THE VISION OF THE DEPARTMENT OF AUTOMOBILE ENGINEERING IS:

“To be a premier department in Automobile engineering and reach the highest academic level in the field of Automobile Engineering by imparting knowledge, continuously enhancing Research & Development activities, supporting industries through consultancy programme and providing the nation with high quality engineers”

THE MISSION OF THE DEPARTMENT OF AUTOMOBILE ENGINEERING IS:

1. To prepare students excel in their chosen professions by offering high quality education in automobile engineering with fundamental knowledge, interdisciplinary problem-solving skills and confidence required.
2. To provide supportive and diverse environment that encourage students to achieve the best of their abilities to be innovators or job providers.
3. To maintain constant and active partnership with industries for technology development and transfer through consultancy projects.
PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

Students will
i. Excel in their professional career in automobile industry.
ii. Exhibit research with highest professional and ethical standards.
iii. Acquire knowledge in basics of automobile engineering to apply in growth of the industry.
iv. Showcase professionalism, team work in their chosen profession and
v. Update themselves to recent trends, technologies and industrial scenarios by pursuing lifelong learning.

PROGRAMME OUTCOMES (POs)

After completion of their Under Graduate Program in Automobile Engineering, the graduates will demonstrate ability to:

<table>
<thead>
<tr>
<th>POs</th>
<th>Graduate Attribute</th>
<th>Programme Outcome</th>
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<tbody>
<tr>
<td>1.</td>
<td>Engineering knowledge</td>
<td>Express strong basics skills in Mathematics, Science and Engineering.</td>
</tr>
<tr>
<td>2.</td>
<td>Problem analysis</td>
<td>Design and conduct Experiments, as well as to analyze and interpret data.</td>
</tr>
<tr>
<td>3.</td>
<td>Design/development of solutions</td>
<td>Design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and Safety, manufacturability and sustainability.</td>
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<tr>
<td>4.</td>
<td>Conduct investigations of complex problems</td>
<td>acquire the capability to identify, formulate and solve complex engineering problems related to Automobile Engineering</td>
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<tr>
<td>5.</td>
<td>Modern tool usage</td>
<td>Become familiar with modern engineering tools and analyze the problems within the domains of Automobile Engineering as the members of multidisciplinary teams.</td>
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<tr>
<td>6.</td>
<td>The engineer and society</td>
<td>Understand and work for the impact of development of Automobile engineering on global, economic environment and societal context.</td>
</tr>
<tr>
<td>7.</td>
<td>Environment and sustainability</td>
<td>Design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.</td>
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<tr>
<td>8.</td>
<td>Ethics</td>
<td>Understand the professional and ethical responsibility with reference to their career in the field of Automobile Engineering</td>
</tr>
<tr>
<td>9.</td>
<td>Individual and team work</td>
<td>Work as team player or individual in solving their assigned task.</td>
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<tr>
<td>10.</td>
<td>Communication</td>
<td>Communicate effectively both in verbal non-verbal forms.</td>
</tr>
<tr>
<td>11.</td>
<td>Project management and finance</td>
<td>Understand engineering and management principles to apply for (his/her) own work and team. Manage projects in multidisciplinary environments with financial concise.</td>
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<td>12.</td>
<td>Life-long learning</td>
<td>Pursue higher studies and do research in inter and multidisciplinary fields for continuous learning lifestyle.</td>
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## Mapping of PEOs with POs

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*Attested*
| YEAR 2 | SEM III | Engine Management Systems | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
|YEAR 2 | SEM III | Elective – IV | |
|YEAR 2 | SEM III | Elective – V | |
|YEAR 2 | SEM III | Open Elective | |
|YEAR 2 | SEM III | Dissertation - I | |
|YEAR 2 | SEM IV | Dissertation - II | |

<p>| ELECTIVES |</p>
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# M.E. AUTOMOBILE ENGINEERING (FT and PT) UNIVERSITY DEPARTMENTS REGULATIONS - 2019

## CHOICE BASED CREDIT SYSTEM

### I TO IV SEMESTERS CURRICULUM AND SYLLABUS

#### SEMESTER I

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**TOTAL** 19 2 8 29 23

* Audit Course is optional.

#### SEMESTER II

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* Audit Course is optional.
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**TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE - 74**
## SEMESTER I

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* Audit Course is optional.

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### OPEN ELECTIVE COURSES [OEC]
(Out of 6 Courses one Course must be selected)

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### AUDIT COURSES (AC)
Registration for any of these courses is optional to students

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MA5154 ADVANCED NUMERICAL METHODS

L T P C
3 1 0 4

OBJECTIVES:
- To impart knowledge in understanding the advantages of various solution procedures of solving the system of linear and nonlinear equations.
- To give a clear picture about the solution methods for solving the BVPs and the system of IVPs.
- To acquire knowledge in solving time dependent one and two dimensional parabolic PDEs by using various methodologies.
- To strengthen the knowledge of finite difference methods for solving elliptic equations.
- To get exposed to the ideas of solving PDEs by finite element method.

UNIT I ALGEBRAIC EQUATIONS
12

UNIT II ORDINARY DIFFERENTIAL EQUATIONS
12
Runge Kutta Methods for system of IVPs, numerical stability, Adams-Bashforth multistep method, solution of stiff ODEs, shooting method, BVP: Finite difference method, collocation method, orthogonal collocation method, Galerkin finite element method.

UNIT III FINITE DIFFERENCE METHOD FOR TIME DEPENDENT PARTIAL DIFFERENTIAL EQUATION
12

UNIT IV FINITE DIFFERENCE METHODS FOR ELLIPTIC EQUATIONS
12
Laplace and Poisson’s equations in a rectangular region: Five point finite difference schemes, Leibmann’s iterative methods, Dirichlet and Neumann conditions – Laplace equation in polar coordinates: finite difference schemes – approximation of derivatives near a curved boundary while using a square mesh.

UNIT V FINITE ELEMENT METHOD
12

TOTAL: 60 PERIODS

OUTCOMES:
At the end of the course, students will be able to
- Get familiarized with the methods which are required for solving system of linear, nonlinear equations and eigenvalue problems.
- Solve the BVPs and the system of IVPs by appropriate methods discussed.
- Solve time dependent parabolic PDEs by using various methodologies up to dimension two.
- Solve elliptic equations by finite difference methods.
- Use the ideas of solving PDEs by finite element method.
REFERENCES:

AM5101 AUTOMOTIVE CHASSIS  L T P C  3 1 0 4

OBJECTIVES:
- To understand the basic knowledge about various vehicle frames, front axles, steering systems and understand the conditions for true rolling motion of wheels during steering.
- To recognize the construction and working principle of drive line, final drive and differential systems
- To review the knowledge about the constructional feature of rear axle, wheels and tyres.
- To evaluate the working principles of both conventional and independent suspension system.
- To demonstrate working principle of braking system used in automobile.

UNIT I LAYOUT, FRAME, FRONT AXLE AND STEERING SYSTEM  12

UNIT II DRIVE LINE, FINAL DRIVE AND DIFFERENTIAL  12

UNIT III REAR AXLES, WHEELS, RIMS AND TYRES  12
UNIT IV  SUSPENSION SYSTEM  12

UNIT V  BRAKING SYSTEM  12

OUTCOMES:
At the end of this course the student will be able to
• Identify the different types of frame and chassis used in Automotive.
• Relate different types of drive lines and drives used in Automotive.
• Acquire knowledge about different types of front axle and rear axles used in motor vehicles.
• Examine the working principle of conventional and independent suspension systems.
• Apply knowledge on working principles of brake and its subsystems.

REFERENCES

AM5102  ENGINE AND AUXILLARY SYSTEMS  L T P C
3 0 0 3

OBJECTIVES:
• To impart knowledge on engine operation and its constructional details
• Understand various subsystems involved in engine operation
• To impart knowledge to design and analyse engine operating parameters like air fuel ratio, injection parameters etc
• Understand the concept of combustion and its effects under various conditions
• To impart knowledge on recent developments on IC engines.

UNIT I  ENGINE BASIC THEORY  9
Introduction - Engine types – Operating cycle - otto, diesel, dual operating cycles – Fuel air cycle and actual cycles — Two and four stroke engines - Engine design and operating parameters - Typical performance and pollution curves for automobile engines.
UNIT II FUEL SUPPLY AND IGNITION SYSTEMS 9
Objective and theory of carburetion - carburetors, Types, Additional system and modern devices of carburetor — Calculation of air fuel ratio of carburetor - Diesel fuel injection objective and types - pumps and injectors, Introduction to Petrol Injection system - conventional ignition systems, advance mechanisms.

UNIT III AIR MOTION, COMBUSTION AND COMBUSTION CHAMBERS 9

UNIT IV ENGINE COOLING, LUBRICATING SYSTEMS AND SUPERCHARGING, TURBOCHARGING 9

UNIT V NEW ENGINE TECHNOLOGY 9

TOTAL : 45 PERIODS

OUTCOMES:
• Students will have the basic knowledge on Automotive Engines and its various sub systems along with its functions.
• Student can able to design and solve engine related problems
• Student will have command knowledge over recent development in the area of internal combustion engines.
• Student can apply their knowledge to analyse and correlate the data with recent requirements of automobile industry
• Student to can explore new alternate fuels or energy system to run the automobile

REFERENCES:
OBJECTIVES:
- To impart knowledge on detailed concept, construction and principle of operation of various types of mechanical transmission components
- To design various transmission components like clutch and gear box
- To expose recent developments of automobile transmission
- To design and select Hydrodynamic Transmission for various applications
- To understand Electric drive used in road vehicles automatic transmission system.

