT
Fuel injection system parameters affecting combustion, noise and emissions in CI engines. Pilot, main, advanced post injection and retarded post injection. Electronically controlled Unit Injection system. Layout of the common rail fuel injection system. Working of components like fuel injector, fuel pump, rail pressure limiter, flow limiter, EGR valves

UNIT V VEHICLE MANAGEMENT SYSTEMS

OUTCOME:
• At the end of the course, the student will understand the role of various sensor, its construction and working principle and it influence in controlling pollution, enhancing safety of the vehicle.

TEXT BOOKS:

REFERENCES:

ME8692 FINITE ELEMENT ANALYSIS
OBJECTIVES:
• To introduce the concepts of Mathematical Modeling of Engineering Problems.
• To appreciate the use of FEM to a range of Engineering Problems.

UNIT I INTRODUCTION

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UNIT II ONE-DIMENSIONAL PROBLEMS

UNIT III TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS

UNIT IV TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS
Equations of elasticity – Plane stress, plane strain and axisymmetric problems – Body forces and temperature effects – Stress calculations - Plate and shell elements.

UNIT V ISOPARAMETRIC FORMULATION

TOTAL : 45 PERIODS

OUTCOMES:
- CO1 Summarize the basics of finite element formulation.
- CO2 Apply finite element formulations to solve one dimensional Problems.
- CO3 Apply finite element formulations to solve two dimensional Problems.
- CO4 Apply finite element method to solve heat transfer and fluid mechanics problems.
- CO5 Apply finite element method to solve problems on dynamic analysis.

TEXT BOOKS:

REFERENCES:
OBJECTIVE:

- To know about the various methods of maintaining vehicles and their subsystems.

UNIT I MAINTENANCE, WORKSHOP PRACTICES, SAFETY AND TOOLS 10

UNIT II ENGINE AND ENGINE SUBSYSTEM MAINTENANCE 8
General Engine service- Dismantling of Engine components- Engine repair- working on the underside, front, top, ancillaries- Service of basic engine parts, 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 8
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 10
Inspection, Maintenance and Service of Hydraulic brake, 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, Maintenance and Service of steering linkage, steering column, Rack and pinion steering, Recirculating ball steering service- Worm type steering, power steering system

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

OUTCOME:
- Upon the completion of the course, the student can able to understand the importance of maintenance and also the step by step procedure for maintain the various automotive sub systems

TEXT BOOKS:
2. Vehicle Service Manuals of reputed manufacturers

REFERENCE:
AT8711 ENGINE PERFORMANCE AND EMISSION TESTING LABORATORY  

OBJECTIVE:
- To conduct performance test and emission test on the IC engines.

LIST OF EXPERIMENTS
1. Study of hydraulic, electrical and eddy current dynamometers
2. Valve timing and port timing diagrams
3. Performance and emission test on two wheeler SI engine
4. Performance and emission test on automotive multi-cylinder SI engine
5. Performance and emission test on automotive multi-cylinder CI engine
7. Heat balance test on automotive multi-cylinder SI engine
8. Heat balance test on automotive multi-cylinder CI engine
9. Morse test on multi-cylinder SI engine
10. Engine cylinder pressure measurement P-θ and P-V diagrams for IC engine with piezo-electric pick up, charge amplifier, angle encoder and data acquisition system.
11. Motoring test for indicated power

TOTAL: 60 PERIODS

OUTCOME:
- Ability to control the emission and use of different equipments to conduct performance test.

LIST OF EQUIPMENT FOR A STUDENTS

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hydraulic dynamometer</td>
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<tr>
<td>2</td>
<td>Eddy current dynamometer</td>
<td>1 No.</td>
</tr>
<tr>
<td>3</td>
<td>Engine test rig with electrical dynamometer</td>
<td>1 No.</td>
</tr>
<tr>
<td>4</td>
<td>Single cylinder two stroke cut section engine</td>
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</tr>
<tr>
<td>5</td>
<td>Single cylinder four stroke cut section engine</td>
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<tr>
<td>6</td>
<td>Two-wheeler engine test rig</td>
<td>1 No.</td>
</tr>
<tr>
<td>7</td>
<td>Automotive multicylinder SI engine test rig with heat balance arrangement</td>
<td>1 No.</td>
</tr>
<tr>
<td>8</td>
<td>Automotive multicylinder CI engine test rig with heat balance arrangement</td>
<td>1 No.</td>
</tr>
<tr>
<td>9</td>
<td>Emission Measuring Instruments for Petrol &amp; Diesel Engines</td>
<td>1 No each</td>
</tr>
<tr>
<td>10</td>
<td>Piezo-electric pick up, Charge Amplifier, Angle Encoder and (DDAS) Digital data acquisition system</td>
<td>1 set</td>
</tr>
</tbody>
</table>

AT8712 VEHICLE MAINTENANCE LABORATORY  

OBJECTIVE:
- To train the structures in identifying the fault and rectification.

