## ANNA UNIVERSITY, CHENNAI 600 025
### UNIVERSITY DEPARTMENTS
### R 2017
### B.E. (PART TIME) AUTOMOBILE ENGINEERING
### I TO VII SEMESTERS CURRICULUM AND SYLLABUS

### SEMESTER I

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<tr>
<td>14.</td>
<td>PTAU7011</td>
<td>Hydraulic and Pneumatics Systems</td>
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<td>15.</td>
<td>PTAU7012</td>
<td>Manufacturing of Automotive Components</td>
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<td>16.</td>
<td>PTAU7013</td>
<td>Metrology and Measurement System</td>
<td>3</td>
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<td>17.</td>
<td>PTAU7014</td>
<td>Noise, Vibration and Harshness</td>
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<td>18.</td>
<td>PTAU7015</td>
<td>Off Highway Vehicles</td>
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<td>19.</td>
<td>PTAU7016</td>
<td>Principles of Control Systems</td>
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<td>PTAU7017</td>
<td>Quality Control and Reliability</td>
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<td>21.</td>
<td>PTPR7001</td>
<td>Quantitative Techniques in Management</td>
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<td>22.</td>
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<td>Simulation of IC Engines</td>
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<td>Total Quality Management</td>
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<td>Two and Three Wheeler Technology</td>
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<td>Vehicle Air-Conditioning</td>
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<td>PTAU7021</td>
<td>Vehicle Maintenance</td>
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<td>27.</td>
<td>PTAU7022</td>
<td>Vehicle Multiplexing</td>
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<td>28.</td>
<td>PTAU7023</td>
<td>Virtual Instrumentation in Automobile Engineering</td>
<td>3</td>
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</table>
OBJECTIVES:
- To facilitate the understanding of the principles and to cultivate the art of formulating physical problems in the language of mathematics.

UNIT I MATRICES
Characteristic equation – Eigen values and Eigenvectors of a real matrix – Properties of eigen values and eigenvectors – Cayley Hamilton theorem – Diagonalization of matrices - Reduction of a quadratic form to canonical form by orthogonal transformation.

UNIT II FUNCTIONS OF SEVERAL VARIABLES

UNIT III ANALYTIC FUNCTION
Analytic functions – Necessary and sufficient conditions for analyticity – Properties – Harmonic conjugates – Construction of analytic function – Conformal Mapping – Mapping by functions \( w = a + z, az, 1/z \) - Bilinear transformation.

UNIT IV COMPLEX INTEGRATION

UNIT V LAPLACE TRANSFORMS

TOTAL: 45 PERIODS

OUTCOMES:
- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.
TEXT BOOK:

REFERENCES:

PTGE7151 COMPUTING TECHNIQUES
(Common to all branches of Engineering and Technology)  L  T  P  C  3 0 0 3

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

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

UNIT II C PROGRAMMING BASICS

UNIT III ARRAYS AND STRINGS

UNIT IV POINTERS
Macros - Storage classes –Basic concepts of Pointers– Pointer arithmetic - Example Problems - Basic file operations

UNIT V FUNCTIONS AND USER DEFINED DATA TYPES

TOTAL: 45 PERIODS
OUTCOMES
At the end of the course, the student should be able to:
  • Write C program for simple applications
  • Formulate algorithm for simple problems
  • Analyze different data types and arrays
  • Perform simple search and sort.
  • Use programming language to solve problems.

TEXT BOOKS:

REFERENCES:

PTGE7152 ENGINEERING MECHANICS

OBJECTIVE :

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

UNIT I  STATICS OF PARTICLES

UNIT II  EQUILIBRIUM OF RIGID BODIES

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

UNIT IV FRICTION

UNIT V DYNAMICS OF PARTICLES

L–45 TOTAL: 45 PERIODS

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

TEXT BOOK

REFERENCES

PTPH7152 MATERIALS SCIENCE
(Common to Manufacturing, Industrial, Mining, Aeronautical, Automobile and Production Engineering) 3 0 0 3

OBJECTIVE:
- 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 AND HEAT TREATMENT

UNIT III MECHANICAL PROPERTIES

UNIT IV MAGNETIC, DIELECTRIC AND SUPERCONDUCTING MATERIALS

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

TOTAL: 45 PERIODS

OUTCOME:
- Upon completion of this course, the students can be able to apply the different materials, their processing, and heat treatments in suitable application in mechanical engineering fields.

TEXT BOOKS:

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

UNIT I  CASTING PROCESSES  10

UNIT II  METAL FORMING PROCESSES  8

UNIT III  MACHINING PROCESSES  9
Machine and machine tool – construction, types operations in the following machines with block diagrams – Lathe, Milling, Drilling and Grinding – Concept of NC/CNC machines – Comparison of CNC with conventional machines – sample manual part programming for CNC Lathe and milling.

UNIT IV  WELDING PROCESSES  9

UNIT V  UNCONVENTIONAL MACHINING PROCESSES  9
Need for unconventional – Construction, working principle merits, demerits and applications with block diagram only for AJM, AWJM, USM, CHM, ECM, EDM, EBM, LBM, PAM and IBM.

TOTAL: 45 PERIODS

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

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

PTAU7201 AUTOMOTIVE PETROL ENGINES

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

UNIT I ENGINE CONSTRUCTION AND WORKING

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

UNIT III COOLING AND LUBRICATION SYSTEM

UNIT IV COMBUSTION AND COMBUSTION CHAMBERS

UNIT V TWO STROKE ENGINES

TOTAL : 45 PERIODS

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

TEXT BOOKS

REFERENCES

PTEI7205 ELECTRICAL AND ELECTRONICS ENGINEERING

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

UNIT I BASIC CONCEPTS AND D.C. CIRCUIT ANALYSIS
Ohm’s law - Ideal voltage and current sources-Independent sources -dependent sources-circuit elements - Kirchhoff’s law - voltage and current division in series and parallel circuits-Node and Mesh analysis - Star/Delta transformations- Thevenin’s , Norton’s and Super position theorem.

