KUMARAGURUCOLLEGE OF TECHNOLOGY
(An Autonomous Institution Affiliated to Anna University, Chennai)
COIMBATORE – 641049

REGULATIONS 2014

CURRICULUM AND SYLLABUS

III- VIII Semesters

B.E., AUTOMOBILE ENGINEERING

Department of Automobile Engineering
Department of Automobile Engineering

Vision
To be recognized as Learning and Research Department in Automobile Engineering in India that attracts outstanding researchers, leading industries, competent faculty and interested students

Mission
➢ To prepare Automobile Engineering Students for a successful career in global Automotive industry through effective teaching, training and research.
➢ To mould Students of Automobile Engineering as value based engineers, creative researchers and innovative entrepreneurs.

Programme Educational Objectives
1. Prepare Graduates to pursue successful career in automotive and allied industries as an Engineer
2. Prepare Graduates to pursue higher education, research and teaching profession in the related areas of automobile engineering.
3. Prepare Graduates to become entrepreneur in manufacturing, retailing and servicing sectors.

Program Outcomes
1. Ability to apply mathematical concepts, scientific techniques and Engineering Knowledge.
2. Ability to identify, formulates, and analyse Automotive engineering problems.
3. Ability to design and develop solutions for practical problems of Automobile systems and processes.
4. Ability to investigate, interpret, analyze data and report results for complex problem.
5. Ability to use modern computing tools to design and develop Automotive components and systems.
6. Ability to apply skill and subject knowledge base to study and address the needs and impact on the society.
7. Ability to offer solutions with reference to the social, legal and environmental issues and to maintain sustainability.
8. Ability to understand ethical, social and professional responsibilities to practice in the right way.
9. Ability to contribute effectively as an individual and also as a team player.
10. Ability to communicate effectively using graphical techniques, reports and presentations with a broad range of information technology skills.
11. Ability to plan and execute projects with due considerations for quality, financial constraints and time schedules.
12. Ability to understand the need for lifelong learning to update on latest technologies through self learning.

Kumaraguru College of Technology

Signature of the Chairman
BOS/Automobile Engineering
## B.E.-Automobile Engineering

### SEMESTER III

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Signature of the Chairman
BOS/Automobile Engineering
### ONE CREDIT COURSES

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<td>U14AU/N02</td>
<td>Automotive Styling</td>
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### SUMMARY OF CREDITS FOR 2014 REGULATION

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SEMESTER III
Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Solve a set of algebraic equations representing steady state models formed in engineering problems [K3]

CO2: Fit smooth curves for the discrete data connected to each other or to use interpolation methods over these data tables [K3]

CO3: Find the trend information from discrete data set through numerical differentiation and summary information through numerical integration [K4]

CO4: Predict the system dynamic behavior through solution of ODEs modeling the system [K5]

CO5: Solve PDE models representing spatial and temporal variations in physical systems through numerical methods [K3]

CO6: Have the necessary proficiency of using MATLAB for obtaining the above solutions [K2]

Pre-requisite:
1. Nil

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

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Course Assessment methods:

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INTRODUCTION
3 Hours
Simple mathematical modeling and engineering problem solving – Algorithm Design – Flow charting and pseudocode – Accuracy and precision – round off errors

Signature of the Chairman
BOS/Automobile Engineering
NUMERICAL SOLUTION OF ALGEBRAIC EQUATIONS 7 +3 Hours

CURVE FITTING AND INTERPOLATION 7 +3 Hours

NUMERICAL DIFFERENTIATION AND INTEGRATION 7+3 Hours
Numerical differentiation by using Newton’s forward, backward and divided differences – Numerical integration by Trapezoidal and Simpson’s 1/3 and 3/8 rules – Numerical double integration.

NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 10+3 Hours

NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATION(PDEs) 11+3 Hours
Use of MATLAB Programs to workout solutions for all the problems of interest in the above topics

Theory :45 Hr  Tutorial: 15 Hr  Total Hours: 60

References:

Other references:
Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Understand the construction details of various types of automotive chassis and basic functions of subsystems in the chassis.

CO2: Distinguish various types of suspension system, brake system, steering system and wheels & tyres in the vehicles.

CO3: Apply the knowledge for selection of suitable subsystems for a vehicle.

Pre-requisite:
1. Nil

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

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INTRODUCTION
9 Hours
Types of Chassis layout, with reference to Power Plant location and drive, various types of frames, Loads acting on vehicle frame, Constructional details and materials for frames, Testing of frames, Types of Front Axles and Stub Axles, Front Wheel Geometry, namely, Castor, Camber, King Pin Inclination and Toe–in, Ackerman’s and Daut’s Steering Mechanisms, Steering Linkages, Different Types of Steering Gears, Slip Angle, Over–Steer and Under–Steer, Reversible and Irreversible Steering, Power–Assisted Steering.

DRIVE LINE
9 Hours
AXLES  
9 Hours
Construction of Drive Axles, Types of Loads acting on drive axles, Full – Floating, Three–Quarter Floating and Semi–Floating Axles, Axle Housings and Types, Types and Constructional Details of Different Types of Wheels and Rims, Different Types of Tyres and their constructional details.

SUSPENSION SYSTEM  
9 Hours

BRAKING SYSTEM  
9 Hours

Theory: 45 Hr  
Total Hours: 45

References:

Other references:

Signature of the Chairman  
BOS/Automobile Engineering
Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Understand the basics and laws of thermodynamics with respect to heat engines and thermal equipment.

CO2: Apply the knowledge of working fluids in various thermodynamic equipment.

CO3: Understand the modes of heat transfer with respect to various heat exchangers.