STUDY EXPERIMENTS:
1. Tools and instruments required for maintenance
2. Safety aspects with respect to man, machine and tools
3. General procedures for servicing and maintenance schedule
4. Wheel Alignment procedure
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 driveline system
6. Fault diagnosis and service of braking system
7. Fault diagnosis and service of suspension system
8. Fault diagnosis and service of steering system
9. Fault diagnosis and service of Electrical system like battery, starting system, charging system, lighting system etc
10. Fault diagnosis and service of vehicle air conditioning system
11. 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

OUTCOME:
• Ability to identify the faults and knowledge on maintenance

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Engine Analyzer</td>
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<tr>
<td>2</td>
<td>Cylinder compression pressure gauge</td>
<td>1 No.</td>
</tr>
<tr>
<td>3</td>
<td>Vacuum gauge</td>
<td>1 No.</td>
</tr>
<tr>
<td>4</td>
<td>Spark plug cleaner and tester</td>
<td>1 No.</td>
</tr>
<tr>
<td>5</td>
<td>Cam angle and rpm tester</td>
<td>1 No.</td>
</tr>
<tr>
<td>6</td>
<td>Tachometer</td>
<td>1 No.</td>
</tr>
<tr>
<td>7</td>
<td>Wheel alignment apparatus</td>
<td>1 No.</td>
</tr>
<tr>
<td>8</td>
<td>Gas welding equipment</td>
<td>1 No.</td>
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<tr>
<td>9</td>
<td>Tyre remover</td>
<td>1 No.</td>
</tr>
<tr>
<td>10</td>
<td>Bearing puller</td>
<td>1 No.</td>
</tr>
<tr>
<td>11</td>
<td>Head light alignment gauge</td>
<td>1 No.</td>
</tr>
<tr>
<td>12</td>
<td>Service manuals of petrol, diesel engines</td>
<td>1 No: each</td>
</tr>
<tr>
<td>13</td>
<td>Cylinder reboring machine</td>
<td>1 No.</td>
</tr>
<tr>
<td>14</td>
<td>Valve grinding machine</td>
<td>1 No.</td>
</tr>
<tr>
<td>15</td>
<td>Valve lapping machine</td>
<td>1 No.</td>
</tr>
<tr>
<td>16</td>
<td>Fuel injection calibration test bench with nozzle tester</td>
<td>1 No.</td>
</tr>
<tr>
<td>17</td>
<td>HRD tester, Clamp on meter, Hydrometer</td>
<td>1 No: each</td>
</tr>
</tbody>
</table>
OBJECTIVE:

- The main objective of this course is to impart knowledge in the construction of vehicle, aerodynamic, concept, paneling of passenger car body trim. At the end of the course the student will be well versed in the design and construction of external body of the vehicles.

UNIT I CAR BODY DETAILS 10

UNIT II BUS BODY DETAILS 9
Types of bus body: based on capacity, distance traveled and based on construction.– Bus body lay out for various types, Types of metal sections used – Regulations – Constructional details: Conventional and integral. driver seat design- Safety aspect of bus body.

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

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

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of the course, students will
- Know about different aspects of car body and bus body, types, commercial vehicle.
- Role of various aerodynamic forces and moments, measuring instruments
- Know about the material used in body building, tools used, body repairs.

TEXT BOOKS:

REFERENCES:
**OBJECTIVE:**
- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

**OUTCOME:**
- On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

**AT8801 AUTOMOTIVE AIR-CONDITIONING**

**OBJECTIVE:**
- At the end of the course, the students will be able to understand the components of the automotive air-conditioning and their functions and the latest developments in this field.

**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 driveability- Preventing Overheating
- Ram air ventillation- 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

OUTCOME

- Upon the completion of the course, the student should understand the basic of vehicle air-conditioning system, its components, working principle, control mechanism, service etc.

TEXT BOOKS:


REFERENCES:


AT8002  ADVANCE THEORY OF IC ENGINES

OBJECTIVES:

- Knowledge in usage of software for simulating the performance of IC engines
- Acquiring ability to simulate the various types combustion processes of IC engines.
- Knowledge in performance simulation of IC 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 9

UNIT V COMBUSTION ANALYSIS IN IC ENGINES 9

OUTCOME:
• At the end of the course, the student can able to model and simulate the engine cycle, perform combustion analysis, instruments used in measurement, recent developments in the IC engines.