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

UNIT III ELECTRICAL MACHINES

UNIT IV ANALOG ELECTRONICS

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

TOTAL : 45 PERIODS
OUTCOMES

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

REFERENCES


PTAE7201 MECHANICS OF SOLIDS

OBJECTIVES

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

UNIT I STRESS-STRAIN – AXIAL LOADING

- Definition of stress and strain- Stress-Strain relation- Relation between material constants.-Bar under axial loading- Statically determinate and indeterminate cases – Thermal stress-Impact Loading

UNIT II STRESSES IN BEAMS

- Types of beams and loadings – Relation between shear force and bending moment - Shear force and bending moment diagrams – Euler beam theory - Bending stress in beams – Shear stress in beam – Composite beam.

UNIT III DEFLECTION OF BEAM


UNIT IV TORSION AND SPRINGS

- Shear stress and twist relation for circular section – Comparison of hollow shaft and solid shaft – Compound shaft – Power transmission by circular shafts – Springs – Deflection expression for close coiled helical spring – Stress in springs.
UNIT V  BIAXIAL STRESS
Thin walled cylinder under internal pressure – Principal stresses for general biaxial stress field – Mohr’s circle - Stresses in combined loading

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

TEXT BOOKS:

REFERENCES:

PTMA7251  NUMERICAL METHODS

OBJECTIVES:
- To provide the mathematical foundations of numerical techniques for solving linear system, eigen value problems, interpolation, numerical differentiation and integration and the errors associated with them;
- To demonstrate the utility of numerical techniques of ordinary and partial differential equations in solving engineering problems where analytical solutions are not readily available.

UNIT I  SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS
UNIT II  INTERPOLATION AND APPROXIMATION  9
Interpolation with unequal intervals - Lagrange interpolation – Newton’s divided difference interpolation – Cubic splines - Interpolation with equal intervals - Newton’s forward and backward difference formulae – Least square method - Linear curve fitting.

UNIT III  NUMERICAL DIFFERENTIATION AND INTEGRATION  9

UNIT IV  INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS  9

UNIT V  BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS  9
Finite difference methods for solving two - point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace’s and Poisson’s equations on rectangular domain – One dimensional heat - flow equation by explicit and implicit (Crank-Nicholson) methods - One dimensional wave equation by explicit method.

TOTAL : 45 PERIODS

OUT COMES :
- Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions.
- Apply numerical methods to obtain approximate solutions to mathematical problems.
- Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
- Analyse and evaluate the accuracy of common numerical methods.

TEXT BOOKS :

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

UNIT I  BASIC THERMODYNAMICS  09

UNIT II  AIR STANDARD CYCLES AND COMPRESSORS  09
Otto, Diesel, Dual combustion and Brayton cycles. Air standard efficiency. Mean effective pressure. Compressors, Classifications of compressors, Single stage and multi stage, Effect of intercooler in multi stage compressor, Perfect and imperfect intercooler, work done by the compressor, Reciprocating, Rotary, Axial, Vane compressors.

UNIT III  STEAM AND JET PROPULSION  10
Properties of steam, Dryness fraction, Quality of steam by steam tables and Mollier chart – Rankine cycle, Work done, Steam rate – Steam Nozzles, Types of nozzles, Friction in nozzles - Simple jet propulsion system – Thrust rocket motor – Specific impulse.

UNIT IV  REFRIGERATION AND AIR-CONDITIONING  08
Principles of refrigeration, Vapor compression – Vapor absorption types, comparison - Co-efficient of performance (COP), Properties of refrigerants – Basic Principle, Summer, winter and Year round Air conditioning.

UNIT V  HEAT AND MASS TRANSFER  09

TOTAL:45 PERIODS

(Use of standard Steam tables with mollier chart and Refrigerant tables are permitted)

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

TEXT BOOKS:
REFERENCES:

PTAU7301 AUTOMOTIVE CHASSIS L T P C 3 0 0 3
OBJECTIVES:
- The student shall gain appreciation and understanding function of front axle, types of stub axle, types of steering gear box, Shall be able to understand need of suspension and its types, types of tyre, tyre specification, tyre rotation, Student shall gain knowledge of design consideration braking system, suspension system and for chassis

UNIT I LAYOUT, FRAME, FRONT AXLE AND STEERING SYSTEM

UNIT II DRIVE LINE, FINAL DRIVE AND DIFFERENTIAL

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

UNIT IV SUSPENSION SYSTEM

UNIT V BRAKE SYSTEMS

16
OUTCOMES
- Ability to know the steering geometry, what should be the tyre pressure for different vehicle, which type of brakes are best for vehicle.
- Ability to recognize which safety systems are best for vehicle and also for safety consideration.

TEXT BOOKS

REFERENCES

PTAU7302 AUTOMOTIVE DIESEL ENGINES

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

UNIT I BASICS OF DIESEL ENGINES

UNIT II FUEL INJECTION IN DIESEL ENGINES

UNIT III AIR MOTION, COMBUSTION AND COMBUSTION CHAMBERS

UNIT IV SUPERCHARGING AND TURBOCHARGING

UNIT V ENGINE TESTING AND RECENT DEVELOPMENTS 9

TOTAL : 45 PERIODS

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

TEXT BOOKS

REFERENCES

PTAE7301 ENGINEERING FLUID MECHANICS AND MACHINERY L T P C
3 0 0 3

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

UNIT I INTRODUCTION 8
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 9
UNIT III  DIMENSIONAL ANALYSIS  
Need for dimensional analysis – methods of dimensional analysis – Similitude – types of similitude - Dimensionless parameters- application of dimensionless parameters – Model analysis.