Pre-requisite:
1. Engineering Physics

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CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

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BASIC THERMODYNAMICS 10+3 Hours

AIR STANDARD CYCLES AND COMPRESSORS 9+3 Hours
Otto, Diesel and Dual combustion. Air standard efficiency. Mean effective pressure, Reciprocating compressors. Intercooling – Minimum work requirement

STEAM AND JET PROPULSION 8+3 Hours
Properties of steam — Simple Rankine cycle- Brayton cycles – Simple jet propulsion system

REFRIGERATION AND AIR-CONDITIONING 9+3 Hours

HEAT TRANSFER
9+3 Hours

Theory :45 Hr  Tutorial: 15 Hr  Total Hours: 60

References:

Other references:
Course Outcomes
After successful completion of this course, the students should be able to:
CO1: Understand the Casting, Welding & Machining processes used for automotive components manufacturing
CO2: Understand the basic methods of Forming
CO3: Apply the knowledge for selecting suitable manufacturing process for various automotive components manufacturing.

Pre-requisite:
1. Nil

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

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CASTING 10 Hours
Casting types, procedure to make sand mould, types of core making, moulding tolls, machine moulding, special moulding processes – CO₂ moulding; shell moulding, investment moulding, permanent mould casting, pressure die casting, centrifugal casting, continuous casting, casting defects, Application of Castings in Automobile.

FORMING PROCESSES AND POWDER METALLURGY 10 Hours
Principles and applications of the following processes: Forging, Rolling, Extrusion, Wire drawing and Spinning, Forming and Shaping of Plastics – Moulding Types, Thermoforming, Press forming Powder metallurgy – Principal steps involved advantages, disadvantages and limitations of powder metallurgy. Application of Forming, Hydro forming, Powder Metallurgy in Automobile.

Signature of the Chairman
BOS/Automobile Engineering
WELDING 8 Hours

MACHINING 12 Hours
Introduction to the Lathe, Shaper, Planer, Horizontal milling machine, Universal drilling machine, Cylindrical grinding machine, Capstan, Turret lathe CNC machines & Operations. Principles and applications of the Abrasive jet machining, Ultrasonic machining, Electric discharge machining, Electro chemical machining, Plasma arc machining, and Electron beam machining and Laser beam machining. Application of Machining in Automobile

ASSEMBLY 3 Hours
Assembly methods, straight assembly, group assembly, line balancing.

Theory :45 Hr  Total Hours: 45

References:

Other references:
Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Understand the importance of engineering materials and their structures and Phase diagrams.

CO2: Understand the various heat treatments process

CO3: Understand the Testing of materials and its properties.

CO4: Understand about the Fe & Non-Fe alloys, Non-Metallic materials and Modern Materials

CO5: Select the materials for particular engineering application

Pre-requisite:
1. Engineering Physics, Material Science and Engineering Chemistry

CO/PO Mapping

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CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS
8 Hours

HEAT TREATMENT
8 Hours
MECHANICAL PROPERTIES AND TESTING  
6 Hours

FERROUS AND NON-FERROUS ALLOYS  
8 Hours
Composition, structure and properties of carbon steels - low alloy steels, stainless steels, tool steels, Cast irons - grey iron, ductile iron, white iron and malleable iron, Non-ferrous alloys - copper and copper alloys, aluminium and aluminium alloys, magnesium and magnesium alloys, nickel and nickel alloys and titanium and titanium alloys.

NON-METALLIC MATERIALS  
8 Hours
Polymeric materials - Formation of polymer structure - Properties and applications of engineering polymers - Advanced structure ceramics, WC, TiC, Al₂O₃, SiC, Si₃N₄, CBN and Diamond - Properties, processing and applications. Composite materials: Types, production techniques, structure, properties and applications.

MODERN MATERIALAS  
4 Hours
Micro alloyed steels, High Strength Low alloy (HSLA) steel -Transformation induced plasticity (TRIP) steel, Maraging steel, Smart materials, Shape memory alloys Metallic glasses - Quasi crystals and nano crystalline materials.

APPLICATION OF MATERIALS  
3 Hours
Criteria of selecting materials for automotive components viz cylinder block, Cylinder head, piston, piston ring, Gudgeon pin, connecting rod, crank shaft, crank case, cam, cam shaft, engine valve, gear wheel, clutch plate, axle, bearings, chassis, spring, body panel, radiator, brake lining etc. Automotive technical textiles.

Total Hours: 45

References:

Other references:

Signature of the Chairman  
BOS/Automobile Engineering
Course Outcomes
After successful completion of this course, the students should be able to:
CO1: Understand the concepts of stress and strain
CO2: Analyze the beams of different cross sections for shear force, bending moment, slope and deflection
CO3: Understand the concepts necessary to design the structural elements and pressure vessels

Pre-requisite:
1. Nil

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10+3 Hours

CONCEPT OF STRESSES AND STRAINS

ANALYSIS OF BEAMS 9 +3 Hours
Types of beams and loads – shear force and bending moment diagrams for cantilevers, simply supported and over hanging beams. Theory of pure bending- Bending stresses in simple and composite beams. Shear stress distribution in beams of different sections.

DEFLECTION OF BEAMS 9 +3 Hours
Slope and deflection of cantilever, simply supported beam by double integration method – Macaulay’s method – Moment area method – Castigliano’s theorem.

Signature of the Chairman
BOS/Automobile Engineering
TORSION OF SHAFTS  
Theory of pure torsion, torsion of circular shafts and composite shafts.

COLUMNS AND CYLINDERS  
Columns and struts: Member subjected to combined bending and axial loads, Euler’s theory, Crippling load, Rankine’s theory.
Cylinders And Shells: Thin cylinder, thin spherical shells under internal pressure – Thick cylinders – Lame’s equation – Shrink fit and compound cylinders.