UNIT I CLUTCH

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

UNIT III HYDRODYNAMIC TRANSMISSION

UNIT IV HYDROSTATIC DRIVE

UNIT V AUTOMATIC TRANSMISSION AND ELECTRIC DRIVE

OUTCOMES:
- Acquire knowledge in detailed concept, construction and principle of clutches.
- Understand the concept, construction and principle of gear box
- Examine the usage of Hydrodynamic devices, hydrostatic devices, automatic transmission system
- Apply a knowledge on hydrostatic devices
- Understand Electric drive used in road vehicles automatic transmission system.

REFERENCES:
COURSE OBJECTIVES:
To impart knowledge and skills required for research and IPR:
- Problem formulation, analysis and solutions.
- Technical paper writing / presentation without violating professional ethics
- Patent drafting and filing patents.

UNIT I RESEARCH PROBLEM FORMULATION 6
Meaning of research problem- Sources of research problem, criteria characteristics of a good research problem, errors in selecting a research problem, scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, necessary instrumentations

UNIT II LITERATURE REVIEW 6
Effective literature studies approaches, analysis, plagiarism, and research ethics.

UNIT III TECHNICAL WRITING / PRESENTATION 6
Effective technical writing, how to write report, paper, developing a research proposal, format of research proposal, a presentation and assessment by a review committee.

UNIT IV INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS (IPR) 6

UNIT V INTELLECTUAL PROPERTY RIGHTS (IPR) 6

TOTAL: 30 PERIODS

COURSE OUTCOMES:
1. Ability to formulate research problem
2. Ability to carry out research analysis
3. Ability to follow research ethics
4. Ability to understand that today’s world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity
5. Ability to understand about IPR and filing patents in R & D.

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REFERENCES:
OBJECTIVES:
- To assemble and disassemble the parts of an IC engine.
- To identify the various components of an IC engine.
- To identify the various components in transmission systems of an automobile.
- To assemble and disassemble the various components of transmission systems.

LIST OF EXPERIMENTS
1. To assemble and disassemble 1000CC engine
2. To assemble and disassemble six cylinder engine
3. To assemble and disassemble V8 engine
4. To assemble and disassemble CRDI engine
5. To assemble and disassemble MPFI engine
6. To assemble and disassemble Single plate, Diaphragm Clutch.
7. To assemble and disassemble Constant mesh, Sliding mesh gear box
8. To assemble and disassemble Transfer case
9. To assemble and disassemble Differential, Rear axle
10. To assemble and disassemble Front axle.
11. To Study different chassis layouts
12. To Study braking system
13. To Study steering system
14. To Study Suspension system

TOTAL: 60 PERIODS

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

OBJECTIVES:
- To familiarize the students to use modeling software for modelling engine components
- To design chassis components with dimensions and strength requirements.
- To learn the use of standard practices in modeling of components.
- The use of modeling software to control the quality of the final engineered product.
- To visualize the complete assembly of the various system.

LIST OF ENGINE DESIGN EXPERIMENTS
1. Design and modelling of piston, piston pin and piston rings.
2. Design modelling of the connecting rod assembly.
3. Design of crankshaft, balancing weight calculations and modelling of the crankshaft assembly.
4. Design and modelling of flywheel
5. Design and modelling of the inlet and exhaust valves.
6. Design and modelling of cam and camshaft.
7. Design and modelling of combustion chamber.
LIST OF CHASSIS DESIGN EXPERIMENTS
8. Design and modelling of frame
10. Design and modelling of constant mesh gearbox
11. Design and modelling of sliding mesh gearbox
13. Design and modelling of rear axle

TOTAL: 60 PERIODS

OUTCOMES:
Students will be able to
- visualize the automotive components with the help of modelling software.
- make the modifications instantly if required at the initial stage itself
- synthesize, analyse and document the design of the various components

AM5201 VEHICLE BODY ENGINEERING
L T P C
3 0 0 3

OBJECTIVES:
- To acquire knowledge on Different aspects of car body,
- To acquire knowledge on bus body and commercial vehicle bodies.
- To acquire knowledge on Role of various aerodynamic forces and moments, measuring instruments in vehicle body design.
- To acquire knowledge on Material used in body building,
- To acquire knowledge on Tools used in body repairs and command over vehicle body engineering applications.

UNIT I CAR BODY DETAILS
Types of Car body - Saloon, convertibles, Limousine, Estate Van, Racing and Sports car—car body terminology - 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. AIS and SAE car body Regulations

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

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 balance.
UNIT V BODY MATERIALS, TRIM, MECHANISMS AND BODY REPAIR


TOTAL : 45 PERIODS

OUTCOMES:
Upon completion of the course, students will acquire knowledge on
- Different aspects of car body,
- bus body and commercial vehicle bodies.
- Role of various aerodynamic forces and moments, measuring instruments in vehicle body design.
- Material used in body building,
- Tools used in body repairs and command over vehicle body engineering applications.

REFERENCES:

AM5202 AUTOMOTIVE ENGINE POLLUTION AND ITS CONTROL

OBJECTIVES:
- To discuss the harmful effects of major pollutants on living beings and the environment
- To analyse the formation of major pollutants like UBHC, CO, NOx, particulate matter and smoke.
- To design various control techniques to reduce pollutants in combustion
- To determine the various after treatment process to minimize emissions
- To demonstrate the various devices used to measure pollutants and discuss the Emission standards followed in various nations

UNIT I EMISSION FROM AUTOMOBILES

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 analysers —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
- Differentiate the various emissions formed in IC engines
- Analyze the effects of pollution on human health and environment
- Design the control techniques for minimizing emissions
- Categorize the emission norms
- Identify suitable methods to reduce the noise emissions.

REFERENCES

AM5203  DYNAMICS OF ROAD VEHICLE  L T P C
3 0 0 3

OBJECTIVES:
- To provide fundamental knowledge of the dynamics of ground vehicles,
- To impart knowledge of suspension design and function,
- To provide basic concepts on concerning stability and control
- To understand basic analysis of vehicle dynamics in performance, handling and ride modes.
- To Evaluate the longitudinal dynamics and control in a automobile
UNIT I  CONCEPT OF VIBRATION  9
Definitions, Modeling and Simulation, Global and Vehicle Coordinate System, Free, Forced,
Undamped and Damped Vibration, Response Analysis of Single DOF, Two DOF, Multi DOF,
Magnification factor, Transmissibility ratio, Base excitation. Vibration absorber, Vibration measuring
instruments, Torsional vibration, Critical speed

UNIT II  TYRES  9
Tyre axis system, tyre forces and moments, tyre marking, tyre structure, hydroplaning, wheel and rim.
Rolling resistance, factors affecting rolling resistance, Longitudinal and Lateral force at various slip
angles, Ttractive and cornering property of tire. Performance of tire on wet surface. Ride property of
tyres. Various test carried on a tyre.

UNIT III  VERTICAL DYNAMICS  9
Human response to vibration, Sources of Vibration. Suspension requirements – types. State Space
Representation. Design and analysis of Passive, Semiactive and Active suspension using Quarter
car, Bicycle Model, Half car and full car vibrating model. Influence of suspension stiffness, suspension
damping, and tire stiffness. Control law. Suspension optimization techniques. Air suspension system
and their properties.

UNIT IV  LONGITUDINAL DYNAMICS AND CONTROL  9
Aerodynamic forces and moments. Equation of motion. Load distribution for three-wheeler and four-
wheeler. Calculation of maximum acceleration, ttractive effort and reaction forces for different drive
vehicles. Power limited acceleration and traction limited acceleration. Estimation of CG location.
Stability of vehicles resting on slope. Driveline dynamics. Braking and Driving torque. Prediction of
Vehicle performance. ABS, stability control, Traction control.

UNIT V  LATERAL DYNAMICS  9
Steady state handling characteristics. Steady state response to steering input – Yaw velocity gain,
Lateral acceleration gain, curvature response gain. Testing of handling characteristics. Transient
Stability of vehicle on banked road, during turn. Effect of suspension on cornering. Minuro Plot for
Lateral Transient Response.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the courses, the students can able to
1. Develop physical and mathematical models to predict the dynamic response of vehicles
2. Apply vehicle design performance criteria and how to use the criteria to evaluate vehicle dynamic
response
3. Use dynamic analyses in the design of vehicles.
4. Understand the principle behind the lateral dynamics.
5. Evaluate the longitudinal dynamics and control in a automobile

REFERENCES:
   2014
   Elsevier Limited, 2004
OBJECTIVES:
- To impart knowledge in automotive Emission measurement and methods of testing engines.
- To categorize the different measuring techniques of pollutants like UBHC, CO, NOx, CO2 and smoke.
- To investigate the performance and combustion parameters for different engine models.
- To learn removal and fitting of automotive accessories.
- To understand the adjustment of play in various automobile components.

LIST OF EXPERIMENTS ON ENGINE TESTING:
1. Performance test and study on SI engine.
2. Performance test and study on diesel engine.
3. Determine the Frictional power by motoring test on petrol engines.
4. Heat balance test on Diesel engine.
5. Determination of Volumetric efficiency on diesel Engine.
6. Retardation Test On 4-Stroke, Single Cylinder Diesel Engine Test Rig.
7. Morse test to determine Indicated power for multi-cylinder SI Engine.