UNIT IV  TURBINES  

UNIT V  PUMPS  

TOTAL: 45 PERIODS

OUTCOME:

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

TEXT BOOKS:

REFERENCES:

PTPR7301  KINEMATICS AND DYNAMICS OF MACHINES  L T P C
3 0 0 3

OBJECTIVE:

- To understand the basic concepts of mechanisms and machinery.

UNIT I  MECHANISMS  

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

UNIT IV VIBRATION

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

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

TEXT BOOKS:

REFERENCES:

PTAU7311 AUTOMOTIVE ENGINE AND CHASSIS
COMPONENTS LABORATORY

OBJECTIVES:
• To familiarize and train the students on the constructional arrangements of different engine system.
• Study of the following engines and its components by dismantling, comparing with recent engine components and assembling various parts.
• To familiarize and train the students on the constructional arrangements of different engine system.
LIST OF EXPERIMENT FOR AUTOMOTIVE ENGINE
1. Study the layout of chassis system
2. Study the layout of steering systems with different Steering gearboxes
3. Dismantling, study and Assembling of Transfer case
4. Dismantling, study and Assembling of Constant Velocity Joint(Front Axles )
5. Dismantling, study and Assembling of Clutch.
6. Dismantling, study and Assembling of sliding mesh gear box
7. Dismantling, study and Assembling of Constant mesh gear box
8. Dismantling, study and Assembling of Syncro mesh gear box
10. Study the Layout of Rear Axle.
11. Study the Layout of Braking system.
12. Study of different types of suspension system.
13. Study the Automatic transmission system.

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

TOTAL: 30 PERIODS

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

PTAU7401 AUTOMOTIVE ELECTRICAL AND ELECTRONICS SYSTEMS

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

UNIT I BATTERIES AND STARTING SYSTEM
Different types of Batteries – principle, rating, testing and charging. Starter motors characteristics, capacity requirements. Drive mechanisms. Starter switches.
UNIT I  CHARGING SYSTEM LIGHTING AND ACCESSORIES  9
DC Generators and Alternators their characteristics. Control unit – cut out, electronic
regulators. Vehicle interior lighting system. Vehicle exterior lighting system. Wiring
requirements. Lighting design. Dashboard instruments. Horn, trafficator.

UNIT III  ELECTRONIC IGNITION AND INJECTION SYSTEM  9
Spark plugs. Advance mechanisms. Different types of ignition systems. Electronic fuel
injection systems.

UNIT IV  SENSORS AND MICROPROCESSORS IN AUTOMOBILES  9
Basic sensor arrangements. Types of sensors – oxygen sensor, hot wire anemometer sensor,
vehicle speed sensor, detonation sensor, accelerometer sensor, crank position sensor.
Microprocessor and microcomputer controlled devices in automobiles such voice warning
system, travel information system, keyless entry system, automatic transmission system,
electronic steering system.

UNIT V  SAFETY SYSTEMS  8
Antilock braking system, air bag restraint system, voice warning system, seat belt system, road
navigation system, anti theft system.

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

REFERENCES:
2. Young.A.P., & Griffiths.L., Automobile Electrical Equipment, English Language Book Society
   & New Press, 1990

PTAU7402  AUTOMOTIVE TRANSMISSION  L T P C
3 0 0 3

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

UNIT I  CLUTCH  9
Requirement of transmission system, Types of transmission system, Clutches – Functions-
Types of clutches, construction and operation of Single plate, multi plate and Diaphragm spring
clutches.
UNIT II  GEAR BOX
Purpose of gear box. Construction and working principle of sliding, constant and synchromesh gear boxes. Problems on performance of automobile such as Resistance to motion, Ttractive effort, Engine speed & power and acceleration. Determination of gear box ratios for different vehicle applications.

UNIT III HYDRODYNAMIC TRANSMISSION

UNIT IV AUTOMATIC TRANSMISSION

UNIT V HYDROSTATIC DRIVE AND ELECTRIC DRIVE

TOTAL :45 PERIODS

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

TEXT BOOKS:

REFERENCES:
1. SAE Transactions 900550 & 930910.
OBJECTIVE
- To understand the basic of manufacturing of fuels and lubricants along with properties of fuels and lubricants for the design and operation of the I.C engines.

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

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

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

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

UNIT V  FUEL RATING  9

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

TEXT BOOKS:

REFERENCES

PTAU7411 AUTOMOTIVE ELECTRICAL AND ELECTRONICS LABORATORY

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

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

TOTAL : 45 PERIODS

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

PTAU7501 AUTOMOTIVE COMPONENTS DESIGN

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

UNIT I INTRODUCTION
UNIT II  DESIGN OF SHAFTS AND SPRINGS  9

UNIT III  DESIGN OF FLYWHEELS  9

UNIT IV  DESIGN OF BEARINGS  9
Types of bearings – Sliding contact bearings –Rolling contact bearings .Bearing life –Static load capacity – Dynamic load capacity – Bearing material – Boundary lubrication – Oil flow and temperature rise. Design of journal bearings - Ball and Roller bearings

UNIT V  GEAR DESIGN  9

OUTCOMES:
The students will be able
- To identify the design requirements for any specific components.
- To design transmission parts.
- To explain the requirements of flywheel.

TEXT BOOK

REFERENCES

PTAU7502  AUTOMOTIVE POLLUTION AND CONTROL  L T P C
3 0 0 3

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

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

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

UNIT IV  NOISE POLLUTION FROM AUTOMOBILES

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

TOTAL : 45 PERIODS

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

TEXT BOOKS:

REFERENCES:
3. SAE Transactions, Vehicle emission, 1982 (3 volumes).
OBJECTIVES:
- The main objective of this course is to impart knowledge in the construction of vehicle, aerodynamics, paneling of passenger car and commercial vehicle body design. At the end of the course the student will be well versed in the design and construction of external body of all types of vehicles such as car, light commercial vehicles and heavy commercial vehicles.