Theory :45 Hr  
Tutorial: 15 Hr  
Total Hours: 60

References:

Other references:
U14AUP301
MANUFACTURING
TECHNOLOGY LABORATORY

Course Outcomes
After successful completion of this course, the students should be able to:
CO1: Use of appropriate method, Tools and machine tools for performing Lathe operations
CO2: Use of appropriate method, Tools and machine tools for performing drilling operations
CO3: Use of appropriate method, Tools and machine tools for performing grinding operations
CO4: Use of appropriate method, Tools and machine tools for manufacturing gears

Pre-requisite:
1. Nil

CO/PO Mapping
(S/M/W indicates strength of correlation)  S-Strong, M-Medium, W-Weak

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LIST OF EXPERIMENTS

1. LATHE
   1.1. Facing, plain turning and step turning
   1.2. Taper turning using compound rest.
   1.3. Taper turning using taper turning attachment
   1.4. Single start V thread, cutting and knurling
2. SHAPER AND SLOTTER
   2.1. Machining a V- block (in a Shaper)
   2.2. Machining internal key-way (in a Slotter)
3. DRILLING
   3.1. Drilling 4 or 6 holes at a given pitch circle on a plate
   3.2. Drilling, reaming and tapping
4. MILLING
   4.1. Plain Milling Exercise
   4.2. Gear Milling Exercise
5. GRINDING
   5.1. Cylindrical Grinding Exercise

(Note: Experiments beyond the syllabus should be conducted)

Total Hours 30

Signature of the Chairman
BOS/Automobile Engineering
A) STRENGTH OF MATERIALS LABORATORY

B) METALLURGY LABORATORY

Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Required knowledge in the area of testing of materials and components of structural elements experimentally.

CO2: Understand the procedures for evaluating the mechanical behaviour of materials

CO3: Understand the experimental procedures in carrying out heat treatment operations

Pre-requisite:
1. Nil

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LIST OF EXPERIMENTS

a) STRENGTH OF MATERIALS LABORATORY

1. Tension & Shear Test on Mild Steel Rod
2. a) Torsion Test on Mild Steel Rod
   b) Compression Test on Concrete Cube.
3. Hardness Test- Brinell, Vickers and Rockwell Hardness tests
4. Impact Test- Izod, Charpy Impact Tests
5. Test on Helical Springs- Compression and Tension Springs
6. Defection Test on Beams
b) METALLURGY LABORATORY
   1. Specimen preparation for metallographic examination
   2. Study of metallurgical microscope, different types and their operations
   4. Micro-structural study of Low, Medium, High Carbon steels
   5. Micro-structural study of Quenched, Tempered, Case hardened steel

(Note: Experiments beyond the syllabus should be conducted)

Total Hours 30
Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Dismantle and Assemble the automobile chassis and Engine components
CO2: Identify & differentiate components of SI & CI engines
CO3: Understand working of braking, steering, clutch, transmission, Suspension systems.
CO4: Differentiate various subsystems of two, three & Four wheeler vehicles

Pre-requisite:
1. Nil

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LIST OF EXPERIMENTS

AUTOMOTIVE CHASSIS LABORATORY
1. Study and measurement of the Light duty vehicle chassis frame
2. Performance test on suspension test Rig
3. Performance test on chain test Rig

Study, dismantling and assembling of
4. Front Axle and Rear Axle
5. Differential
6. Steering systems along with any two types of steering gear box
7. Braking systems–compressed air power brakes, drum and disc brakes

Study, Dismantling and Assembling of
8. Clutch assembly of different types

Signature of the Chairman
BOS/Automobile Engineering
ENGINE COMPONENTS LABORATORY
1. Dismantling of 4 cylinder petrol engine.
5. Study of oil filter, fuel filter, fuel injection system, carburetor, MPFI
6. Study of engine lubrication system components

(Note: Experiments beyond the syllabus should be conducted)

Total Hours 30
U14GHP301  SOCIA L VALUES

(Com mon to all branches of Engineering and Technology)

Course Outcomes
After successful completion of this course, the students should be able to:
CO1: Adopt and practice social values as his regular duties.
CO2: Take over the social responsibilities.
CO3: Give solutions and to manage the challenging social issues.
CO4: Voluntarily participate and organize social welfare programmes.
CO5: Explore his ideology of techno social issues and provide the best solution.

Pre-requisite:
1. Nil

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ORIGIN OF SOCIETY
5 Hours
Practical: Group Discussion on Evolution of Man and formation of society, Panel discussion on Social values - Pancha Bhoodha Navagraha Meditation.

SELF AND SOCIETY
2 Hours
Duty to self, family, society and world – Realization of Duties and Responsibilities of individuals in the society (Five fold cultures) – impact of social media on present day youth and correction measures.
Practical: Case study – interaction with different professionals.
EDUCATION& SOCIETY
Education: Ancient and Modern Models.
Practical: Making Short film on impact of education in social transformation.

DISPARITY AMONG HUMAN BEINGS
Wealth’s for humans, Factors leading to disparity in human beings and Remedies.
Practical: Debate on disparity and social values.

CONTRIBUTION OF SELF TO SOCIAL WELFARE
Practical: In campus, off campus projects.

GENERAL PRACTICAL
Standing : Pada Hastasana, Ardha Cakrasana, Trikonasana, Virukhsana (Eka Padaasana)
Sitting : Padmasana, Vakrasana, Ustrasana, Paschimatanasana.
Prone : Uthanapathasana, Sarvangasana, Halasana, Cakrasana,
Supine : Salabhasana, Bhujangasana, Dhanurasana, Navukasana.