LIST OF EXPERIMENTS ON VEHICLE TESTING:
1. Tightening and adjustment of wheel bearing.
2. Adjustment of pedal play in clutch, brake, hand brake lever and steering wheel orientation.
3. Wheel alignment in four wheelers.
4. Service of transmission, braking and suspension systems.
5. Fault diagnosis and service of Electrical system like battery, starting system, charging system, lighting system.
6. Work on body and paint shop.

TOTAL: 60 PERIODS

OUTCOMES:
At the end of the course the student will be able to:
- Analysis of combustion parameters
- Differentiate the variation performance parameters of diesel engines
- Differentiate the variation performance parameters of diesel engines
- Learn removal and fitting of automotive accessories
- Understand the adjustment of play in various automobile components.

OBJECTIVE:
To import the knowledge in the area of automotive electrical system and electronic system associated in modern vehicles.

LIST OF EXPERIMENTS:
1. Testing of
   a. battery
   b. starting systems
   c. charging systems
   d. ignition systems
   e. body controller systems
2. Study of a. automotive lighting system and adjustment of head lights beam
   a. major electrical components used in modern vehicles
   b. diagnostic tool used in vehicle

3. Dismantling, testing and assembling of Starter system components

4. Dismantling, testing and assembling of charging system components

5. Basic Analog Experiments like
   a. Logic gates, Adders, Flip flops
   b. Amplifier, filter,
   c. Multiplexer and De-multiplexer

6. Interfacing seven segment displays

7. Microprocessor and microcontroller programming
   a. Arithmetic and Logic operation,
   b. Code conversion,
   c. Waveform generation,
   d. Look up table

8. Interfacing ADC and DAC for Data Acquisition and Control Application

9. Interfacing Sensors for Measurements of position, displacement, velocity, force, temperature, proximity/range


*Mini Project

**TOTAL: 60 PERIODS**

**OUTCOMES:**
At the end of the course the students will be able to have the knowledge in
- Automotive electrical systems and electrical accessories
- Basic microprocessor / microcontroller programming
- Automotive sensor, transducer, actuator, virtual instrumentation, data acquisition
- Development of embedded systems for automobiles

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**AM5301 ENGINE MANAGEMENT SYSTEMS**

**OBJECTIVES:**
- To impart knowledge on engine management systems viz fuel injection, ignition system.
- To understand various controlling system for emission control and engine operation
- To provide opportunities to discuss the fundamentals of engine control sensors and actuators,
- To identify and analyze electric and electronic related problems
- To distinguish various engine control algorithm used during engine operation.
UNIT I  FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS  9
Components for electronic engine management system, open and closed loop control strategies, PID control, Look up tables, introduction to modern control strategies like Fuzzy logic and adaptive control. Switches, active resistors, Transistors, Current mirrors/amplifiers, Voltage and current references, Comparator, Multiplier. Amplifier, filters, A/D and D/A converters.

UNIT II  SENSORS AND ACTUATORS  9
Inductive, Hall Effect, thermistor, piezo electric, piezoresistive, based sensors. Throttle position, mass air flow, crank shaft position, cam position, engine speed sensor, exhaust oxygen level(two step, linear lambda and wideband), knock, manifold temperature and pressure sensors. Solenoid, relay(four and five pin), stepper motor

UNIT III  SI ENGINE MANAGEMENT  9
Layout and working of SI engine management systems. Group and sequential injection techniques. Advantages of electronic ignition systems. Types of solid state ignition systems and their principle of operation, Contactless (BREAKERLESS) electronic ignition system, Electronic spark timing control.

UNIT IV  CI ENGINE MANAGEMENT  9

UNIT V  DIGITAL ENGINE CONTROL SYSTEM  9
Cold start and warm up phases, idle speed control, acceleration and full load enrichment, deceleration fuel cutoff. Fuel control maps, open loop and closed loop control – Integrated engine control system, Electromagnetic compatibility – EMI Suppression techniques – Electronic dash board instruments – Onboard diagnosis system.

TOTAL : 45 PERIODS

OUTCOMES:
At the end of the course, the student should able to
- Explain the fundamentals, operation, function of various sensors and actuators in engine management systems.
- Explain the fundamentals, operation, function of various fuel injection systems pertain to SI and CI Engine.
- Explain the control algorithm during various engine operating conditions.
- Distinguish and analyze various ignition systems and different injection systems
- Apply various engine control algorithm used during engine operation.

REFERENCES:
2. Automobile Electronics by Eric Chowanietz SAE
OBJECTIVES:
To understand the various steps involved in the design of automotive components.
To show their knowledge in designing engine components.
To complete design exercise and arrive at important dimensions of chassis components.
To learn the use of standard practices in design.
To determine the dimensions of front and rear axles.

UNIT I  DESIGN OF CYLINDER, PISTON AND CONNECTING ROD  10
Choice of material for cylinder and piston, design of cylinder, design of piston, piston pin, piston rings and piston assembly. Material for connecting rod, design of connecting rod assembly. Case study on design of piston for passenger car.

UNIT II  DESIGN OF CRANK SHAFT AND VALVES  9

UNIT III  DESIGN OF CLUTCHES AND GEARS  10

UNIT IV  DESIGN OF VEHICLE FRAME AND SUSPENSION  6
Study of loads-moments and stresses on frame members. Design Of frame for passenger and commercial vehicle - Design of leaf Springs-Coil springs and torsion bar springs. Case study on development of frame for ATV.

UNIT V  DESIGN OF FRONT AND REAR AXLE  10

TOTAL: 45 PERIODS

OUTCOMES:
The students will be able to
• Analyse the stress and strain imparted on automotive components.
• Compute the design and find the dimension of the vehicle components.
• Identify optimal design solutions to real-world problems in compliance with industry standards.
• Demonstrate the design skill by creating new design strategy with the application of the knowledge.
• Interpret the modern system in vehicle and would help in developing the system with less impact to the environment.

REFERENCES:

AM5002 AUTOMOTIVE MATERIALS

OBJECTIVES

The course should enable the students to:
- select suitable materials for design
- understand the concepts of heat treatment and surface modification techniques
- gain knowledge on materials and their applications in automotive applications
- analyze the properties of different materials used for automotive structures, engine and transmission systems.
- gain knowledge on advanced metallic and non-metallic materials.

UNIT I INTRODUCTION

Elasticity-forms - Stress and strain relationship in engineering materials - Deformation mechanism - Strengthening material - Strain hardening, alloying, polyphase mixture, martensitic precipitation, dispersion, fiber and texture strengthening - iron carbon diagram.

UNIT II METALLIC MATERIALS

Cast irons - types, properties, structures, compositions and applications, plain carbon steels, low alloy steels and effects of alloying elements, high alloy steels, stainless steel types, castability, formability, machinability, hardenability and weldability of the material, high temperature steels and super alloys. Decorative and functional coating materials for automotive parts - Electro less Nickel, Hard Chrome, and, Zirconium Phosphate, Zinc flake, Metal oxides.

UNIT III COMPOSITES


UNIT IV ELECTRICAL AND MAGNETIC MATERIALS


UNIT V RUBBER AND PLASTICS MATERIALS


TOTAL: 45 PERIODS
OUTCOMES
The student will be able to:
• Understand failure mechanisms.
• Gain knowledge on different class of materials and their applications
• Understand the Selection criteria for various components and importance.
• Select proper material for Automobile applications
• Understand different materials used for sensors in a vehicle

REFERENCES

AM5003
SPECIAL PURPOSE VEHICLES

OBJECTIVES:
• To enhance the knowledge of the students about the various equipment’s used in earth moving, applications.
• To understand the construction and working of the vehicle for constructional application
• To describe the working nature of farm equipment’s based on their application.
• To discriminate the various industrial vehicles based on the purpose.
• To acquire the knowledge on the functioning of military vehicle.

UNIT I
EARTH MOVING EQUIPMENTS
Construction layout, capacity, specification and applications of dumpers, articulated haulers, front-end loaders, backhoe loaders, bulldozers, scrapers, motor graders, skid steer loaders, excavator, hydraulic shovels, bucket conveyors, surface miners – highwall Miners. Selection criteria for prime mover.

UNIT II
CONSTRUCTIONAL EQUIPMENTS
Construction layout, capacity, specification and applications of cranes – types, Articulated Trucks, concrete ready mixer, trenchers, Asphalt Pavers, road reclaimers, General description, specification and functions of smooth wheeled rollers, pneumatic tired rollers, sheep’s foot rollers, vibrating compactors, draglines, drillers, borewell machine

UNIT III
FARM EQUIPMEMTS
Classification of tractors – Main components of tractor. Working attachment of tractors – Auxiliary equipment — Top lifting harvesters. General description, working, specification and functions of paddy harvesting machines, Sugarcane harvesting, feller bunchers, forest machines.
UNIT IV  INDUSTRIAL VEHICLE  9
General description, specification, capacity and working of fork lifts - attachment, Utility vehicles, towing vehicles, man-lift chassis, scissor lift trucks, material handlers, fire fighting vehicle, reclaimers, Street sweepers

UNIT V  MILITARY AND COMBAT VEHICLES  8
Special features and constructional details of Main Battle tank, gun carriers, truck-mounted missile launchers, transport vehicles, armoured vehicle-launched bridge, amphibious bridging vehicle, and communication vehicles.