TEXT BOOKS:

REFERENCES:

AT8003 METROLOGY AND MEASUREMENTS FOR AUTOMOBILE ENGINEERS

OBJECTIVE:
• Knowledge in usage of software to measure parameters like speed, position, velocity, pressure, force, torque, temperature etc

UNIT I INTRODUCTION TO MEASUREMENTS AND SENSORS 9
Sensors: Functions- Classifications- Main technical requirement and trends Units and standards- Calibration methods- Classification of errors- Error analysis- Limiting error- Probable error- Propagation of error- Odds and uncertainty- principle of transduction- Classification.
Static characteristics- mathematical model of transducers- Zero, First and Second order transducers- Dynamic characteristics of first and second order transducers for standard test inputs.

UNIT II VARIABLE RESISTANCE, INDUCTANCE AND CAPACITIVE SENSOR 11
Principle of operation- Construction details- Characteristics and applications of resistive potentiometer- Strain gauges- Resistive thermometers- Thermistors- Piezoresistive sensors Inductive potentiometer- Variable reluctance transducers- EI pick up and LVDT
SPECIAL SENSORS
Variable air gap type, variable area type and variable permittivity type- capacitor microphone Piezoelectric, Magnetostrictive, Hall Effect, semiconductor sensor- digital transducers-Humidity Sensor. Rain sensor, climatic condition sensor, solar, light sensor, antiglare sensor.

UNIT III AUTOMOTIVE PRESSURE AND FORCE/TORQUE SENSOR
Pressure Sensor:
Typical automotive applications- Thick film pressure sensor- Semiconductor pressure sensor- Integrated silicon intake-manifold pressure sensor-Integrated silicon combustion-pressure sensor- Piezo electric sensor-High pressure sensor with metal diaphragm.

Force/Torque Sensor:
Typical automotive applications- Magneto elastic bearing-pin sensor- Magneto elastic tension/compressive-force sensor – Basic principle of torque measurement – steering- Angle measuring torque sensor

UNIT IV AUTOMOTIVE POSITION AND RPM/VELOCITY SENSORS
Temperature Sensors:- Typical automotive applications -Sintered-Ceramic resistors-Thin film resistors-Thick film resistors- Monocrystalline silicon semiconductor resistor- Thermopile sensors
Introduction to MEMs

UNIT V METROLOGY
Basic concept - scientific, industrial and legal metrology - linear and angular measuring instruments, measurement of screw thread - Two, three wire method, measurement with optical flats, laser interferometer, coordinate measuring machine.

TOTAL : 45 PERIODS

OUTCOME:
- At the end of the course, the students will aware the various instruments that are available to measure parameters like speed, position, velocity, pressure, force, torque, temperature etc.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- This course aims at introducing the students to the basic concepts of engineering design and product development with focus on the front end processes.
- At the end of this course the student is expected to demonstrate an understanding of the overview of all the product development processes and knowledge of concept generation and selection tools.

UNIT I INTRODUCTION
Need for developing products — the importance of engineering design — types of design — the design process — relevance of product lifecycle issues in design — designing to codes and standards — societal considerations in engineering design — generic product development process — various phases of product development—planning for products — establishing markets — market segments — relevance of market research

UNIT II CUSTOMER NEEDS
Identifying customer needs — voice of customer — customer populations — hierarchy of human needs — need gathering methods — affinity diagrams — needs importance — establishing engineering characteristics — competitive benchmarking — quality function deployment — house of quality — product design specification — case studies

UNIT III CREATIVE THINKING
Creative thinking — creativity and problem solving — creative thinking methods — generating design concepts — systematic methods for designing — functional decomposition — physical decomposition — functional representation — morphological methods — TRIZ — axiomatic design

UNIT IV DECISION MAKING AND PRODUCT ARCHITECTURE
Decision making — decision theory — utility theory — decision trees — concept evaluation methods — Pugh concept selection method — weighted decision matrix — analytic hierarchy process — introduction to embodiment design — product architecture — types of modular architecture — steps in developing product architecture

UNIT V DESIGN AND COST ANALYSIS
Industrial design — human factors design — user friendly design — design for serviceability — design for environment — prototyping and testing — cost evaluation — categories of cost — overhead costs — activity based costing — methods of developing cost estimates — manufacturing cost — value analysis in costing

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES
OBJECTIVE:
• To give an idea about IPR, registration and its enforcement.