Theory :16 Hr  Tutorial: 14 Hr  Total Hours: 30

References:

Other references:
SEMESTER IV
Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Understand the properties of the fluid.
CO2: Understand and solve the fluid flow problems.
CO3: Understand the mathematical techniques of practical flow problems.
CO4: Understand the energy exchange process in fluid machines.

Pre-requisite:
1. Nil

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PROPERTIES OF FLUIDS AND FLUID STATICS 9+3 Hours
Fluid properties: Mass density, specific weight, specific volume, specific gravity, viscosity, vapour pressure, compressibility, surface tension and capillarity. Fluid statics: fluid pressure at a point, variation of pressure within a static fluid, hydrostatic law – Pressure head, Pascal’s law. Measurement of pressure – Piezometric tube, manometry.

FLUID KINEMATICS AND FLUID DYNAMICS 10+3 Hours
Fluid dynamics: Euler’s equation of motion along a streamline – Bernoulli’s equation. Practical applications of Bernoulli’s equation in flow measurement devices like venturimeter, orificemeter and pitot tube. Concept of impulse momentum equation & angular momentum principle with applications.

Signature of the Chairman
BOS/Automobile Engineering
DIMENSIONAL AND MODEL ANALYSIS  8+3 Hours
Dimensional analysis: dimensions, dimensional homogeneity, methods of dimensional analysis-Buckingham Pi theorem. Model analysis – Advantages and applications of model testing. Similitude, derivations of important dimensionless numbers, model laws.

FLOW THROUGH PIPES  8+3 Hours
Laminar and turbulent flow characteristics, laminar flow through circular pipes – Hagen Poiseuille law, major and minor losses in pipes, pipe friction, Darcy – Weisbach equation, parallel, series and branched pipes.

HYDRAULIC MACHINES  10+3 Hours

Theory :45 Hr  Tutorial: 15 Hr  Total Hours: 60

References:

Other references:
Course Outcomes
After successful completion of this course, the students should be able to:
CO1: Distinguish the various basic electrical and electronics systems of an automobile.
CO2: Recognize and understand the different wiring diagrams used in automobile manuals.

Pre-requisite:
1. Basics of Electrical and Electronics Engineering

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TYPES OF BATTERIES
9 Hours
Batteries – types, construction and working principle of Lead Acid Battery, Nickel – Cadmium Battery, Nickel Metal Hydride Battery, Sodium Sulphur Battery and Aluminum air Battery, lithium ion batteries, Characteristics of batteries, battery rating, capacity and efficiency, Various Tests on battery, battery – charging techniques, maintenance of batteries.

STARTING AND CHARGING SYSTEM
9 Hours
Requirements of Starter Motor, Starter Motor types, construction and characteristics, Starter drive mechanisms, Starter Switches and Solenoids, Charging system components, Generators and Alternators, types, construction and Characteristics, Voltage and Current Regulation, Cut –out relays and regulators, charging circuits.

IGNITION SYSTEM
9 Hours
FUEL INJECTION SYSTEM  
9 Hours
Introduction, electronic fuel carburetion, fuel injection- types and system overview, components of fuel injection system, diesel fuel injection – introduction of diesel fuel injection, diesel exhaust emissions, electronic control of diesel injection

WIRING, LIGHTING AND OTHER INSTRUMENTS  
9 Hours
Automotive electrical wiring, terminals and switching, multiplexed wiring system, electromagnetic compatibility(EMC), Lighting system – basic lighting system, Head Lamp and Indicator Lamps, Anti–Dazzling and Dipper system

Theory : 45 Hr  
Total Hours: 45

References:

Other references:

Signature of the Chairman
BOS/Automobile Engineering
Course Outcomes
After successful completion of this course, the students should be able to:
CO1: Understand the Construction and operation of IC Engine
CO2: Understand the Fuels and Combustion in IC Engines
CO3: Apply the knowledge for Performance calculation of IC Engine

Pre-requisite:
1. Nil

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Course Assessment methods:
1. Assignments
2. Continuous assessment tests
3. End-semester examination

ENGINE CONSTRUCTION AND OPERATION 10 Hours
Four stroke SI and CI engines – Working principle – function, materials, constructional details of engine components – Valve timing diagram – Firing order and its significance – relative merits and demerits of SI and CI engines
Two stroke engine construction and operation. Comparison of four-stroke and two-stroke engine operation

FUELS AND COMBUSTION 10 Hours
Combustion equation, conversion of gravimetric to volumetric analysis – Determination of theoretical minimum quantity of air for complete combustion – Determination of air fuel ratio for a given fuel.
Properties and rating of fuels (petrol and diesel), chemical energy of fuels, reaction equation, combustion temperature, combustion chart.

Signature of the Chairman
BOS/Automobile Engineering
COMBUSTION IN SI ENGINES  
8 Hours

COMBUSTION IN CI ENGINES  
9 Hours
Importance of air motion – Swirl, squish and turbulence – Swirl ratio. Fuel air mixing – Stages of combustion – Delay period – Factors affecting delay period, Knock in CI engines – methods of controlling diesel knock. CI engine combustion chambers – Combustion chamber design objectives – open and divided. Induction swirl, turbulent combustion chambers. – Air cell chamber – M Combustion chamber

ENGINE PERFORMANCE  
8 Hours

Theory :45 Hr

Total Hours: 45

References:

Other references:
Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Understand and remember the fundamentals of various mechanisms, structures, inversion mechanisms etc

CO2: Applying the knowledge for selecting the suitable drives like belt, ropes, pulleys etc.

CO3: Creating the cam profile for required conditions.