TOTAL: 45 PERIODS

OUTCOMES:
The students will be able to
• Demonstrate their understanding about the operation of the various special purpose vehicle
• Understand the construction layout of earth moving equipment’s.
• Have the ability to apply the knowledge to design a new concept for construction application.
• Demonstrate their skill in developing modern techniques for future farming vehicles
• Distinguish the various military vehicle and infer their particular technology.

REFERENCES:
4. B. Geleman and M. Moskvin, Farm tractors, MIR publishers, Moscow.

AM5004  INSTRUMENTATION AND EXPERIMENTAL TECHNIQUES

OBJECTIVES:
• To Study the theory, construction and operation of different measurement technology for automobiles
• To understand working principle of various instruments, transducers and their application in automotive industry.
• To acquire knowledge on various mechanical measurement instruments techniques
• To study different types of instruments used for engine testing and its working principle
• To acquire knowledge in experimental methods for testing the vehicle with different instruments

UNIT I  MEASUREMENT SYSTEMS  8
Static and Dynamic Measurement systems-importance of measurement system – methods of measurement -applications - characteristics of measuring system-static and dynamic characteristics of measuring system – Analysis of experimental detail, Error analysis-types of errors-limiting errors
UNIT II  TRANSDUCERS, MODIFIERS AND TERMINATING DEVICES  8
Transducers for Automotive Applications – Amplifiers-Classifications and application in automobile – filters -types – Data Acquisition system - analog and digital type DAS- Indicators, Printers and display device –Signal Analyzing with example of automobile applications.

UNIT III  MECHANICAL MEASUREMENT  10
Instrumentation for Measuring Weight, Force, torque , pressure, power, temperature, fluid flow and special methods , vibration piezo electric effect, rotational speed .Measuring Velocity, acceleration and angular motion with respect to automobile applications

UNIT IV  ENGINE EXPERIMENTAL TECHNIQUES  10

UNIT V  VEHICLE EXPERIMENTAL TECHNIQUES  9

TOTAL: 45 PERIODS

OUTCOMES:
At the end of this course the student should be able to
• Understand the components of the automotive instruments and their functions and the latest developments in this field
• Understand transducers, modifiers and terminating devices
• Understand mechanical measurement
• Grasp the basics of engine experimental techniques
• Grasp the basics of vehicle experimental techniques

REFERENCES
2. W. Judge, ‘Engineering Precision Measurement’, Chapman and Hall Ltd, Essex StreetW.C.,1951,
OBJECTIVES:
- To impart knowledge to the students in the principles of operation and constructional details of various Automotive Electrical and Electronic Systems
- To understand the need for starter batteries, starter motor and alternator in the vehicle.
- To differentiate the conventional and modern vehicle architecture and the data transfer among the different electronic control unit using different communication protocols
- To list common types of sensor and actuators used in vehicles.
- To understand dash – Board Instruments, various sensors and networking in vehicles.

UNIT I BATTERY AND STARTING SYSTEMS

UNIT II CHARGING AND LIGHTING SYSTEMS

UNIT III ELECTRONIC IGNITION AND INJECTION SYSTEMS

UNIT IV ELECTRICAL SYSTEMS
Warning and alarm instruments : Brake actuation warning system, traficators, flash system, oil pressure warning system, engine over heat warning system, air pressure warning system, speed warning system, door lock indicators, neutral gear indicator, horn design, permanent magnet horn, air & music horns. Wind shield wiper, window washer, instrument wiring system and electromagnetic interference suppression, wiring circuits for instruments, electronic instruments, dash board illumination.

UNIT V MICROPROCESSOR IN AUTOMOBILES
Microprocessor And Microcomputer controlled devices in automobiles such as instrument cluster, Voice warning system, Travel information system, Keyless entry system. Environmental requirements (vibration, Temperature and EMI).

TOTAL : 45 PERIODS

OUTCOMES:
At the end of this course the student should be able to
- Define the glossary related to vehicle electrical and electronic system
- Understand the need for starter batteries, starter motor and alternator in the vehicle.
- Differentiate the conventional and modern vehicle architecture and the data transfer among the different electronic control unit using different communication protocols
- List common types of sensor and actuators used in vehicles.
- Understand networking in vehicles.
REFERENCES:

AM5005  FINITE ELEMENT METHODS IN AUTOMOBILE ENGINEERING L T P C
3 0 0 3

OBJECTIVES:
- To equip the students with the Finite Element Analysis fundamentals.
- To enable the students to formulate the design problems into FEA.
- To introduce basic aspects of finite element technology, including domain discretization, polynomial interpolation, application of boundary conditions
- To understand the assembly of global arrays, and solution of the resulting algebraic systems.
- Understand how to use finite element analysis in engineering problems and application areas including stress, heat transfer, and vibration analysis

UNIT I  INTRODUCTION

UNIT II  1D ELEMENTS

UNIT III  2D ELEMENTS

UNIT IV  STRUCTURAL AND DYNAMIC ANALYSIS
UNIT V HEAT TRANSFER ANALYSIS AND FLOW ANALYSIS

1D & 2D problems in fluid mechanics and heat transfer by conduction and convection. Transient thermal analysis. Case Studies like Heat transfer analysis of piston, fins.

TOTAL: 45 PERIODS

OUTCOMES:
Upon completing this course, the students will be able to:
- Identify mathematical model for solution of common engineering problems.
- Formulate simple problems into finite elements.
- Solve structural, thermal, fluid flow problems.
- Use professional-level finite element software to solve engineering problems in Solid mechanics, fluid mechanics and heat transfer.
- Derive element matrix equation by different methods by applying basic laws in mechanics and integration by parts

REFERENCES

AM5006 NOISE, VIBRATION AND HARSHNESS FOR AUTOMOBILES

OBJECTIVES:
The course should enable the students to:
1. To introduce source of noise and vibration
2. To broaden the understanding of sound measurement and human sensitivity
3. To underline the importance of simulation, anechoic chamber and acoustic holography
4. To broaden the importance of statistical and frequency analysis
5. To introduce active control techniques

UNIT I NVH IN THE AUTOMOTIVE INDUSTRY

UNIT II SOUND AND VIBRATION THEORY
UNIT III TEST FACILITIES AND INSTRUMENTATION
Laboratory simulation: rolling roads (dynamometers), road simulators, semi-anechoic rooms, wind tunnels, etc. Transducers, signal conditioning and recording systems. Binaural head recordings. Sound Intensity technique, Acoustic Holography, Statistical Energy Analysis

UNIT IV SIGNAL PROCESSING

UNIT V NVH CONTROL STRATEGIES & COMFORT

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course the student will be able to:
1. Identify sources of noise and vibration
2. Measure sound intensity and human sensitivity
3. Carryout statistical energy analysis and simulators
4. Determine active control techniques
5. Carryout statistical and frequency analysis barrier.

REFERENCES:

AM5007 TWO AND THREE WHEELERS

OBJECTIVES:
The objective of this course is to make the students to
- analyse various two wheelers and their dynamics
- design the power unit
- apply the design aspects of transmission system
- analyse different frames and suspension system used in two wheelers.
- design and analyse Three wheelers

UNIT I INTRODUCTION
Classifications of different two wheelers based on usage - design considerations – weight and dimension limitations – requirements, stability problems, gyroscopic effect- pendulum effect of two and three wheelers. All-terrain vehicles.

UNIT II POWER UNITS, IGNITION SYSTEMS AND OTHER ELECTRICAL SYSTEMS
UNIT III  CLUTCHES AND TRANSMISSION  10
Pre-unit, gearbox and final drive. Design of clutch. Types of clutches and gear boxes. Gear change mechanism. CVT. Belt, chain and shaft drive. Freewheeling devices, starting systems.

UNIT IV  FRAMES, SUSPENSION, WHEELS, TYRES AND BRAKES  8

UNIT V  THREE WHEELERS  8
Auto rickshaws, different types, Pick-Ups and delivery type vehicle, frames and transmission, wheel types, wheel mountings attachment, tyre types. Brake systems.

TOTAL : 45 PERIODS

OUTCOMES
At the end of the course the students will be able to
• Analyse various two wheelers and its technology along with its functions.
• Design power plant for different applications.
• Design and analyse transmission units used in two wheelers.
• Analyse different frames and suspension system used in two wheelers.
• Through knowledge on various three wheelers.

REFERENCES:
7. Build Your Own Electric Motorcycle, By Carl Vogel,2009

AM5008  ALTERNATIVE FUELS AND PROPULSION SYSTEMS  L T P C
3 0 0 3

OBJECTIVES
• To acquire knowledge on availability of renewable fuels in the world and the technologies used for biofuel production
• To understand the challenges and difficulties involved in using alternative fuels in internal combustion engines
• To acquire complete knowledge on availability of possible alternate fuels and their properties to use as fuel in CI and SI engines
• To explore the possible methods of using all the renewable fuels in SI and CI engines and analyze the engines behavior with different fuels and methods
• To develop a complete understanding of changing the engine system, modifying the fuel for efficient use in engines

TOTAL : 45 PERIODS

OUTCOMES
At the end of the course the students will be able to
• Analyse various two wheelers and its technology along with its functions.
• Design power plant for different applications.
• Design and analyse transmission units used in two wheelers.
• Analyse different frames and suspension system used in two wheelers.
• Through knowledge on various three wheelers.