UNIT I  INTRODUCTION  9
Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II  REGISTRATION OF IPRs  10
Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III  AGREEMENTS AND LEGISLATIONS  10

UNIT IV  DIGITAL PRODUCTS AND LAW  9

UNIT V  ENFORCEMENT OF IPRs  7
Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

TOTAL :45 PERIODS

OUTCOME:
• Ability to manage Intellectual Property portfolio to enhance the value of the firm.

TEXT BOOKS

REFERENCES
OBJECTIVE:
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

UNIT IV CHARACTERIZATION TECHNIQUES

UNIT V APPLICATIONS

TOTAL : 45 PERIODS

OUTCOMES:
- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

TEXT BOOKS :

REFERENCES:
OBJECTIVE:
- To impart knowledge on basic principle and production methods of automotive components.

UNIT I CASTED ENGINE COMPONENTS
Material selection and Manufacturing methods for Piston, Piston rings, Cylinder block, wet and dry liners, Engine head, Oil pan, Carburetors. Thermal barrier coating of Engine head and valves.

UNIT II FORGED ENGINE COMPONENTS
Material selection and Manufacturing methods for Crank shaft, Connecting rod, Cam shaft, valve, Piston pin, Push rod, Rocker arm, tappets, spark plug.

UNIT III TRANSMISSION SYSTEM

UNIT IV VEHICLE CHASSIS

UNIT V RECENT DEVELOPMENTS

OUTCOME:
- Upon completion of this course the student can able to use the basic principle and production methods of automotive components

TEXT BOOK:

REFERENCES:
3. Newton and steels, the motor vehicle, ELBS, 1990
OBJECTIVE:
• To illustrate the new generation vehicles and their operation and controls

UNIT I INTRODUCTION
Electric and hybrid vehicles, flexible fuel vehicles (FFV), solar powered vehicles, vehicles, fuel cells vehicles.

UNIT II POWER SYSTEM AND NEW GENERATION VEHICLES
Hybrid Vehicle engines, Stratified charge engines, learn burn engines, low heat rejection engines, hydrogen engines, HCCI engine, VCR engine, surface ignition engines, VVTI engines. High energy and power density batteries, fuel cells, flexible fuel systems.

UNIT III VEHICLE OPERATION AND CONTROL
Computer Control for pollution and noise control and for fuel economy – Transducers and actuators - Information technology for receiving proper information and operation of the vehicle like optimum speed and direction.

UNIT IV VEHICLE AUTOMATED TRACKS
Preparation and maintenance of proper road network - National highway network with automated roads and vehicles - Satellite control of vehicle operation for safe and fast travel, GPS.

UNIT V SUSPENSION, BRAKES, AERODYNAMICS AND SAFETY
Air suspension – Closed loop suspension, compensated suspension, anti skid braking system, retarders, regenerative braking, safety gauge air bags- crash resistance. Aerodynamics for modern vehicles, safety systems, materials and standards.

OUTCOME:
• Upon completion of this course the student will familiar in the recent development pertain to energy system, vehicle operation, newer vehicle, recent technologies in the area of suspension systems, brakes, aerodynamics etc

TEXT BOOKS:

REFERENCES:
1. Advance hybrid vehicle power transmission, SAE.
2. Light weight electric for hybrid vehicle design.
OBJECTIVE:
- At the end of the course, the students will be able to apply basic principles of aerodynamics for the design of vehicle body.

UNIT I INTRODUCTION
Scope, historical developments, fundamental of fluid mechanics, flow phenomenon related to vehicles, external and internal flow problem, resistance to vehicle motion, performance, fuel consumption and performance potential of vehicle aerodynamics.

UNIT II AERODYNAMIC DRAG OF CARS
Cars as a bluff body, flow field around car, drag force, types of drag force, analysis of aerodynamic drag, drag coefficient of cars, strategies for aerodynamic development, low drag profiles.

UNIT III SHAPE OPTIMIZATION OF CARS
Front end modification, front and rear wind shield angle, boat tailing, hatch back, fast back and square back, dust flow patterns at the rear, effects of gap configuration, effect of fasteners. Case studies on modern vehicles.

UNIT IV 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, characteristics of forces and moments, dirt accumulation on the vehicle, wind noise, drag reduction in commercial vehicles and racing cars.

UNIT V WIND TUNNELS FOR AUTOMOTIVE AERODYNAMICS
Introduction, principle of wind tunnel technology, limitation of simulation, stress with scale models, full scale wind tunnels, measurement techniques, equipment and transducers, road testing methods, numerical methods. CFD analysis.