CO4: Analyzing the various vibrations in the moving components of a mechanism

Pre-requisite:
1. Engineering Mechanics

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9+3 Hours

MECHANISMS

FRICTION
9+3 Hours
Thrust bearing – Plate and disc clutches – Belt (flat and V) and rope drives. Ratio of tensions – Effect of centrifugal and initial tension – Condition for maximum power transmission – Open and crossed belt drive.

GEARING AND CAMS
9+3 Hours
BALANCING

Static and dynamic balancing – Single and several masses in different planes – Balancing of reciprocating masses - primary balancing and concepts of secondary balancing – Single and multi-cylinder engines (Inline) – Balancing of radial V engine – direct and reverse crank method.

VIBRATION


Theory : 45 Hr  Tutorial: 15 Hr  Total Hours: 60

References:

Other references:
Course Outcomes
After successful completion of this course, the students should be able to:
CO1: Attempt modeling real life systems of interest in order to predict its dynamic behavior
CO2: Use simulation tools to determine dynamic response of system following external inputs
CO3: Take up advanced courses on system dynamics, monitoring and control with familiarity on
terminology and techniques employed in the above.

Pre-requisite:
1. Nil

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MODELING ELEMENTARY SYSTEMS 9+3 Hours

TIME RESPONSE ANALYSIS OF SYSTEMS 9+3 Hours
Time response, test signals, obtaining dynamic response of first order and second order linear systems for step inputs through analytical solution of governing equations – Transient response specifications – Delay time, rise time, peak overshoot, undamped natural frequency, damping factor, settling time – Experimental determination of above parameters.

FREQUENCY RESPONSE OF ANALYSIS OF SYSTEMS 9+3 Hours
Frequency response, frequency domain specifications, Excitation and response signals of systems – Transfer functions – The sinusoidal steady state – Magnitude and phase response – Bode plots from transfer functions, Contributions from first order poles and zeros and complex conjugate pole pairs in frequency response.
MATHEMATICAL MODELING OF ELEMENTARY SYSTEMS

USING MATLAB

Introduction to MATLAB, elementary Math built-in Functions, general Commands, Programming in MATLAB, dynamic response of general (including non-linear) system models through numerical integration of ODEs using MATLAB, Simulink.

Case study: Elementary suspension system.

AUTOMOTIVE SYSTEM MODELS USING SIMULINK /SCADA / LABVIEW


Theory :45 Hr  Tutorial: 15 Hr  Total Hours: 60

References:

Other references:
Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Play an important role in transferring a healthy environment for future generations

CO2: Analyse the impact of engineering solutions in a global and societal context

CO3: Discuss contemporary issues that result in environmental degradation and would attempt to provide solutions to overcome those problems

CO4: Ability to consider issues of environment and sustainable development in his personal and professional undertakings

CO5: Highlight the importance of ecosystem and biodiversity

CO6: Paraphrase the importance of conservation of resources

Pre-requisite:
1. Nil

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**CO/PO Mapping**
(S/M/W indicates strength of correlation)  S-Strong, M-Medium, W-Weak

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**INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES**

Definition, scope and importance – Need for public awareness – Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, floods, drought, conflicts over water, dams benefits and problems – Mineral resources: Use and exploitation,
environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

**ECOSYSTEMS AND BIODIVERSITY**  
14 Hours

ECOSYSTEM : Concept of an ecosystem – Structure and function of an ecosystem: Producers, consumers and decomposers, Energy flow in the ecosystem, Food chains, food webs and ecological pyramids – Ecological succession – Introduction, types, characteristic features, structure and function of the (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) –


**ENVIRONMENTAL POLLUTION**  
8 Hours

Definition – Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – Solid waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

**SOCIAL ISSUES AND THE ENVIRONMENT**  
7 Hours


**HUMAN POPULATION AND THE ENVIRONMENT**  
6 Hours


**Field Work**

Visit to local area to document environmental assets- river / grassland / hill / mountain, visit to local polluted site- urban / rural / industrial / agricultural, study of common plants, insects, birds, study of simple ecosystems-pond, river, hill slopes etc.,

**Theory :45 Hr**  
**Total Hours: 45**
References:

Other references:
Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Modeling the Automotive components using Design software

CO2: Assemble the Automotive components.

Pre-requisite:
1. Nil

CO/PO Mapping
(S/M/W indicates strength of correlation)  S-Strong, M-Medium, W-Weak

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LIST OF EXPERIMENTS

Part Design:
1. Piston
2. Connecting Rod
3. Crank shaft
4. Cam Shaft
5. Valve
6. Flywheel
7. Cylinder Block
8. Cylinder Head
9. Tyre & Rim
10. Clutch Components

Assembly Design:
1. Piston ,Connecting Rod and Crank shaft Assembly
2. Clutch Assembly

(Note: Experiments beyond the syllabus should be conducted)

Total Hours 30
A) THERMAL ENGINEERING LABORATORY

B) FLUID MECHANICS & MACHINERY LABORATORY

Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Apply the knowledge for finding performance characteristics of thermal equipments

CO2: Apply the knowledge of heat transfer

CO3: Use the measurement equipments for flow measurement

CO4: Do performance test on different fluid machinery

Pre-requisite:
1. Nil

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LIST OF EXPERIMENTS

a) THERMAL ENGINEERING LABORATORY

1. Experimental study on valve timing diagram in 4-stroke diesel engine and Experimental study on port timing diagram in 2-stroke petrol engine
2. Performance test on Air Compressor
3. Determination of COP of a Refrigeration System
4. Heat Transfer on PIN FIN Apparatus
5. Effectiveness of Parallel and counter-flow heat exchanger

b) FLUID MECHANICS & MACHINERY LABORATORY

1. Determination of the Coefficient of discharge of a given Orifice meter.
2. Determination of the Coefficient of discharge of a given Venturi meter.
3. Determination of friction factor for a given set of pipes.
4. Performance Characteristic curves of centrifugal pump
5. Performance characteristics of Francis turbine.