REFERENCES:
7. Build Your Own Electric Motorcycle, By Carl Vogel,2009

AM5008  ALTERNATIVE FUELS AND PROPULSION SYSTEMS  L T P C
3 0 0 3

OBJECTIVES
• To acquire knowledge on availability of renewable fuels in the world and the technologies used for biofuel production
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• To explore the possible methods of using all the renewable fuels in SI and CI engines and analyze the engines behavior with different fuels and methods
• To develop a complete understanding of changing the engine system, modifying the fuel for efficient use in engines

TOTAL : 45 PERIODS

OUTCOMES
At the end of the course the students will be able to
• Analyse various two wheelers and its technology along with its functions.
• Design power plant for different applications.
• Design and analyse transmission units used in two wheelers.
• Analyse different frames and suspension system used in two wheelers.
• Through knowledge on various three wheelers.

REFERENCES:
7. Build Your Own Electric Motorcycle, By Carl Vogel,2009

AM5008  ALTERNATIVE FUELS AND PROPULSION SYSTEMS  L T P C
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OBJECTIVES
• To acquire knowledge on availability of renewable fuels in the world and the technologies used for biofuel production
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• To develop a complete understanding of changing the engine system, modifying the fuel for efficient use in engines

TOTAL : 45 PERIODS

OUTCOMES
At the end of the course the students will be able to
• Analyse various two wheelers and its technology along with its functions.
• Design power plant for different applications.
• Design and analyse transmission units used in two wheelers.
• Analyse different frames and suspension system used in two wheelers.
• Through knowledge on various three wheelers.

REFERENCES:
7. Build Your Own Electric Motorcycle, By Carl Vogel,2009

AM5008  ALTERNATIVE FUELS AND PROPULSION SYSTEMS  L T P C
3 0 0 3

OBJECTIVES
• To acquire knowledge on availability of renewable fuels in the world and the technologies used for biofuel production
• To understand the challenges and difficulties involved in using alternative fuels in internal combustion engines
• To acquire complete knowledge on availability of possible alternate fuels and their properties to use as fuel in CI and SI engines
• To explore the possible methods of using all the renewable fuels in SI and CI engines and analyze the engines behavior with different fuels and methods
• To develop a complete understanding of changing the engine system, modifying the fuel for efficient use in engines

TOTAL : 45 PERIODS

OUTCOMES
At the end of the course the students will be able to
• Analyse various two wheelers and its technology along with its functions.
• Design power plant for different applications.
• Design and analyse transmission units used in two wheelers.
• Analyse different frames and suspension system used in two wheelers.
• Through knowledge on various three wheelers.

REFERENCES:
7. Build Your Own Electric Motorcycle, By Carl Vogel,2009
UNIT I  ALTERNATIVE FUELS, PROPERTIES AND PRODUCTION METHODS OF FUELS

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

UNIT II  ALCOHOLS


UNIT III  VEGETABLE OILS

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

UNIT IV  HYDROGEN


UNIT V  BIOGAS, LPG AND NATURAL GAS

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 possible 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 liquid alternative fuels effectively in the engines.
- They will be able to demonstrate the engines operation with new fuels and methods
- They further will innovate methods and design changes for optimal use of liquid alternative fuels in conventional engines
- They will be able to apply knowledge in using all the renewable gaseous fuels in IC engines with superior engine operation.

REFERENCES

5. Technical papers of SAE on Biofuels (Alcohols, vegetable oils, CNG, LPG, Hydrogen, Biogas etc.).
OBJECTIVES:

- To understand the basics of hydraulic and pneumatic systems
- To examine the working of hydraulic power drives
- To apply knowledge on fluid power elements
- To design hydraulic and pneumatic systems.
- To evaluate the concept of programming in PLC circuits.

UNIT I INTRODUCTION

UNIT II PNEUMATIC SYSTEMS

UNIT III HYDRAULIC SYSTEMS

UNIT IV SERVO AND PLC SYSTEMS
Electro pneumatics, ladder diagram. Servo and Proportional valves - types, operation, application. Hydro-Mechanical servo systems. PLC-construction, types, operation, programming.

UNIT V AUTOMOTIVE APPLICATIONS
Hydraulic tipping mechanism, power steering, for lift hydraulic gear, hydro-pneumatic suspension, air brake. Maintenance and trouble shooting. Design and analysis of a hydraulic /Pneumatic system-Case Study

OUTCOMES:

- Understand the basics of hydraulic and pneumatic systems
- Examine the working of hydraulic power drives
- Apply knowledge on fluid power elements
- Design hydraulic and pneumatic systems.
- Evaluate the concept of programming in PLC circuits.

REFERENCES:
2. Werner Deppert and Kurt Stoll, “Pneumatic Controls : An introduction to principles“, Vogel-Druck Wurzburg, Germany, 1975

**AM5010 IC ENGINE PROCESS MODELING**

**OBJECTIVES**

1. To impart knowledge in modeling the Internal combustion engine processes and acquire knowledge in different types of engine models and their importance
2. To understand the calculation of heat of reaction, air fuel ratio and flame temperature for developing a thermodynamic engine model.
3. To acquire knowledge on the detailed concept of air standard, fuel air cycle, progressive and actual cycle simulation of SI engine.
4. To understand the gas exchange process and develop models for the intake and exhaust processes.
5. To develop a complete theoretical engine model for the SI engine and differentiate the model from CI engine model.

**UNIT I INTRODUCTION TO SIMULATION**


**UNIT II STOICHIOMETRY AND ADIABATIC FLAME TEMPERATURE**

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

**UNIT III SI ENGINE SIMULATION**

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

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

Introduction, gas exchange process, Heat transfer process, friction calculations, comparison 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 and analysis of the data.

**UNIT V ENGINE SIMULATION FOR CI AND ADVANCED ENGINES**


**TOTAL: 45 PERIODS**
OUTCOMES
1. 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.
2. They will be able to calculate the heat of reaction, fuel air ratio and flame temperature for developing a thermodynamic engine model.
3. They will acquire knowledge on the detailed concept of air standard, fuel air cycle, progressive and actual cycle simulation of SI engine.
4. 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.
5. 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.

REFERENCES

AM5011 VEHICLE CONTROL SYSTEMS

OBJECTIVES
- To understand the basics of control system used in automobiles.
- To recognize the electronically controlled system used in driving mechanics.
- To understand the working principle of driver modelling and power train control systems.
- To identify the control system used in hybrid and electrical vehicles.
- To illustrate the need of automated transport systems.

UNIT I INTRODUCTION
Components of chassis management system – role of various sensors and actuators pertaining to chassis system – construction – working principle of wheel speed sensor, steering position, tyre pressure, brake pressure, steering torque, fuel level, Engine and vehicle design data.

UNIT II DRIVELINE CONTROL SYSTEM

UNIT III SAFETY AND SECURITY SYSTEM
Airbags, seat belt tightening system, collision warning systems, child Lock, anti lock braking systems, Vision enhancement, road recognition system, Anti theft technologies, smart card system, number plate coding, central locking system.
UNIT IV \hspace{1cm} COMFORT SYSTEM \hspace{1cm} 9
Active suspension systems, requirement and characteristics, different types, Vehicle Handling and Ride characteristics of road vehicle, pitch, yaw, bounce control, power windows, thermal management system, adaptive noise control.

UNIT V \hspace{1cm} INTELLIGENT TRANSPORTATION SYSTEM \hspace{1cm} 9

TOTAL: 45 PERIODS

OUTCOMES:
- Understand the basics of control system used in automobiles
- Recognize the electronically controlled system used in driving mechanics.
- Understand the working principle of driver modelling and power train control systems.
- Identify the control system used in hybrid and electrical vehicles.
- Illustrate the need of automated transport systems.

REFERENCES:

AM5012 \hspace{1cm} ROAD VEHICLE AERODYNAMICS \hspace{1cm} L T P C
3 \hspace{0.5cm} 0 \hspace{0.5cm} 0 \hspace{0.5cm} 3

UNIT I \hspace{1cm} SCOPE OF ROAD VEHICLE AERODYNAMICS \hspace{1cm} 9

UNIT II \hspace{1cm} AIR RESISTANCE ON PASSENGER CARS \hspace{1cm} 9

UNIT III \hspace{1cm} AERODYNAMIC DRAG ON COMMERCIAL VEHICLES \hspace{1cm} 9

UNIT IV \hspace{1cm} MOTORCYCLE AERODYNAMICS \hspace{1cm} 9
UNIT V  WIND TUNNELS, MEASUREMENT AND TEST TECHNIQUES


TOTAL: 45 PERIODS

OUTCOMES
1. Knowledge upon the forces & moments influencing drag.
2. Solve exercises related to fuel economy & drag.
3. Appraise upon the techniques of shape based optimization practiced in industry.
4. Awareness about the influence of rider position in motorcycle aerodynamics.
5. Expose to fundamentals of Experimental testing.

REFERENCES:

AM5013 ELECTRIC AND HYBRID VEHICLES

OBJECTIVES:
The course should enable the students to:
1. General aspects of Electric and Hybrid Vehicles (EHV), including architectures, modeling, sizing, sub-system design and hybrid vehicle control.
2. Understand about vehicle dynamics,
3. Design the required energy storage devices,
4. Select the suitable electric propulsion systems and
5. Understand of hybrid electric vehicles.