TOTAL : 45 PERIODS

OUTCOME:
- Upon completion of this course, the students will understand the fundamentals of aerodynamics, vehicle body optimisation, measuring aerodynamics forces etc.

TEXT BOOK:

REFERENCES :
AT8006 OFF ROAD VEHICLES

OBJECTIVE:
- At the end of the course, the students will be able to understand the various Off road vehicle and their systems and features

UNIT I CLASSIFICATION AND REQUIREMENTS OF OFF ROAD VEHICLES 6
Construction layout, capacity and applications of off road vehicle - prime mover, chassis and transmission, Multiaxle vehicles.

UNIT II EARTH MOVING CONSTRUCTIONAL MACHINES 10
dumpers - safety features, safe warning system for dumper , Design aspects on dumper body, Articulated Dumpers, loaders - single bucket, Multi bucket and rotary types - bulldozers, kinematics for loader and bulldozers with operational linkages, excavators, backhoe loaders, scrappers, motor graders, power shawl, bush cutters, Bush cutters, stumpers, rippers.

UNITY III INDUSTRIAL APPLICATIONS 10
Constructional and working details of Jib crane, concrete ready mixers, compactors - vibratory compactors, forklift, utility vehicles, man - lift, scissors, lift trucks, material handlers, power generators.

UNIT IV FARM EQUIPMENTS, MILITARY AND COMBAT VEHICLES 8
Tractors, classification - working attachments, power take off, special implements, paddy harvester, sugarcane harvester, feller bunchers, special features and constructional details of military tankers, AVLB gun carriers and transport vehicles.

UNIT V VEHICLE SYSTEMS, FEATURES 11

TOTAL: 45 PERIODS

OUTCOME:
- At the end of the course, the students will understand the types, special features, design methodology, working principle, application of various off – road vehicles.

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
- To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.

UNIT I  LINEAR MODELS  15

UNIT II  TRANSPORTATION MODELS AND NETWORK MODELS  8

UNIT III  INVENTORY MODELS  6
Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice.

UNIT IV  QUEUEING MODELS  6
Queueing models - Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.

UNIT V  DECISION MODELS  10

TOTAL: 45 PERIODS

OUTCOME:
- Upon completion of this course, the students can able to use the optimization techniques for use engineering and Business problems

TEXT BOOKS:

REFERENCES:
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
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)
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
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
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
Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

OUTCOMES:
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, Scenarious 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

AT8007 NOISE, VIBRATION AND MEASUREMENTS L T P C

OBJECTIVES:
• knowledge in basic of vibration and noise
• Understanding the effect of noise an human comfort and environment
• Knowing the methods of vibration and noise measurement.

UNIT I FUNDAMENTALS OF ACOUSTICS AND NOISE, VIBRATION 8

UNIT II EFFECTS OF NOISE, BLAST, VIBRATION, AND SHOCK ON PEOPLE 7

UNIT III TRANSPORTATION NOISE AND VIBRATION—SOURCES, PREDICTION, AND CONTROL 10

UNIT IV INTERIOR TRANSPORTATION NOISE AND VIBRATION SOURCES - PREDICTION AND CONTROL 10
Introduction to Interior Transportation Noise and Vibration Sources, Automobile, Bus, and Truck Interior Noise and Vibration Prediction and Control, Noise and Vibration in Off-Road Vehicle Interiors-Prediction and Control,
UNIT V  
NOISE AND VIBRATION TRANSDUCERS, ANALYSIS EQUIPMENT, SIGNAL PROCESSING, AND MEASURING TECHNIQUES


TOTAL : 45 PERIODS

OUTCOME:

- At the end of the course, the student will understand the sources, effects, prediction, control techniques, measurement techniques of noise, vibration pertain to an automobile.

TEXT BOOKS:

REFERENCES:

PR8071  
LEAN SIX SIGMA

OBJECTIVE:

- To gain insights about the importance of lean manufacturing and six sigma practices.

UNIT I  
LEAN & SIX SIGMA BACKGROUND AND FUNDAMENTALS

Historical Overview – Definition of quality – What is six sigma - TQM and Six sigma - lean manufacturing and six sigma- six sigma and process tolerance – Six sigma and cultural changes – six sigma capability – six sigma need assessments - implications of quality levels, Cost of Poor Quality (COPQ), Cost of Doing Nothing – assessment questions

UNIT II  
THE SCOPE OF TOOLS AND TECHNIQUES

UNIT III SIX SIGMA METHODOLOGIES
Design For Six Sigma (DFSS), Design For Six Sigma Method - Failure Mode Effect Analysis (FMEA), FMEA process - Risk Priority Number (RPN) - Six Sigma and Leadership, committed leadership – Change Acceleration Process (CAP) - Developing communication plan – Stakeholder.