(Note: Experiments beyond the syllabus should be conducted)

Total Hours 30

Signature of the Chairman
BOS/Automobile Engineering
Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Recognize and understand the different wiring diagrams used in automobile manuals.

CO2: Understand basic electrical and electronic circuits used in automobile systems and also understand the basic programming with the 8085 microprocessor

Pre-requisite:
1. Basics of Electrical and Electronics Engineering Laboratory

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LIST OF EXPERIMENTS

AUTOMOTIVE ELECTRICAL LABORATORY
1. Testing of batteries and battery maintenance
2. Study of starting motors and generators
3. Diagnosis of ignition system faults
4. Study of Automobile electrical wiring
5. Study of power window

AUTOMOTIVE ELECTRONICS LABORATORY
1. Study of rectifiers, Logic gates, 555 timer
2. Study of RTD, LVDT, and Load Cell.
3. Study of A to D and D to A converters
4. Micro Processor programming and interfacing

(Note: Experiments beyond the syllabus should be conducted )

Total Hours: 30

Signature of the Chairman
BOS/Automobile Engineering
Course Outcomes
After successful completion of this course, the students should be able to:
CO1: Act as a good and responsible citizen.
CO2: Conserve and protect eco cycle.
CO3: Voluntarily work with global welfare organization and provide solution for global peace.
CO4: Invent his Technical design by considering humanity and nature.

Pre-requisite:
1. Nil

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ROLE OF A RESPONSIBLE CITIZEN
Citizen – its significance–National and Global perspectives.
Practical: Group discussion on National and Global values.

GREATNESS OF INDIAN CULTURE
Emerging India – past and present, about Culture, Morality and spirituality– Beauty of Unity in diversity – Impact of western culture in India and Indian culture over other countries.
Practical: Demonstration and impact measurements of simple and good actions.

GLOBAL WELFARE ORGANISATIONS
Education – Health – Nature – Peace
Practical: Organizing an event linking with one of the Organizations In campus /off campus.
PRESERVING NATURE  
2 Hours
Appreciating the flora and fauna on Earth – Importance of Ecological balance – Conservation.
Practical: Trekking, field visit.
Practical: Debate on disparity and social values.

GLOBAL PEACE  
4 Hours
One World and One Humanity – Global Peace.
Practical: Group discussion on individual plans for world peace.

GENERAL PRACTICAL  
16 Hours
Simplified physical Exercise – Kayakalpa practice (Follow up practice) – Meditation - Theory & Practice
Pranayama: Bhashrika, Kapala Bhati, Nadi suddhi, Sikari, Sitali.

Theory: 14 Hr  Tutorial: 16 Hr  Total Hours: 30

References:

Other references:
SEMESTER V
U14AU7501 AUTOMOTIVE FINITE ELEMENT ANALYSIS

Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Understand the discretization and finite element approach
CO2: Select appropriate elements to solve physical and engineering problems with emphasis as an automobile engineering applications
CO3: Derive element matrix equation by different methods by applying basic laws in mechanics and integration by parts.

Pre-requisite:
1. Numerical Methods

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INTRODUCTION
8+3 Hours

ONE DIMENSIONAL PROBLEMS
12+3 Hours
TWO DIMENSIONAL PROBLEMS – SCALAR VARIABLE PROBLEMS  
6+3 Hours
Finite element modeling – CST element – Element equations, Load vectors and boundary conditions – Assembly – Application to heat transfer – Automotive Examples.

TWO DIMENSIONAL PROBLEMS – VECTOR VARIABLE PROBLEMS  
10+3 Hours

ISOPARAMETRIC ELEMENTS FOR TWO DIMENSIONAL PROBLEMS  
9+3 Hours

Theory :45 Hr  
Tutorial: 15 Hr  
Total Hours: 60

References:

Other references:

Signature of the Chairman  
BOS/Automobile Engineering
Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Identify the basic measurement tools
CO2: Apply the concept of measurements in inspecting various parameters.

Pre-requisite:
1. Engineering Physics

CO/PO Mapping

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INTRODUCTION TO METROLOGY
9 Hours
Units and standards, terminology and measurement errors. Linear measuring instruments, dial gauges, comparators and linear measuring machines. Angular measuring instruments - measurement of straightness flatness and surface finish. Profilographs.

MEASUREMENTS OF SCREW THREAD – GEAR ELEMENTS – SURFACE FINISH
9 Hours

PRESSURE AND FLOW MEASUREMENT
9 Hours
Bourden tube, diaphragm, bellows and pressure capsules: Transducers used in pressure measurement- potentiometer, strain gauges, LVDT, capacitive and variable reluctance type transducers.
Obstruction type flow meter-, flow nozzles, pitot tube, Positive displacement flow meters – turbine flow meter, flouted tube flow meter, anemometer, ultrasonic flow meter, magnetic flow meters.