UNIT I  NEED FOR ALTERNATIVE SYSTEM
Need for hybrid and electric vehicles – main components and working principles of a hybrid and electric vehicles, Different configurations of hybrid and electric vehicles. Comparative study of diesel, petrol, hybrid and electric Vehicles. Advantages and Limitations of hybrid and electric Vehicles. Case study on specification of electric and hybrid vehicles.

UNIT II  DESIGN CONSIDERATIONS FOR ELECTRIC VEHICLES
Design requirement for electric vehicles- Range, maximum velocity, acceleration, power requirement, mass of the vehicle. Various Resistance- Transmission efficiency- Electric vehicle chassis and Body Design, Electric Vehicle Recharging and Refueling Systems

UNIT III  ENERGY SOURCES
UNIT IV MOTORS AND CONTROLLERS
Types of Motors, Characteristic of DC motors, AC single phase and 3-phase motor, PM motors, Switched reluctance motors, Motor Drives and speed controllers, Torque Vectoring, Regenerative Braking. Rectifiers, Inverters, DC/DC converters.

UNIT V SUBSYSTEMS OF HYBRID AND ELECTRIC VEHICLES

TOTAL: 45 PERIODS

OUTCOMES:
The students will able to
- Understand working of different configurations of hybrid and electric vehicles
- Design and develop basic schemes of electric vehicles and hybrid electric vehicles.
- Choose proper energy storage systems for vehicle applications
- Choose a suitable drive scheme for developing an electric hybrid vehicle depending on resources
- Understand basic operation of power-split device in hybrid electric vehicle.

REFERENCES:

AM5014 VEHICLE MAINTENANCE

OBJECTIVES:
To import knowledge on
- To give knowledge on the importance of vehicle maintenance
- To impart knowledge on sub systems of engine and chassis and its maintenance
- To understand different transmission systems and its maintenance
- To understand vehicle body structure and its maintenance
- To understand the function of various electrical and electronic units and its maintenance

UNIT I MAINTENANCE RECORDS, BASIC TOOLS AND INSTRUMENTS

UNIT II POWER PLANT REPAIR AND OVERHAULING
UNIT III MAINTENANCE, REPAIR AND OVERHAULING OF THE CHASSIS 9
Maintenance, servicing and repair of clutch, gearbox, propeller shaft. Maintenance of front axle, rear axle, brakes, steering systems. Tyre maintenance.

UNIT IV MAINTENANCE AND REPAIR OF VEHICLE BODY 9
Body panel tools for repairing. Tinkering and painting. Minor and major repairs. Door lock and window glass actuating system maintenance.

UNIT V MAINTENANCE AND REPAIR OF ELECTRICAL AND ELECTRONIC SYSTEMS 9
Maintenance, testing and trouble shooting of battery, starter motor, dynamo, alternator, regulator, lighting system, horn and dash board instruments. Introduction to OBD.

TOTAL : 45 PERIODS

OUTCOMES:
Upon the completion of the course student can able to understand
- the importance of maintenance
- various sub systems of vehicle and its maintenance
- Understand Transmission
- functions of transmission and its maintenance
- the importance of vehicle body structure
- Basic functional principle of electrical and electronic gadgets in automobile and its maintenance

REFERENCES:
3. Ernest Venk., Edward spicer, Automotive maintenance and trouble shooting, D.B.
4. Taraporevala Sons, Bombay, 1963

AM5015 PRODUCTION OF AUTOMOTIVE COMPONENTS

OBJECTIVES:
- To compare and analyse the different casting process
- To design various machining process according to the requirement
- Analysis of suitable process related to forming
- To differentiate the effect of powder metallurgy on selective components
- To impart knowledge on recent trends of automotive components

UNIT I CASTING 10
UNIT II  MACHINING
Special consideration of machining of various components such as flywheel, piston rings, bearing bushes, and liners, permanent mould casting of piston

UNIT III  FORGING AND EXTRUSION PROCESS

UNIT IV  POWDER METALLURGY AND PROCESSING OF PLASTICS

UNIT V  RECENT TRENDS IN MANUFACTURING OF AUTO COMPONENTS

TOTAL: 45 PERIODS

OUTCOMES:
By the end of this course, students will be able to
• Identify the methods to manufacture the vehicle components
• Analyze the requirements of each component and material
• Differentiate between the casting and forming process
• Design the process for manufacturing vehicle components
• Understand the advanced techniques used for manufacturing Automobile components

REFERENCES
6. High Velocity "Forming of Metals ", ASTME, prentice Hall of India (P) Ltd., New Delhi, 1990
7. HMT handbook
OBJECTIVES

- To impart the knowledge on automotive air-conditioning and its components functions
- To understand the Psychometric concepts, refrigerant characteristics,
- To understand the range of techniques that can be used in diagnosing
- To identify faults which affect automotive air-conditioning system performance
- To provide adequate knowledge in safe working practice, understanding the correct procedures for A/C service and repair

UNIT I  FUNDAMENTALS
Terminology, design factors and concepts related to air conditioning system – Construction and Working principles of Thermostatic Expansion valve and Orifice tube based system- Heating system types -detailed study of HVAC components like compressor, evaporator, condenser, TXV, orifice tube, Receiver-drier, heater core etc. Location of air conditioning components in a vehicle.

UNIT II  REFRIGERANTS & AIR MANAGEMENT SYSTEMS
Refrigerants: Temperature and pressure relation, Properties of R-12 and R134a- refrigerant oil. Simple problems -Containers - Handling refrigerants - Tapping into the refrigerant container - Ozone Layer Depletion. Air management system: Air routing for manual, semi and automatic system- cases and ducts- Air distribution, control head and doors- Defrost system

UNIT III  AUTOMATIC CLIMATE CONTROL SYSTEM
Block diagram - types of Sensors and Actuators, - Control Logic Electrical wiring diagram of manual and automatic system - multiplexing between BCM and PCM- control of compressor clutch, blower motor etc.- diagnostics tools and features.

UNIT IV  DESIGN OF AIR-CONDITIONING COMPONENTS
Modeling of Fixed and variable Displacement type compressor, evaporator modeling – heat transfer correlations for the fluids inside the evaporator, analysis of evaporator frosting- condenser modeling - improvement of refrigerant flow control method.

UNIT V  AIR CONDITIONING DIAGNOSIS AND SERVICES
AC system diagnosis based on temperature and pressure measurements, sight glass, sound etc. - refrigerant leak detection- Trouble shooting and Servicing of compressor, evaporator, condenser, heater core – HVAC equipment , recovery and charging. Air routing system service.

TOTAL: 45 PERIODS

OUTCOMES:

- Solve the simple problems related to psychrometry and refrigerant
- Understand the operation of the individual components of the A/System, sensors, actuators and electronic control
- Understand the range of techniques that can be used in diagnosing
- Identify faults which affect system performance
- Provide adequate knowledge in safe working practice, understanding the correct procedures for A/C service and repair

REFERENCES:

AM5017 AUTOMOTIVE SAFETY

OBJECTIVES:
The course should enable the students:
- To introduce vehicle structural crashworthiness and crash testing
- To introduce pedestrian safety
- To get the knowledge in sensors provided in the vehicle to avoid the crash and to detect the obstacles around the vehicle.
- To understand the fundamentals of sensor data fusion as it relates to ADAS.
- To understand the concept of the connected vehicle and its role in ADAS and automated vehicles.

UNIT I CONCEPTS OF AUTOMOTIVE SAFETY

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

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

UNIT IV VEHICLE INTEGRATION AND NAVIGATION SYSTEM

UNIT V AUTONOMOUS VEHICLE

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, seatbelts
- Understand the fundamentals of sensor data fusion as it relates to ADAS.
- Understand the concept of the connected vehicle and its role in ADAS and automated vehicles.
REFERENCES:
1. ARAI Safety standards

AM5018 ENGINE COMBUSTION THERMODYNAMICS AND ENGINE HEAT TRANSFER

OBJECTIVES
1. To develop the students, understand the thermodynamic principles of general and engine combustion.
2. To acquire knowledge in chemical kinetics involved in general and engine combustion.
3. To study different types of flames, their structures and analyze the factors affecting on them.
4. To demonstrate the importance of engine heat release rate and heat transfer models for engine combustion analysis.
5. To acquire knowledge in experimental methods for combustion and heat transfer calculations to apply in engines analysis.

UNIT – I INTRODUCTION TO COMBUSTION PROCESSES

UNIT – II THERMODYNAMICS OF COMBUSTION

UNIT – III NORMAL, ABNORMAL COMBUSTION IN SI ENGINES
Stages of combustion – Flame propagation — Flame Limits –Flame Extinction - Rate of pressure rise – Cycle to cycle variation – Abnormal combustion – Theories of detonation – Effect of engine operating variables on combustion –Example problems.

UNIT – IV COMBUSTION AND HEAT TRANSFER IN IC ENGINES

UNIT – V EXPERIMENTAL INVESTIGATION OF COMBUSTION AND HEAT TRANSFER IN IC ENGINES
Photographic studies of combustion processes – P-θ diagrams in SI and CI engines, Assembly – Temperature measurement in piston – cylinder liner – Cylinder head and engine valves.