UNIT IV SIX SIGMA IMPLEMENTATION AND CHALLENGES

UNIT V EVALUATION AND CONTINUOUS IMPROVEMENT METHODS
Evaluation strategy – the economics of six sigma quality, Return on six Sigma (ROSS), ROI, poor project estimates – continuous improvement – lean manufacturing – value, customer focus, Perfection, focus on waste, overproduction – waiting, inventory in process (IIP), processing waste, transportation, motion, making defective products, underutilizing people – Kaizen – 5S.

OUTCOMES:
Upon completion of this course student can able to
- Understand the fundamentals of Lean and Six sigma.
- Understand the tools and techniques used in analysis.
- Understand the six sigma methodologies.
- Understand the implementation and challenges in six sigma.
- Understand the evaluation and continuous improvement methods.

REFERENCES:
1. Forrest W. Breyfogle, III, James M. Cupello, Becki Meadows, Managing Six Sigma: A Practical
2. Fred Soleimannejad, Six Sigma, Basic Steps and Implementation, AuthorHouse, 2004

ME8099 ROBOTICS

OBJECTIVES:
- To understand the functions of the basic components of a Robot.
- To study the use of various types of End of Effector and Sensors
- To impart knowledge in Robot Kinematics and Programming
- To learn Robot safety issues and economics.

UNIT I FUNDAMENTALS OF ROBOT
Robot - Definition - Robot Anatomy - Co ordinate Systems, Work Envelope Types and Classification- Specifications-Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load- Robot Parts and their Functions-Need for Robots-Different Applications.
UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS
Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

UNIT III SENSORS AND MACHINE VISION

UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING
Forward Kinematics, Inverse Kinematics and Difference; Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of freedom (in 3 Dimension) Jacobians, Velocity and Forces-Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design-Derivations and problems. Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effector commands and simple Programs.

UNIT V IMPLEMENTATION AND ROBOT ECONOMICS
RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.

TOTAL: 45 PERIODS

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

CO1 Explain the concepts of industrial robots, classification, specifications and coordinate systems. Also summarize the need and application of robots in different sectors.

CO2 Illustrate the different types of robot drive systems as well as robot end effectors.

CO3 Apply the different sensors and image processing techniques in robotics to improve the ability of robots.

CO4 Develop robotic programs for different tasks and familiarize with the kinematics motions of robot.

CO5 Examine the implementation of robots in various industrial sectors and interpolate the economic analysis of robots.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To understand the fundamentals of composite material strength and its mechanical behavior
- Understanding the analysis of fiber reinforced Laminate design for different combinations of plies with different orientations of the fiber.
- Thermo-mechanical behavior and study of residual stresses in Laminates during processing.
- Implementation of Classical Laminate Theory (CLT) to study and analysis for residual stresses in an isotropic layered structure such as electronic chips.

UNIT I  INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS & MANUFACTURING  9

UNIT II  FLAT PLATE LAMINATE CONSTITUTE EQUATIONS  9

UNIT III  LAMINA STRENGTH ANALYSIS  9

UNIT IV  THERMAL ANALYSIS  9

UNIT V  ANALYSIS OF LAMINATED FLAT PLATES  9

TOTAL: 45 PERIODS

OUTCOMES:
Upon the completion of this course the students will be able to
CO1 Summarize the various types of Fibers, Equations and manufacturing methods for Composite materials
CO2 Derive Flat plate Laminate equations
CO3 Analyze Lamina strength
CO4 Analyze the thermal behavior of Composite laminates
CO5 Analyze Laminate flat plates
TEXT BOOKS:

REFERENCES:

GE8072 FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT L T P C
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 in to 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 9

UNIT II REQUIREMENTS AND SYSTEM DESIGN 9

95
UNIT III DESIGN AND TESTING 9

UNIT IV SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT 9

UNIT V BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY 9

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:

TOTAL: 45 PERIODS
OBJECTIVE:
• 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:

OBJECTIVE:
• The students are able to manage a transport fleet and their related activities for minimizing operational cost.

UNIT I
INTRODUCTION
Personnel management; objectives and functions of personnel management, psychology, sociology and their relevance to organization, personality problems. Selection process: job description, employment tests, interviewing, introduction to training objectives, advantages, methods of training, training procedure, psychological tests.
UNIT II TRANSPORT SYSTEMS 9
Introduction to various transport systems. Advantages of motor transport. Principal function of administrative, traffic, secretarial and engineering divisions. chain of responsibility, forms of ownership by state, municipality, public body and private undertakings.