UNIT I CAR BODY DETAILS
Types of Car body - Saloon, convertibles, Limousine, Estate Van, Racing and Sports car – Visibility- regulations, driver’s visibility, improvement in visibility and tests for visibility. Driver seat design - Car body construction- Various panels in car bodies. Safety: Safety design, safety equipment for cars.

UNIT II BUS BODY DETAILS
Types of bus body: based on capacity, distance travelled and based on construction. – Bus body lay out, floor height, engine location, entrance and exit location. Types of metal sections used – Regulations – Constructional details: Conventional and integral.

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

UNIT IV VEHICLE AERODYNAMICS
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
Types and properties of materials used in body construction-Such as steel sheet, timber, plastics and GRP. Body trim items-body mechanisms. Hand tools-power tools for body repair. Vehicle corrosion-Anticorrosion methods-Modern painting process procedure.

TOTAL : 45 PERIODS

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

TEXT BOOKS:

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

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

TOTAL : 30 PERIODS

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

TEXT BOOK:

REFERENCES:
UNIT I  MODERN POWER PLANT AND POWER TRAIN  9
Modern Engine Technology like DTS - i, DTS – Fi, DTS – Si, VVT, Camless Engine, GDi, CRDi , Hybrid / Electric and Future Cars, Fuel Cell.

UNIT II  PASSIVE SAFETY EQUIPMENTS AND CONVENIENCE SYSTEM  9
Seat belt, Seat belt tighten system and importance , collapsible steering column. Air bags and its activation .Designing aspcets of automotive bumpers and materials for bumpers. Steering And mirror adjustment, central locking system, Tire pressure control system, rain sensor system, automated wiper system.

UNIT III  ACTIVE SAFETY  9
Antilock braking system, Stability Control. Adaptive cruise control, Lane Keep Assist System, Collision warning, avoidance system, Blind Spot Detection system, Driver alertness detection system.

UNIT IV  VEHICLE INTEGRATION  9
Vision enhancement, road recognition system, Looking out sensors and Looking in sensors, intelligent vision system, Vehicle Integration system. Anti theft technologies, smart card system, number plate coding. Locking system- Central locking system- acoustic signaling devices.

UNIT V  VEHICLE NAVIGATION SYSTEM  9

TOTAL : 45 PERIODS

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

Know about the rear vehicle detection system, and the braking system, the comfort and convenience system for the vehicle such as central

TEXT BOOKS:
REFERENCES:
4. ARAI Safety standards

PTAU7602       ELECTRONIC ENGINE MANAGEMENT SYSTEMS       L T P C
                                    3 0 0 3

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

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

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

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

UNIT IV  CI ENGINE MANAGEMENT

UNIT V  DIGITAL ENGINE CONTROL SYSTEM

TOTAL : 45 PERIODS

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

REFERENCES:

PTAU7611 VEHICLE TESTING LABORATORY

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

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

TOTAL : 30 PERIODS

OUTCOMES
• End of the course student would have deep practical knowledge on
OBJECTIVE:
- The objective of this course is to provide fundamental knowledge of the dynamics of ground vehicles, knowledge of suspension design and function, basic concepts on concerning stability and control and to study about basic analysis of vehicle dynamics in performance, handling and ride modes.

UNIT I  CONCEPT OF VIBRATION  

UNIT II  TYRES  

UNIT III  VERTICAL DYNAMICS  

UNIT IV  LONGITUDINAL DYNAMICS AND CONTROL  

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

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

TEXT BOOKS:
OBJECTIVES

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

UNIT I COMBUSTION OF FUELS

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

UNIT III COMBUSTION MODELLING

UNIT IV NON CONVENTIONAL IC ENGINES

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

TOTAL: 45 PERIODS
OUTCOMES:

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

TEXT BOOKS


REFERENCES


PTAU7002 ALTERNATIVE FUELS AND ENERGY SYSTEMS L T P C

3 0 0 3

OBJECTIVES

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

UNIT I INTRODUCTION TO ALTERNATIVE FUELS

Need for alternative fuels. World and Indian energy scenario on alternative fuels. Availability of different alternative fuels for SI and CI engines. Production technologies for biofuels for internal combustion engines- Pyrolysis, gasification, digestion.

UNIT II ALCOHOLS AS FUELS


UNIT III VEGETABLE OILS AS FUELS

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

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

TOTAL : 45 PERIODS

OUTCOMES

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

TEXT BOOKS

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

PTAU7003  AUTOMOTIVE AERODYNAMICS  
L  T  P  C  3  0  0  3

OBJECTIVE

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

UNIT I  BASICS OF FLUID DYNAMICS ON VEHICLE MOTION  
Importance of study - timeline developments -basics of fluid mechanics -flow phenomenon related to vehicles - external flow problem -various resistances to vehicle motion - performance, fuel consumption and traction force diagram of a passenger car.
UNIT II DRAG FRACTIONS AND LOCAL ORIGINS IN A PASSENGER CAR 9
Car as a bluff body - generation & transportation of vortices around car - types of aerodynamic drag forces & its contribution to total drag - analysis of aerodynamic drag at local origins - shape and detail optimization techniques with case studies.

UNIT III VEHICLE HANDLING 9
The origin of forces and moments on a vehicle - lateral stability problems - methods to calculate forces and moments – vehicle dynamics under side winds - the effects of forces and moments, dirt accumulation on the vehicle, wind noise. Add-ons to improve stability of road vehicles.

UNIT IV COMMERCIAL VEHICLE AERODYNAMICS 9
Tractive resistance & fuel consumption – Drag coefficients of various commercial Vehicles – Scope for reducing drag on commercial vehicles (Trucks with trailers and buses), Advantages of commercial vehicles aerodynamics & its effects – Vehicle soiling & its effects on driving.

UNIT V WIND TUNNELS FOR ROAD VEHICLES AERODYNAMICS 9
Need of a wind tunnel, principle of wind tunnel technology, problems with reduced scale models, full scale wind tunnels examples and case studies, instrumentation & measurement techniques, Introduction to numerical analysis (CFD).