Signature of the Chairman
BOS/Automobile Engineering
TEMPERATURE MEASUREMENT 9 Hours

FORCE AND TORQUE MEASUREMENT 9 Hours

Theory :45 Hr Total Hours: 45

References:

Other references:
Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Understand the Intake and Exhaust Systems
CO2: Understand the Carburetion and injection in Engines
CO3: Understand the Supercharging, Turbocharging and Scavenging in Engines

Pre-requisite:
1. Nil

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INTAKE AND EXHAUST SYSTEMS
9 Hours
Intake system components – Discharge coefficient, Pressure drop – Air filter, intake manifold, Connecting Pipe – Exhaust system components – Exhaust manifold and exhaust pipe – Spark arresters – Exhaust mufflers, Types, operation

CARBURATION AND GASOLINE INJECTION
9 Hours
Mixture requirements for steady state and transient operation, Mixture formation studies of volatile fuels, design of elementary carburetor Chokes – Effects of altitude on carburetion – Carburetor for 2-stroke and 4-stroke engines – carburetor systems for emission control. Petrol injection – Open loop and closed loop systems, mono point, multi-point and direct injection systems – Principles and Features, Bosch injection systems.

DIESEL INJECTION
9 Hours

Signature of the Chairman
BOS/Automobile Engineering
LUBRICATION AND COOLING  
Need for cooling system – Types of cooling system – Liquid cooled system: Thermosyphon system, Forced circulation system, pressure cooling system – properties of coolant, additives for coolants
Need for lubrication system – Mist lubrication system, wet sump any dry sump lubrication – Properties of lubricants, consumption of oil.

SUPERCHARGING AND SCAVENGING  
Classification of scavenging systems –Mixture control through Reed valve induction – Charging Processes in two-stroke cycle engine – Terminologies – Shankey diagram – perfect displacement, perfect mixing

Theory :45 Hr  
Total Hours: 45

References:

Other references:
Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Understand and Apply Engineering Design process
CO2: Apply engineering principles and analytical techniques in the design process
CO3: Design the Machine Components like Shafts and Springs Gear Design Flywheels and Bearings.

Pre-requisite:
1. Strength of Materials

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INTRODUCTION
9+3 Hours
Classification of design – Engineering materials and their physical properties as applied to design – Selection of materials – Factors of safety in design – Endurance limit of materials – Determination of endurance limit for ductile materials.
Limits-Types of fits – types of tolerance – calculation of minimum and maximum clearances and allowances.

DESIGN OF SHAFTS AND SPRINGS
9+3 Hours

GEAR DESIGN
9+3 Hours
FLYWHEELS

Determination of the mass of a flywheel for a given co-efficient of speed fluctuation. Engine flywheels stresses of rim of flywheels. Design of hubs and arms of flywheel – Turning moment diagram.

DESIGN OF BEARINGS


Theory :45 Hr  Tutorial: 15 Hr  Total Hours: 60

References:

Other references:
U14AUT7505 AUTOMOTIVE SENSORS AND EMBEDDED SYSTEMS

Course Outcomes
After successful completion of this course, the students should be able to:

**CO1:** Apply the knowledge of engineering for the selection of sensors for measuring various parameters in automotive systems.

**CO2:** Apply the knowledge of sensors in the management of the vehicle control.

**CO3:** Program and interface various sensors used in automobiles using microcontrollers.

Pre-requisite:
1. Nil

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SENSORS 8+3 Hours
Introduction to automotive sensors – resistive, inductive, capacitive transducers, Piezo electric transducers, Hall effect sensors, Ultrasonic sensors, Ranging radar (ACC)

**Power Train:** Fuel level sensors, Speed and RPM sensors, Lambda Oxygen sensor, NOX sensors, Hotwire air mass meter **Chassis:** Steering wheel angle sensor, Vibration and acceleration sensors, Pressure sensors, Speed and RPM sensors, torque sensors

ACTUATORS 8+3 Hours
Introduction to automotive Actuators – Solenoids, Operation and application of brushless DC motors, Servo and stepper motors, switched reluctance motors, Suspension semi active actuators, Mangetostrictive anti vibration actuators, Piezo Actuators

Signature of the Chairman
BOS/Automobile Engineering
INTRODUCTION TO EMBEDDED SYSTEM 10+3 Hours
Introduction to embedded system, applications of embedded system, Microcontroller v/s microprocessor, introduction to MPLAB, making and running projects in MPLAB, basic programs, introduction to PIC Microcontroller, Types and products of PIC - architecture - memory devices-addressing modes, memory mapping, System Peripherals and User peripherals – ADC, Interfacing temperature sensor with PIC micro via ADC

INTERRUPTS AND TIMERS 10+3 Hours
Programming interrupts, counters and timers and serial communication(MSSP), CCP(Capture Compare PWM gen module), External Memory

INTERFACING WITH PIC 9+3 Hours
Interfacing with LCD, sensors and motor control applications

Theory :45 Hr Tutorial: 15 Hr Total Hours: 60

References:
1. Automotive Sensors, BOSCH. 2002

Other references:
Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Understand the refining process of petroleum
CO2: Understand the various types of fuels and their properties
CO3: Apply the knowledge in testing the fuel properties
CO4: Understand the properties and purpose of lubricants.
CO5: Understand the Alternate fuels available

Pre-requisite:
1. Engineering Chemistry, Thermodynamics and Thermal Engineering

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MANUFACTURE OF FUELS AND LUBRICANTS 9 Hours
Fuels, Structure of petroleum, refining process, thermal and catalytic cracking, products of refining process, manufacture of lubricating oil base stocks and finished automotive lubricants.

FUELS FOR I.C. ENGINES 9 Hours
Types of Fuels, Liquid and gaseous fuels, heating value of fuels, higher and lower heating values, chemical structure of hydro-carbons SI Engine fuels, Volatility characteristics, desirable characteristics of SI Engine fuels, knock rating and additives.