UNIT III SCHEDULING AND FARE STRUCTURE 9
Principal features of operating costs for transport vehicles with examples of estimating the costs. Fare structure and method of drawing up of a fare table. Various types of fare collecting methods. Basic factors of bus scheduling. Problems on bus scheduling.

UNIT IV MOTOR VEHICLE ACT 9
Traffic signs, fitness certificate, registration requirements, permit insurance, constructional regulations, description of vehicle-tankers, tippers, delivery vans, recovery vans, Power wagons and fire fighting vehicles. Spread over, running time, test for competence to drive.

UNIT V MAINTENANCE 9
Preventive maintenance system in transport industry, tyre maintenance procedures. Causes for uneven tyre wear; remedies, maintenance procedure for better fuel economy, Design of bus depot layout.

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, students will
- Know about different aspects related to transport system and management.
- Features of scheduling, fixing the fares
- Know about the motor vehicle act and maintenance aspects of transport.

TEXT BOOKS:

REFERENCE:
1. Government Motor Vehicle Act, Publication on latest act to be used as on date

MG8091 ENTREPRENEURSHIP DEVELOPMENT L T P C
3 0 0 3

OBJECTIVE:
- To develop and strengthen entrepreneurial quality and motivation in students and to impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.

UNIT I ENTREPRENEURSHIP 9
UNIT II  MOTIVATION
Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.

UNIT III  BUSINESS

UNIT IV  FINANCING AND ACCOUNTING

UNIT V  SUPPORT TO ENTREPRENEURS

OUTCOME:
• Upon completion of the course, students will be able to gain knowledge and skills needed to run a business successfully.

TEXT BOOKS :

REFERENCES :

AT8009  AUTOMOTIVE SAFETY  L T P C
3 0 0 3

OBJECTIVE:
• At the end, the students will have good exposure to automotive safety aspects including the understanding of the various safety equipments.
UNIT I  INTRODUCTION 9
Design of the body for safety, energy equation, engine location, deceleration of vehicle inside passenger compartment, deceleration on impact with stationary and movable obstacle, concept of crumble zone, safety sandwich construction.

UNIT II  SAFETY CONCEPTS 9
Active safety: driving safety, conditional safety, perceptibility safety, operating safety, passive safety: exterior safety, interior safety, deformation behaviour of vehicle body, speed and acceleration characteristics of passenger compartment on impact.

UNIT III  SAFETY EQUIPMENTS 9
Seat belt, regulations, automatic seat belt tightener system, collapsible steering column, tiltable steering wheel, air bags, electronic system for activating air bags, bumper design for safety.

UNIT IV  COLLISION WARNING AND AVOIDANCE 9
Collision warning system, causes of rear end collision, frontal object detection, rear vehicle object detection system, object detection system with braking system interactions.

UNIT V  COMFORT AND CONVENIENCE SYSTEM 9
Steering and mirror adjustment, central locking system, Garage door opening system, tyre pressure control system, rain sensor system, environment information system

OUTCOME:
- The student will be familiar in various systems that enhances vehicle safety, passenger comfort, recent technologies in automobile field etc.,

TEXT BOOKS

REFERENCES:

AT8010  AUTOMOTIVE POLLUTION AND CONTROL  L T P C
3 0 0 3

OBJECTIVE:
- 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 6
UNIT II EMISSIONS IN SI ENGINE
Chemistry of SI engine combustion – HC and CO formation in SI engines – NO formation in SI engines – Smoke emissions from SI engines – Effect of operating variables on emission formation.

UNIT III EMISSIONS IN CI ENGINE
Basics of diesel combustion – Smoke emission and its types in diesel engines – NOx emission and its types from diesel engines – Particulate emission in diesel engines. Odor, sulfur and Aldehyde emissions from diesel engines – effect of operating variables on emission formation.

UNIT IV CONTROL TECHNIQUES FOR REDUCTION OF EMISSION

UNIT V TEST PROCEDURE, INSTRUMENTATION & EMISSION MEASUREMENT

TOTAL : 45 PERIODS

OUTCOME:
- Upon the completion of the course, the student will understand the fundamentals of formation of automobile pollutions in SI and CI Engines, various control techniques, test procedures etc.

TEXT BOOKS:

REFERENCES:
1. Automobiles and Pollution SAE Transaction, 1995

AT8011 AUTOMOTIVE TESTING

OBJECTIVES:
- To introduce the learners with the need for automotive testing methods and their importance.
- To equip them with knowledge in various testing standards and guidelines.