TOTAL : 45 PERIODS

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

TEXT BOOKS:
1. R.H. Barnard - “Road vehicle aerodynamic design, An Introduction” , Mechaero publications, Third edition
3. Alan Pope, Jewel B. Barlow, William H. Rae “Low speed wind tunnel testing” , John Wiley & Sons Third edition

REFERENCES:

PTAU7004 AUTOMOTIVE AUTOMATION L T P C
3 0 0 3

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

UNIT I AUTOMATION IN AUTOMOBILE MANUFACTURING 9
UNIT II AUTOMATED MATERIAL HANDLING SYSTEMS
Automated assembly systems- Design principles and types – part feeding devices, automated material handling devices – conveyor systems- types and applications, AGVs – types and control applications ,rail guided vehicles-automated storage/retrieval systems-industrial robots-basic components-special features-applications.

UNIT III GROUP TECHNOLOGY AND FMS
Part families-visual-part classification and coding-production flow analysis, benefits of GT-FMS-workstations-FMS layouts configurations-computer control systems- planning the FMS- machine cell design-FMS application and benefits – automated work flow-automated flexible assembly systems.

UNIT IV AUTOMATED ASSEMBLY AND INSPECTION
Automated chassis assembly-car body assembly-engine assembly-transfer lines-visual inspection-machine visions application-CMM-types-principle and applications, industrial robots for assembly of automobile components-applications.

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

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

TEXT BOOKS:

REFERENCES:
UNIT I  ENGINEERING MATERIALS AND THEIR PROPERTIES

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

UNIT II  BASIS OF MATERIAL SELECTION


UNIT III  MATERIALS FOR ENGINES AND TRANSMISSION SYSTEMS

Materials selection for IC engines: Piston, piston rings, cylinder, Engine block, Connecting rod, Crank shaft, Fly wheels, Gear box, Gears, Splines, Clutches.

UNIT IV  MATERIALS FOR AUTOMOTIVE STRUCTURES

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

UNIT V  ELECTRONIC MATERIALS FOR AUTOMOTIVE APPLICATIONS

Materials for electronic devices meant for engine control, ABS, Steering, Suspension, Sensors, anti-collision, Anti-fog, Head lamps.

TOTAL: 45 PERIODS

OUTCOMES

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

TEXT BOOKS


REFERENCES

OBJECTIVES

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

UNIT I   MEASUREMENT SYSTEMS  9
Introduction to Measurement systems-static and dynamic measurement –closed and open loop system - Requirements and characteristics – Analysis of experimental detail. Error analysis

UNIT II   TRANSUDCERS, MODIFIERS AND TERMINATING DEVICES  9
Transducers for Automotive Applications – Amplifiers- filters –data Acquisition- Indicators, Printers and displays –Signal Analyzing.

UNIT III  MECHANICAL MEASUREMENT  9
Instrumentation for measuring Weight, Force, torque, pressure power, temperature, fluid flow, vibration, rotational speed, velocity, acceleration and angular motion.

UNIT IV ENGINE EXPERIMENTAL TECHNIQUES  9

UNIT V VEHICLE EXPERIMENTAL TECHNIQUES  9
Laboratory tests- Study of chassis dynamometer- test tracks - Endurance Tests- crash tests-Vehicle performance test – Brake tests.

TOTAL: 45 PERIODS

OUTCOMES

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

TEXT BOOKS


REFERENCES

1. A.W. Judge, Engineering Precision Measurement, Chapman and Hall Ltd, Essex Street W.C.,1951,
2. T.G. Beckwith and Buck, Mechanical Measurements, Oxford and IBH Publishing House, New Delhi, 1995
OBJECTIVES

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

UNIT I THERMODYNAMICS OF COMBUSTION

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

UNIT II CHEMICAL KINETICS OF COMBUSTION


UNIT III FLAMES

Laminar premixed – flame speed correlations- quenching, flammability, and ignition, flame stabilization, laminar diffusion flames, turbulent premixed flames-Reynolds and Damkohler numbers and their significance.

UNIT IV HEAT TRANSFER IN IC ENGINES


UNIT V EXPERIMENTS IN IC ENGINES

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

TOTAL : 45 PERIODS

OUTCOMES

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

TEXT BOOK


REFERENCES

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

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

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

UNIT III  CONVECTION HEAT TRANSFER BY FINITE DIFFERENCE METHOD AND FINITE VOLUME METHOD 10

UNIT IV  INCOMPRESSIBLE FLUID FLOW BY FINITE DIFFERENCE METHOD AND FINITE VOLUME METHOD 10
Governing Equations, Stream Function – Vorticity method, Determination of pressure for viscous flow, SIMPLE, Computation of Boundary layer flow - Finite difference approach.

UNIT V  FINITE ELEMENT METHOD AND TURBULENCE MODELS 5

TOTAL: 45 PERIODS

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

TEXT BOOKS:
REFERENCES:

PTAU7009 FINITE ELEMENT TECHNIQUES

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

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

UNIT II DISCRETE ELEMENTS

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

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

UNIT V FIELD PROBLEM

TOTAL: 45 PERIODS

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

REFERENCES:

PTAU7010 HYBRID AND ELECTRIC VEHICLES L T P C
3 0 0 3

OBJECTIVE :
- To understand the basic concept of Hybrid, Electric Vehicles , energy Storage devices and controls.