TOTAL 45 PERIODS

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OUTCOMES:
1. Upon completion the students summarize the thermodynamic principles of general and engine combustion.
2. They understand the principle of engine combustion and the various heat transfer models and measuring methods of engine heat transfer in detail
3. They will have comment over on different flames and their importance in combustion applications
4. They will understand thermodynamics of combustion, grasp the knowledge of normal, abnormal combustion and heat transfer in engines
5. They also understand and apply the experimental techniques in investigating the combustion and heat transfer processes in IC engines

REFERENCES:

AM5019 THEOREY OF FUELS AND LUBRICANTS

OBJECTIVES:
- To identify the processes behind fuel extraction system.
- To understand the theory behind lubrication
- To study the properties of lubricants.
- To elaborate the properties of fuels used in IC engines.
- To understand the need of fuel rating.

UNIT I MANUFACTURE OF FUELS AND LUBRICANTS
Structure of petroleum, refining process, fuels, thermal cracking, catalytic cracking, polymerization, alkylation, isomerisation, blending, products of refining process. Manufacture of lubricating oil basestocks, manufacture of finished automotive lubricants.

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

UNIT III PROPERTIES AND TESTING OF LUBRICANTS
Specific requirements for automotive lubricants, oxidation deterioration and degradation of lubricants, 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 AND COMBUSTION
Thermo-chemistry of fuels, properties and testing of fuels, relative density, calorific value, flash point, fire point, distillation, vapour pressure, spontaneous ignition temperature, viscosity, pour point, flammability, ignitability, diesel index, API gravity, aniline point, carbon residue, copper strip corrosion etc. combustion in SI and CI Engine
UNIT V  ADDITIVES FOR LUBRICANTS AND FUELS

Additive - mechanism, requirements of additive, petrol fuel additives, diesel fuel additives. Additives and additive mechanism, for lubricants. Introduction to Nano fluids

OUTCOMES:
• Identify the processes behind fuel extraction system.
• Understand the theory behind lubrication
• Study the properties of lubricants.
• Elaborate the properties of fuels used in IC engines.
• Understand the need of fuel rating.

REFERENCES
OPEN ELECTIVE COURSES (OEC)

OE5091 BUSINESS DATA ANALYTICS

COURSE OBJECTIVES:
- To understand the basics of business analytics and its life cycle.
- To gain knowledge about fundamental business analytics.
- To learn modeling for uncertainty and statistical inference.
- To understand analytics using Hadoop and Map Reduce frameworks.
- To acquire insight on other analytical frameworks.

UNIT I  OVERVIEW OF BUSINESS ANALYTICS

Suggested Activities:
- Case studies on applications involving business analytics.
- Converting real time decision making problems into hypothesis.
- Group discussion on entrepreneurial opportunities in Business Analytics.

Suggested Evaluation Methods:
- Assignment on business scenario and business analytical life cycle process.
- Group presentation on big data applications with societal need.
- Quiz on case studies.

UNIT II  ESSENTIALS OF BUSINESS ANALYTICS

Suggested Activities:
- Solve numerical problems on basic statistics.
- Explore chart wizard in MS Excel Case using sample real time data for data visualization.
- Use R tool for data visualization.

Suggested Evaluation Methods:
- Assignment on descriptive analytics using benchmark data.
- Quiz on data visualization for univariate, bivariate data.

UNIT III  MODELING UNCERTAINTY AND STATISTICAL INFERENCE

Suggested Activities:
- Solving numerical problems in sampling, probability, probability distributions and hypothesis testing.
- Converting real time decision making problems into hypothesis.
Suggested Evaluation Methods:
- Assignments on hypothesis testing.
- Group presentation on real time applications involving data sampling and hypothesis testing.
- Quizzes on topics like sampling and probability.

UNIT IV  ANALYTICS USING HADOOP AND MAPREDUCE FRAMEWORK  

Suggested Activities:
- Practical – Install and configure Hadoop.
- Practical – Use web based tools to monitor Hadoop setup.
- Practical – Design and develop MapReduce tasks for word count, searching involving text corpus etc.

Suggested Evaluation Methods:
- Evaluation of the practical implementations.
- Quizzes on topics like HDFS and extensions to MapReduce.

UNIT V  OTHER DATA ANALYTICAL FRAMEWORKS  
Overview of Application development Languages for Hadoop – PigLatin – Hive – Hive Query Language (HQL) – Introduction to Pentaho, JAQL – Introduction to Apache: Sqoop, Drill and Spark, Cloudera Impala – Introduction to NoSQL Databases – Hbase and MongoDB.

Suggested Activities:
- Practical – Installation of NoSQL database like MongoDB.
- Practical – Demonstration on Sharding in MongoDB.
- Practical – Install and run Pig
- Practical – Write PigLatin scripts to sort, group, join, project, and filter data.
- Design and develop algorithms to be executed in MapReduce involving numerical methods for analytics.

Suggested Evaluation Methods:
- Mini Project (Group) – Real time data collection, saving in NoSQL, implement analytical techniques using Map-Reduce Tasks and Result Projection.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course, the student will be able to:
- Identify the real world business problems and model with analytical solutions.
- Solve analytical problem with relevant mathematics background knowledge.
- Convert any real world decision making problem to hypothesis and apply suitable statistical testing.
- Write and Demonstrate simple applications involving analytics using Hadoop and MapReduce
- Use open source frameworks for modeling and storing data.
- Apply suitable visualization technique using R for visualizing voluminous data.

REFERENCES:

OE5092 INDUSTRIAL SAFETY

COURSE OBJECTIVES:
- Summarize basics of industrial safety
- Describe fundamentals of maintenance engineering
- Explain wear and corrosion
- Illustrate fault tracing
- Identify preventive and periodic maintenance

UNIT I INTRODUCTION
9
Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT II FUNDAMENTALS OF MAINTENANCE ENGINEERING
9
Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT III WEAR AND CORROSION AND THEIR PREVENTION
9

UNIT IV FAULT TRACING
9
Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, i. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

UNIT V PERIODIC AND PREVENTIVE MAINTENANCE
9
maintenance of mechanical and electrical equipment, advantages of preventive maintenance.

**COURSE OUTCOMES:**

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**OE5093 **

OPERATIONS RESEARCH

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**COURSE OBJECTIVES:**

- Solve linear programming problem and solve using graphical method.
- Solve LPP using simplex method
- Solve transportation , assignment problems
- Solve project management problems
- Solve scheduling problems

**UNIT I **

LINEAR PROGRAMMING

Introduction to Operations Research – assumptions of linear programming problems - Formulations of linear programming problem – Graphical method

**UNIT II **

ADVANCES IN LINEAR PROGRAMMING

Solutions to LPP using simplex algorithm- Revised simplex method - primal dual relationships – Dual simplex algorithm - Sensitivity analysis

**UNIT III **

NETWORK ANALYSIS – I

Transportation problems -Northwest corner rule, least cost method, Voges’s approximation method - Assignment problem -Hungarian algorithm

**UNIT IV **

NETWORK ANALYSIS – II

Shortest path problem: Dijkstra’s algorithms, Floyds algorithm, systematic method -CPM/PERT
UNIT V NETWORK ANALYSIS – III
Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models

COURSE OUTCOMES:
CO1: To formulate linear programming problem and solve using graphical method.
CO2: To solve LPP using simplex method
CO3: To formulate and solve transportation, assignment problems
CO4: To solve project management problems
CO5: To solve scheduling problems

TOTAL: 45 PERIODS

REFERENCE:

OE5094 COST MANAGEMENT OF ENGINEERING PROJECTS L T P C
3 0 0 3

COURSE OBJECTIVES:
- Summarize the costing concepts and their role in decision making
- Infer the project management concepts and their various aspects in selection
- Interpret costing concepts with project execution
- Develop knowledge of costing techniques in service sector and various budgetary control techniques
- Illustrate with quantitative techniques in cost management

UNIT I INTRODUCTION TO COSTING CONCEPTS
Objectives of a Costing System; Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost; Creation of a Database for operational control.

UNIT II INTRODUCTION TO PROJECT MANAGEMENT
Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities, Detailed Engineering activities, Pre project execution main clearances and documents, Project team: Role of each member, Importance Project site: Data required with significance, Project contracts.
UNIT III       PROJECT EXECUTION AND COSTING CONCEPTS

Project execution: Project cost control, Bar charts and Network diagram, Project commissioning: mechanical and process, Cost Behavior and Profit Planning; Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis, Various decision-making problems, Pricing strategies: Pareto Analysis, Target costing, Life Cycle Costing.

UNIT IV       COSTING OF SERVICE SECTOR AND BUDGETERY CONTROL

Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis, Budgetary Control: Flexible Budgets; Performance budgets; Zero-based budgeting.

UNIT V       QUANTITATIVE TECHNIQUES FOR COST MANAGEMENT

Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Learning Curve Theory.

TOTAL HOURS: 45

OUTCOMES

CO1 – Understand the costing concepts and their role in decision making
CO2–Understand the project management concepts and their various aspects in selection
CO3–Interpret costing concepts with project execution
CO4–Gain knowledge of costing techniques in service sector and various budgetary control techniques
CO5 - Become familiar with quantitative techniques in cost management

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2. Charles T. Horngren and George Foster, Advanced Management Accounting, 1988

OE5095       COMPOSITE MATERIALS

COURSE OBJECTIVES:

- Summarize the characteristics of composite materials and effect of reinforcement in composite materials.
- Identify the various reinforcements used in composite materials.
- Compare the manufacturing process of metal matrix composites.
- Understand the manufacturing processes of polymer matrix composites.
- Analyze the strength of composite materials.
UNIT I INTRODUCTION
Definition – Classification and characteristics of Composite materials - Advantages and application of composites - Functional requirements of reinforcement and matrix - Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT II REINFORCEMENTS
Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers - Properties and applications of whiskers, particle reinforcements - Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures - Isostrain and Isostress conditions.