UNIT I VEHICLE WIND TUNNEL TESTING AND BODY TESTING
Wind tunnel test requirements - Ground boundary simulation - wind tunnel selection and Reynolds number capability, model details, mounting of model, Test procedure.
Body test - Dynamics simulation sled testing - Dolly roll over test - Dolly roll over fixture - vehicle roof strength test - Door system crash test.

UNIT II COLLISION AND CRASH TESTING
Crash testing: Human Testing, Dummies, Crash worthiness, pole crash testing, near crash testing, vehicle to vehicle impact, side impact testing, crash test sensor, sensor mounting positions, crash test data acquisition, braking distance test.

UNIT III TESTING OF WHEELS AND BRAKES
Wheels: Dynamic cornering fatigue, dynamic radial fatigue tests-procedures, bending moment and radial load calculations. Impact test - Road hazard impact test for wheel and tyre assemblies test procedures, Failure criteria and performance criteria.

UNIT IV ENERGY AND FUEL CONSUMPTION TESTING
Engine cooling fan, air conditioning and brake compressors, hydraulic pumps power consumptions, ABS energy consumption.
Test Route selection, vehicle test speeds, cargo, weights, driver selection, Tested data, finding and calculations. Test on rough terrain, Pot hole with laden and unladen conditions.

UNIT V VEHICLE COMPONENT RELATED TESTING

OUTCOMES:
At the end of the course, learners will be able to:
- Prepare the vehicle for testing according to standards
- Test the vehicle in static and dynamic conditions.
- Incorporate all the automotive testing regulations while testing a vehicle
- Test on effectiveness and efficiency of all the components
- Analyse the vehicle and report the results.

REFERENCES:
5. Automotive Handbook, Bosch.
   Website: www.mainindia.com/Draft, AIS standards. asp.
OBJECTIVE:
- To understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Manufacturing cost, Layout & Material Handling system.

UNIT I INTRODUCTION

UNIT II PRODUCTION PLANNING AND CONTROL AND COMPUTER AIDED PROCESS PLANNING

UNIT III CELLULAR MANUFACTURING

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

UNIT V INDUSTRIAL ROBOTICS

OUTCOMES:
Student will be able to
- Describe about the classical production system, the components of CIM.
- Explain the concept of Computer Aided Process Planning (CAPP) and Material Requirements Planning (MRP)
- Illustrate the cellular manufacturing using Rank order, Clustering and Hollier method
- Explain Flexible Manufacturing system and applications of Automated Guided Vehicles in the implementation of CIM.
- Describe the configurations of Industrial Robots, and their part programming.
- Understand the use of computers in various Manufacturing support systems.

TOTAL : 45 PERIODS
TEXT BOOKS:

REFERENCES:

AT8012 ALTERNATIVE FUELS AND ENERGY SYSTEMS L T P C
3 0 0 3

OBJECTIVE:
- To know about the types of alternative fuels and energy sources for IC engines.

UNIT I ALCOHOLS AS FUELS 9

UNIT II VEGETABLE OILS AS FUELS 9

UNIT III HYDROGEN AS ENGINE FUEL 9

UNIT IV BIOGAS, NATURAL GAS AND LPG AS FUELS 9
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.

UNIT V ELECTRIC, HYBRID AND FUEL CELL VEHICLES 9

TOTAL : 45 PERIODS
OUTCOME:
- On completion of the course, the student will understand the various alternative fuels available, its properties, performance characteristics, combustion characteristics, emission characteristics, engine modifications required etc.,

TEXT BOOK:

REFERENCES:
5. Transactions of SAE on Biofuels (Alcohols, vegetable oils, CNG, LPG, Hydrogen, Biogas etc.).

MG8591 PRINCIPLES OF MANAGEMENT

OBJECTIVE:
- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization.

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

UNIT II PLANNING 9

UNIT III ORGANISING 9

UNIT IV DIRECTING 9
UNIT V  CONTROLLING  9
System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

OUTCOME :
• Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

TEXT BOOKS:

REFERENCES:

GE8076  PROFESSIONAL ETHICS IN ENGINEERING  L T P C  3 0 0 3

OBJECTIVE:
• To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I  HUMAN VALUES  10

UNIT II  ENGINEERING ETHICS  9

UNIT III  ENGINEERING AS SOCIAL EXPERIMENTATION  9
Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.
UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS

UNIT V GLOBAL ISSUES

TOTAL: 45 PERIODS

OUTCOME:
• Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

TEXT BOOKS:

REFERENCES:

Web sources:
1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org