UNIT I INTRODUCTION TO NEED FOR ALTERNATIVE SYSTEM

UNIT II ENERGY STORAGE DEVICES AND FUELL CELLS
Electromechanical batteries- types of batteries –lead acid batteries, nickel based batteries, lithium based batteries, electrochemical reactions, thermodynamic voltage, specific energy, specific power, energy efficiency and ultra-capacitors.
Fuel Cell- Fuel cell characteristics- Fuel cell types-Hydrogen fuel cell- Connecting cell in series-water management in the PEM fuel cell- Thermal Management of the PEM fuel cell

UNIT III ELECTRIC VEHICLES
Electric vehicle layout, performance of electric vehicles – traction motor characteristics, tractive effort, transmission requirements, vehicle performance, energy consumption, advantage and limitations, specifications, system components, electronic control system, safety and challenges in electric vehicles.
UNIT IV  HYBRID VEHICLES  9
Concepts of hybrid electric drive train, types, architecture of series and parallel hybrid electric drive train, merits and demerits, hybrid electric drive train design, mild and full hybrids, plug-in hybrid electric vehicles and range extended hybrid electric vehicles.

UNIT V  PROPULSION MOTORS AND CONTROLLERS  9
Types of electric motors – working principle of AC and DC motors. Characteristic of shunt, series and compound type of DC motors- permanent magnet and separately exited DC motors. AC single phase and 3-phase motor – inverters – DC and AC motor speed controllers.

TOTAL : 45 PERIODS

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

TEXT BOOKS:

REFERENCES:

PTAU7011  HYDRAULIC AND PNEUMATICS SYSTEMS  L T P C
3 0 0 3

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

UNIT I  INTRODUCTION TO FLUID POWER  9
Introduction to fluid power control- Hydraulic and pneumatics- Selection criteria, application of fluid power, application of pascal’s law, equation, Transmission and multiplication of force pressure losses- fluids, selection and properties- ISO symbols

UNIT II  FLUID POWER DRIVES  9
Fluid power drives- Pumps- working principle and construction details of gear, vane and piston pumps, hydraulic motor, Hydrostatic transmission drives and characteristics - Hydraulic supply Components- Pneumatic power supply- Compressor, air distribution, air motors. Case study related to automotive application.

UNIT III  FLUID POWER ELEMENTS  9
UNIT IV  HYDRAULIC AND PNEUMATIC CIRCUITS DESIGN  9

UNIT V  ELECTRO PNEUMATICS AND PLC CIRCUITS  9
Use of electrical timers, switches, solenoid, relay, proximity sensors etc. Electro pneumatic sequencing Ladder diagram- PLC: – elements, function and selection- PLC programming- Ladder and different programming methods- Sequencing circuits. Case study related to automotive application.

TOTAL: 45 PERIODS

OUTCOMES:

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

TEXT BOOKS:

REFERENCES:

PTAU7012  MANUFACTURING OF AUTOMOTIVE COMPONENTS  L T P C
3 0 0 3

OBJECTIVE:

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

UNIT I  ENGINE COMPONENTS  9
UNIT II TRANSMISSION COMPONENTS

UNIT III BODY COMPONENTS

UNIT IV CHASSIS COMPONENTS

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

TOTAL: 45 PERIODS

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

TEXT BOOKS:

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

UNIT I  SCIENCE OF MEASUREMENT  8

UNIT II  LINEAR AND ANGULAR MEASUREMENT  8
Linear measuring instruments: Vernier, micrometer, interval measurement, Slip gauges and classification, interferometer, optical flats, limit gauges – Comparators: Mechanical, pneumatic and electrical types, applications.
Angular measurements:-Sine bar, optical bevel protractor, angle Decker–Taper measurements, coordinate measuring machine (CMM)

UNIT III  FORM MEASUREMENT  8

UNIT IV  PRESSURE, FORCE AND TORQUE MEASUREMENT  11
Bourdon tube, diaphragm, bellows and pressure capsules: Transducers used in pressure measurement – potentiometer, strain gauges, LVDT, capacitive and variable reluctance type transducers. Dynamic pressure measurement piezo electric and piezo resistive transducers. Farnboro engine indicator. Low pressure measurement – Mc leod gage, Pirani gauge, thermal conductivity type pressure measurement.
Force measuring devices – Balances, platform scales, weigh bridges, load cells, proving ring. Torque measurement – prony brake, rope brake and fan type brakes. Dynamometers – hydraulic, electric cradle and eddy current dynamometers.

UNIT V  MEASUREMENT OF TEMPERATURE AND FLOW  10

TOTAL: 45 PERIODS

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

REFERENCES:

PTAU7014

NOISE, VIBRATION AND HARSHNESS

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

UNIT I
FUNDAMENTALS OF NOISE, VIBRATION AND HARSHNESS

Theory of Sound—Predictions and Measurement, Sound Sources, Sound Propagation in the
Atmosphere, Sound Radiation from Structures and Their Response to Sound, General
Introduction to Vibration, Vibration of Simple Discrete and Continuous Systems, Random
Vibration, Response of Systems to Shock, Passive Damping.

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

General Introduction to Noise and Vibration Effects on People and Hearing Conservation, Sleep
Disturbance due to Transportation Noise Exposure, Noise-Induced Annoyance, Effects of
Infrasound, Low-Frequency Noise, and Ultrasound on People, Auditory Hazards of Impulse and
Impact Noise, Effects of Intense Noise on People and Hearing Loss, Effects of Vibration on
People, Effects of Mechanical Shock on People, Rating Measures, Descriptors, Criteria, and

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

Introduction to Transportation Noise and Vibration Sources, Internal Combustion Engine
Noise—Diesel and Gasoline Engines, Tire/Road Noise, Aerodynamic Sound Sources in
Vehicles, Transmission and Gearbox Noise and Vibration, Brake Noise. Introduction to Interior
Transportation Noise and Vibration Sources, Automobile, Bus, and Truck Interior Noise and
Vibration, Noise and Vibration in Off-Road Vehicle Interiors.