UNIT III MANUFACTURING OF METAL MATRIX COMPOSITES

UNIT IV MANUFACTURING OF POLYMER MATRIX COMPOSITES

UNIT V STRENGTH
Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
- CO1 - Know the characteristics of composite materials and effect of reinforcement in composite materials.
- CO2 – Know the various reinforcements used in composite materials.
- CO3 – Understand the manufacturing processes of metal matrix composites.
- CO4 – Understand the manufacturing processes of polymer matrix composites.
- CO5 – Analyze the strength of composite materials.

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COURSE OBJECTIVES:
- Interpret the various types of wastes from which energy can be generated
- Develop knowledge on biomass pyrolysis process and its applications
- Develop knowledge on various types of biomass gasifiers and their operations
- Invent knowledge on biomass combustors and its applications on generating energy
- Summarize the principles of bio-energy systems and their features

UNIT I INTRODUCTION TO EXTRACTION OF ENERGY FROM WASTE
Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT II BIOMASS PYROLYSIS
Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT III BIOMASS GASIFICATION

UNIT IV BIOMASS COMBUSTION
Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT V BIO ENERGY
Properties of biogas (Calorific value and composition), Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

TOTAL: 45 PERIODS

OUTCOMES:
CO1 – Understand the various types of wastes from which energy can be generated
CO2 – Gain knowledge on biomass pyrolysis process and its applications
CO3 – Develop knowledge on various types of biomass gasifiers and their operations
CO4 – Gain knowledge on biomass combustors and its applications on generating energy
CO5 – Understand the principles of bio-energy systems and their features

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AUDIT COURSES (AC)

AX5091 ENGLISH FOR RESEARCH PAPER WRITING L T P C

COURSE OBJECTIVES:
- Teach how to improve writing skills and level of readability
- Tell about what to write in each section
- Summarize the skills needed when writing a Title
- Infer the skills needed when writing the Conclusion
- Ensure the quality of paper at very first-time submission

UNIT I INTRODUCTION TO RESEARCH PAPER WRITING 6
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT II PRESENTATION SKILLS 6

UNIT III TITLE WRITING SKILLS 6
Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check

UNIT IV RESULT WRITING SKILLS 6
Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT V VERIFICATION SKILLS 6
Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first-time submission

COURSE OUTCOMES:

TOTAL: 30 PERIODS
CO1 – Understand that how to improve your writing skills and level of readability
CO2 – Learn about what to write in each section
CO3 – Understand the skills needed when writing a Title
CO4 – Understand the skills needed when writing the Conclusion
CO5 – Ensure the good quality of paper at very first-time submission

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AX5092 DISASTER MANAGEMENT 2000

COURSE OBJECTIVES:
- Summarize basics of disaster
- Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Develop the strengths and weaknesses of disaster management approaches

UNIT I INTRODUCTION
Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT II REPERCUSSIONS OF DISASTERS AND HAZARDS

UNIT III DISASTER PRONE AREAS IN INDIA
Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics
UNIT IV DISASTER PREPAREDNESS AND MANAGEMENT 6
Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT V RISK ASSESSMENT 6
Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People’s Participation in Risk Assessment. Strategies for Survival

TOTAL : 30 PERIODS

COURSE OUTCOMES:
CO1: Ability to summarize basics of disaster
CO2: Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
CO3: Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
CO4: Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
CO5: Ability to develop the strengths and weaknesses of disaster management approaches

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AX5093 SANSKRIT FOR TECHNICAL KNOWLEDGE  L T P C
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COURSE OBJECTIVES:
- Illustrate the basic sanskrit language.
- Recognize sanskrit, the scientific language in the world.
- Appraise learning of sanskrit to improve brain functioning.
- Relate sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power.
- Extract huge knowledge from ancient literature.

UNIT I ALPHABETS
Alphabets in Sanskrit
UNIT II  TENSES AND SENTENCES  6
Past/Present/Future Tense - Simple Sentences

UNIT III  ORDER AND ROOTS  6
Order - Introduction of roots

UNIT IV  SANSKRIT LITERATURE  6
Technical information about Sanskrit Literature

UNIT V  TECHNICAL CONCEPTS OF ENGINEERING  6
Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

TOTAL: 30 PERIODS

COURSE OUTCOMES:
- CO1 - Understanding basic Sanskrit language.
- CO2 - Write sentences.
- CO3 - Know the order and roots of Sanskrit.
- CO4 - Know about technical information about Sanskrit literature.
- CO5 - Understand the technical concepts of Engineering.

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REFERENCES
1. “Abhyaspustakam” – Dr. Vishwas, Samskrita-Bharti Publication, New Delhi
2. “Teach Yourself Sanskrit” Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication

AX5094  VALUE EDUCATION  L T P C
2 0 0 0

COURSE OBJECTIVES:
Students will be able to
- Understand value of education and self-development
- Imbibe good values in students
- Let the should know about the importance of character

UNIT I

UNIT II
UNIT III

UNIT IV

TOTAL: 30 PERIODS

COURSE OUTCOMES:
Students will be able to
- Knowledge of self-development.
- Learn the importance of Human values.
- Developing the overall personality.

Suggested reading

UNIT I       HISTORY OF MAKING OF THE INDIAN CONSTITUTION:
History, Drafting Committee, (Composition & Working)

UNIT II       PHILOSOPHY OF THE INDIAN CONSTITUTION:
Preamble, Salient Features

UNIT III      CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES:

UNIT IV      ORGANS OF GOVERNANCE:
Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

UNIT V       LOCAL ADMINISTRATION:
UNIT VI ELECTION COMMISSION:
Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.

TOTAL: 30 PERIODS

COURSE OUTCOMES:
Students will be able to:
- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

Suggested reading
1. The Constitution of India, 1950 (Bare Act), Government Publication.

AX5096 PEDAGOGY STUDIES

COURSE OBJECTIVES
Students will be able to:
- Review existing evidence on there view topic to inform programme design and policy
- Making under taken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

UNIT I INTRODUCTION AND METHODOLOGY:
Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions - Overview of methodology and Searching.

UNIT II INTRODUCTION AND METHODOLOGY:
Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions - Overview of methodology and Searching.

UNIT III THEMATIC OVERVIEW
Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.

UNIT IV EVIDENCE ON THE EFFECTIVENESS OF PEDAGOGICAL PRACTICES

67
Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers’ attitudes and beliefs and Pedagogic strategies.

UNIT V   PROFESSIONAL DEVELOPMENT
Professional development: alignment with classroom practices and follow up support - Peer support - Support from the head teacher and the community - Curriculum and assessment - Barriers to learning: limited resources and large class sizes

UNIT VI   RESEARCH GAPS AND FUTURE DIRECTIONS
Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.

TOTAL: 30 PERIODS

COURSE OUTCOMES:
Students will be able to understand:

- What pedagogical practices are being used by teachers informal and informal classrooms in developing countries?
- What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

SUGGESTED READING

AX5097        STRESS MANAGEMENT BY YOGA        L  T  P  C
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COURSE OBJECTIVES
- To achieve overall health of body and mind
- To overcome stress

UNIT I
Definitions of Eight parts of yoga.(Ashtanga)

UNIT II

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025
Yam and Niyam - Do’s and Don’t’s in life - i) Ahinsa, satya, astheya, bramhacharya and aparigraha, ii) Ahinsa, satya, astheya, bramhacharya and aparigraha.

UNIT III
Asan and Pranayam - Various yog poses and their benefits for mind & body - Regularization of breathing techniques and its effects-Types of pranayama

TOTAL: 30 PERIODS

COURSE OUTCOMES
Students will be able to:
- Develop healthy mind in a healthy body thus improving social health also
- Improve efficiency

SUGGESTED READING
1. ‘Yogic Asanas for Group Tarining-Part-I”:Janardan Swami Yoga bhyasi Mandal, Nagpur
2. “Rajayoga or conquering the Internal Nature” by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

AX5098 PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

COURSE OBJECTIVES:
- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

UNIT I
Neetisatakam-holistic development of personality - Verses- 19,20,21,22 (wisdom) - Verses- 29,31,32 (pride & heroism) – Verses- 26,28,63,65 (virtue) - Verses- 52,53,59 (dond’s) - Verses- 71,73,75,78 (do’s)

UNIT II
Approach to day to day work and duties - Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48 - Chapter 3-Verses 13, 21, 27, 35 Chapter 6-Verses 5,13,17,23, 35 - Chapter 18-Verses 45, 46, 48.

UNIT III
Statements of basic knowledge - Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 Chapter 12 - Verses 13, 14, 15, 16,17, 18 - Personality of role model - shrimad bhagwad geeta - Chapter2-Verses 17, Chapter 3-Verses 36,37,42 - Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63

TOTAL: 30 PERIODS

COURSE OUTCOMES:
Students will be able to
- Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
- The person who has studied Geeta will lead the nation and mankind to peace and prosperity
- Study of Neet is hatakam will help in developing versatile personality of students.

SUGGESTED READING
1. Gopinath, Rashtriya Sanskrit Sansthanam P, Bhartrihari’s Three Satakam, Niti-sringar-vairagya, New Delhi,2010