UNIT IV
ACOUSTICAL DESIGN OF MUFFLERS AND SILENCERS

Exhaust and Intake Noise in Diesel and Gasoline Engines - Electro-Acoustic Modeling, Transfer
Matrix Modeling, Simple Expansion Chamber, Extended Tube Expansion Chamber, Extended
Concentric Tube Resonator, Plug Muffler, Multiply Connected Muffler, Absorptive Ducts and
Mufflers, Combination Mufflers, Acoustic Source Characteristics of I.C. Engines, Designing for
Adequate Insertion Loss, Mufflers for High Pressure Vents and Safety Valves, Design of Muffler
Shell and End Plates, Helmholtz Resonators, Active Noise Control in a Duct and Pressure Drop
Considerations.
UNIT V  NOISE AND VIBRATION TRANSDUCERS ANALYSIS EQUIPMENT, SIGNAL PROCESSING, AND MEASURING TECHNIQUES.


TOTAL : 45 PERIODS

OUTCOMES:
At the end of this course the student should

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

TEXT BOOKS:

REFERENCES:

PTAU7015  OFF HIGHWAY VEHICLES

OBJECTIVE:
- The main objective of this course is to introduce the concept and principle of operation of special vehicles such as Bulldozers, Ditchers, Bucket excavators, farm equipments, military vehicles etc. At the end of the course, the students can have a better understanding of the application of the Off Highway Vehicle in the excavation of earth.
UNIT I  EARTH MOVING EQUIPMENTS
Construction layout, capacity and applications of earthmovers like dumpers, front-end loaders, bulldozers, backhoe loaders, scrappers, hydraulic shovels, Bucket conveyors etc. Selection criteria of prime mover for dumpers and front end loaders based on vehicle performance characteristics. Surface Miners – Highwall Miners, Off-Highway Mining Trucks.

UNIT II  CONSTRUCTIONAL EQUIPMENTS

UNIT III  FARM EQUIPMENTS

UNIT IV  INDUSTRIAL APPLICATIONS

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

TOTAL: 45 PERIODS

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

TEXT BOOKS:
2. SAE Handbook Volume III
REFERENCES:
1. B. Geleman and M. Moskovin, Farm tractors, MIR publishers, Moscow.

PTAU7016 PRINCIPLES OF CONTROL SYSTEMS

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

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

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

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

UNIT IV STABILITY OF CONTROL SYSTEM
6

UNIT V CONTROL SYSTEM DESIGN
9

TOTAL: 45 PERIODS

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

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

PTAU7017 QUALITY CONTROL AND RELIABILITY L T P C
3 0 0 3

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

UNIT I STATISTICAL PROCESS CONTROL

UNIT II ACCEPTANCE SAMPLING

UNIT III EXPERIMENTAL DESIGN AND TAGUCHI METHOD

UNIT IV RELIABILITY AND ITS PREDICTION

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

TOTAL : 45 PERIODS

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

TEXT BOOKS:

REFERENCES:

PTAU7018 SIMULATION OF IC ENGINES L T P C
3 0 0 3

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

UNIT I  INTRODUCTION TO SIMULATION 9

UNIT II  STOICHIOMETRY AND ADIABATIC FLAME TEMPERATURE 9
Reactive processes, Heat of reaction, measurement of URP, measurement of HRP. Introduction - combustion equation for hydrocarbon fuels. Calculation of minimum air, excess air and stoichiometric air required for combustion. Introduction, complete combustion in C-H-N-O systems, constant volume adiabatic combustion, constant pressure adiabatic combustion, calculation of adiabatic flame temperature, isentropic changes of state.

UNIT III  SI ENGINE SIMULATION 9
SI Engine simulation with air as working medium, deviation between actual and ideal cycle. Fuel air cycle analysis - Temperature drop due to fuel vaporization, full throttle operation, work output and efficiency calculation, part-throttle operation, engine performance at part throttle, super charged operation. SI Engines simulation with progressive combustion. Models for mass burnt fraction.

UNIT IV  SI ENGINE SIMULATION WITH GAS EXCHANGE PROCESS 9
Introduction, gas exchange process, Heat transfer process, friction calculations, compression of simulated values, validation of the computer code, engine performance simulation, pressure crank angle diagram, brake power, brake thermal efficiency, effect of speed on performance.
UNIT V CI ENGINE SIMULATION


OUTCOMES

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

TEXT BOOK


REFERENCES


PTAU7019 TWO AND THREE WHEELER TECHNOLOGY

OBJECTIVE:

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

UNIT I POWER UNIT


UNIT II FUEL AND IGNITION SYSTEM

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

UNIT III CHASSIS AND SUB – SYSTEMS

Main frame for two and three wheelers, its types, Chassis and different drive systems for two wheelers, Single, multiple plates and centrifugal clutches, Gear box and its and various gear controls in two wheelers. Front and rear suspension systems. Shock absorbers. Panel meters and controls on handle bar, Freewheeling devices.
UNIT IV  BRAKES AND WHEELS  9

UNIT V  TWO & THREE WHEELER CASE STUDY  9
Case study of Sports bike, Motor cycles, Scooters and Mopeds - Auto rickshaws, Pick up van, Delivery van and Trailer. Importance of maintenance – general maintenance schedule – Servicing of two and three wheeler – periodic checkups. Recent developments.

OUTCOMES
On successful completion of this course students will be able to:

- Explain the working of two and four stroke engines.
- Illustrate the functioning of clutch and gear box.
- Demonstrate the wheels, tyres, suspensions and braking systems.
- Identify the latest models of two wheelers.
- Define the operations of three wheelers and latest models of three wheelers

TEXT BOOK:

REFERENCES:
2. K. K. Ramalingam, Two Wheelers, Scitech publications, Chennai,

PTAU7020  VEHICLE AIR-CONDITIONING  L  T  P  C
3  0  0  3

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

UNIT I  AUTOMOTIVE AIR CONDITIONING FUNDAMENTALS  9
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  9
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 9
Types of Control devices- Preventing Compressor damage- Preventing damage to other systems- Maintaining drive ability- Preventing Overheating Ram air ventilation- Air delivery Components- Control devices- Vacuum Controls Containers – Handling refrigerants – Discharging, Charging & Leak detection – Refrigeration system diagnosis – Diagnostic procedure – Ambient conditions affecting system pressures.

UNIT IV AUTOMATIC TEMPERATURE CONTROL 9
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 9
Special tools for servicing vehicle air conditioning – Diagnosing components and air conditioning systems- Diagnosing cooling system- Air delivery system- Automatic temperature Control system diagnosis and service

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:

OBJECTIVE:
• To impart the knowledge on basics of vehicle maintenance and maintenance of engine subsystems and drive line components.
UNIT I  MAINTENANCE, WORKSHOP PRACTICES, SAFETY AND TOOLS  
Maintenance – Need, importance, classification of maintenance, basic problem diagnosis. 
Automotive service procedures – workshop operations – Safety – Personnel, machines and 
equipment, vehicles, fire safety - First aid. Basic tools – special service tools – measuring 
instruments.

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

UNIT III  TRANSMISSION AND DRIVELINE MAINTENANCE  
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  
Maintenance and Service of steering system-Inspection, Maintenance and Service of brake 
system- Drum brake, Disc brake, Parking brake. Bleeding of brakes. Inspection, Maintenance 
and Service of Mc person strut, coil spring, leaf spring, shock absorbers-Dismantling and 
assembly procedures. Wheel alignment and balance, removing and fitting of tyres, tyre wear 
and tyre rotation. Inspection,

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

TOTAL : 45 PERIODS

OUTCOMES
End of the course student would have deep knowledge on

- Important of Vehicle maintenance  
- Service procedure of engine and subsystems  
- Service procedure of drive line  
- Maintenance of electrical and air conditioning system

TEXT BOOKS
Publications, 2007

REFERENCES
2. Vehicle Service Manuals of manufacturers
OBJECTIVE:
- The objective of the course is to impart knowledge in the areas of vehicle networking, various vehicle networking standards and multiplexing buses.

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

UNIT II - VARIOUS MULTIPLEXING LEVEL

UNIT III - MULTIPLEXING STANDARDS

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

UNIT V - NEW MULTIPLEXED BUS CONCEPTS
LIN – Local Interconnect Network - Think 'Bus', think 'Fail-safe SBC', 'Gateways' - Safe-by-Wire - Audio-video buses

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

TEXT BOOKS:
OBJECTIVE:
- To learn and understand the programming, data acquisition hardware and implementing small automotive related projects in virtual instrumentation.

UNIT I  INTRODUCTION 9
Virtual Instrumentation-Definition and flexibility-Block diagram and Architecture of Virtual Instrumentation- Virtual instruments versus Traditional Instruments- Review of software in virtual Instrumentation- VI programming techniques- VI, sub VI, Loops and charts, Arrays, Clusters and Graphs, Case and Sequence Structures, Formula nodes, string and File Input / Output.

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

UNIT III  COMMUNICATION NETWORKED MODULES 9

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

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

TOTAL : 45 PERIODS

TEXT BOOKS:

REFERENCES:
OBJECTIVE:

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

UNIT I  LINEAR PROGRAMMING  12

UNIT II  REPLACEMENT MODELS AND GAME THEORY  12

UNIT III  QUEUING MODELS AND SIMULATION  12

UNIT IV  FORECASTING, SEQUENCING AND LINE BALANCING  12

UNIT V  PROJECT NETWORK ANALYSIS AND DECISION TREE ANALYSIS  12
Network – CPM/PERT – Project time estimation – critical path – crashing of network, Decision tree analysis – applications

TOTAL: 60 PERIODS

OUTCOME:

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

TEXT BOOKS:


REFERENCES:

OBJECTIVES:

- To 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 stakeholders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies

UNIT III  INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT
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.

TOTAL: 45 PERIODS

OUTCOMES:
The students will be able to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarious in the Indian context,
- Disaster damage assessment and management.
TEXT BOOKS:
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management,
   NIDM, New Delhi, 2011
   New Delhi, 2010.

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

PTGE7072 ENGINEERING ETHICS AND HUMAN VALUES L T P C
3 0 0 3

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

UNIT I HUMAN VALUES

UNIT II ENGINEERING ETHICS

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

UNIT IV ENGINEER’S RIGHTS AND RESPONSIBILITIES ON SAFETY

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

TOTAL : 45 PERIODS
OUTCOMES

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

TEXT BOOKS

REFERENCES

PTGE7073 HUMAN RIGHTS L T P C
3 0 0 3

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

UNIT I

UNIT II

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

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

UNIT V

TOTAL : 45 PERIODS
OUTCOME:
- Engineering students will acquire the basic knowledge of human rights.

REFERENCES:

PTGE7074 TOTAL QUALITY MANAGEMENT

L T P C 3 0 0 3

AIM
- To provide comprehensive knowledge about the principles, practices, tools and techniques of Total quality management.

OBJECTIVES
- To understand the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
- To understand the TQM Principles.
- To learn and apply the various tools and techniques of TQM.
- To understand and apply QMS and EMS in any organization.

UNIT I INTRODUCTION
Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality - Definition of TQM - Basic concepts of TQM - Gurus of TQM (Brief introduction) - TQM Framework - Barriers to TQM - Benefits of TQM.

UNIT II TQM PRINCIPLES

UNIT III TQM TOOLS & TECHNIQUES I

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


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

TEXT BOOK:

REFERENCES:

PTGE7075 INTELLECTUAL PROPERTY RIGHTS

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

UNIT I INTRODUCTION
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
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

UNIT IV DIGITAL PRODUCTS AND LAW
UNIT V  ENFORCEMENT OF IPRs  
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  

PTGE7076  FUNDAMENTALS OF NANO SCIENCE  
L T P C  
3 0 0 3  

OBJECTIVES:  
- To learn about basis of nanomaterial science, preparation method, types and application  

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

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

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

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

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

TEXT BOOKS

REFERENCES