COMBUSTION OF FUELS 9 Hours
Stoichiometry - calculation of theoretically correct air required for combustion of liquid and gaseous fuels, volumetric and gravimetric analysis of the dry products of combustion, mass of dry gas per kg of fuel burnt, mass of carbon in the exhaust gas, mass of carbon burnt to carbon-monoxide per kg of fuel, heat loss due to incomplete combustion, exhaust gas analysis by Orsat apparatus.
LUBRICANTS 9 Hours

ALTERNATE FUELS 9 Hours
Alternate fuels for SI engines and CI engines, desirable characteristics, Octane and cetane rating, biodiesel. Introduction to electric, hybrid and fuel cell vehicles.

Theory:45 Hr

References:

Other references:

Signature of the Chairman
BOS/Automobile Engineering
Course Outcomes
After successful completion of this course, the students should be able to:
CO1: Analyze various 1D, 2D and 3D Structures using FEA tools.
CO2: Analyze heat transfer modes using FEA tools.
CO3: Analyze fluid flow through pipes using FEA tools.

Pre-requisite:
1. Thermodynamics, Fluid Mechanics and Strength of Materials

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CO/PO Mapping
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LIST OF EXPERIMENTS

I. STRUCTURAL ANALYSIS
   1. 1-D truss
   2. 2-D truss
   3. 3-D truss
   4. Beam analysis
   5. 2-D structure with various loadings
   6. 2-D structures with different materials
   7. Plate with hole
   8. Modal analysis
   9. Transient Response

II. THERMAL ANALYSIS
   1. Steady State heat transfer
   2. Transient heat transfer

III. FLUID ANALYSIS
   1. Flow through pipes

(Note: Experiments beyond the syllabus should be conducted)

Total Hours 30
Course Outcomes
After successful completion of this course, the students should be able to:
CO1: Test the performance of various engines using dynamometers.
CO2: Assess the performance characteristics of automotive engines
CO3: Measure the properties of fuels and lubricants
Pre-requisite:
1. Automotive Engines
2. Thermodynamics and Thermal Engineering

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LIST OF EXPERIMENTS
1. Performance study of petrol engine at full throttle and part throttle conditions.
2. Performance study of diesel engine both at full load and part load conditions.
3. Morse test on petrol engines.
4. Determination of compression ratio, volumetric efficiency and optimum cooling water flow rate in IC engines.
5. Heat balance test on an automotive diesel and petrol engine.
7. Distillation of fuels
8. Aniline Point test of diesel
10. Reid vapour pressure test and Corrosion Test
11. Flash and Fire points of fuels.
12. Cloud & Pour point Test.
13. Ash content and Carbon Residue Test
14. Viscosity of fuels & Lubricants
15. Drop point of grease and mechanical penetration in grease.
(Note: Experiments beyond the syllabus should be conducted)

Total Hours 30
Course Outcomes
On successful completion of the course the learner would be able to:
CO1: Develop their design and fabrication knowledge and skills.
CO2: Develop the report writing and communication skills.

Pre-requisite:
1. Design and Manufacturing

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GUIDELINES:

1. The Mini Project-I may be a theoretical study and analysis, prototype design, modeling & simulation or a combination of these.
2. Should be done as individual project.
3. The progress of the project is evaluated based on a minimum of two reviews and final viva-voce examination.
4. A project report is required to be submitted at the end of the semester in the required format.
5. The review presentations and project report should contain estimated & actual time schedule with charts (PERT/GANTT), prototype cost estimations, drawings, 3D models in addition to the details of project work carried out.

Total Hours 30
Course Outcomes
On successful completion of the course the learner would be able to:
CO1: Imparting the role of communicative ability as one of the soft skills needed for placement
CO2: Developing communicative ability and soft skills needed for placement
CO3: Making students Industry-Ready through inculcating team-playing capacity

Pre-requisite:
1. Nil

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GRAMMAR IN COMMUNICATION
Grammar and Usage – Building Blocks, Homonyms, Subject and Verb Agreement, Error Correction - Grammar Application, Framing Questions – Question words, Verbal Questions, Tags, Giving Replies – Types of Sentences, Listening Comprehension – Listening and Ear training.

ASSERTIVE COMMUNICATION
Listening Comprehension in Cross–Cultural Ambience, Telephonic Conversations/ Etiquette, Role Play Activities, Dramatizing Situations- Extempore – Idioms and Phrases.

CORPORATE COMMUNICATION

PUBLIC SPEAKING
Giving Seminars and Presentations, Nuances of Addressing a Gathering - one to one/ one to a few/ one to many, Communication Process, Visual Aids & their Preparation, Accent Neutralization, Analyzing the Audience, Nonverbal Communication.
INTERVIEW & GD TECHNIQUES


Total Hours 45

References:

Other references (CD’s)
2. BEC Series.
SEMESTER VI
Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Understand the design assumptions.
CO2: Design of various automotive Chassis components

Pre-requisite:
1. Strength of Materials
2. Automotive Chassis

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VEHICLE FRAME AND SUSPENSION 9+3 Hours

FRONT AXLE AND STEERING SYSTEMS 9+3 Hours

DRIVE LINE AND REAL AXLE 9+3 Hours
Design of propeller shaft. Design details of final drive gearing. Design details of full floating, semi-floating and three quarter floating rear shafts and rear axle housings and design aspects of final drive.
GEAR BOX

Gear train calculations, layout of gearboxes. Design of gearboxes.

9+3 Hours

BRAKING SYSTEM

Function, stopping time and distance, weight transfer during braking, brake actuating mechanisms – mechanical, hydraulic and pneumatic, disc and drum brakes - design of brake shoes and friction pads.

9+3 Hours

Theory: 45 Hr  Tutorial: 15 Hr  Total Hours: 60

References:


Other references:

Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Understand the design assumptions.
CO2: Design of various Automotive Engine components

Pre-requisite:
1. Strength of Materials
2. Mechanics of Machines

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DESIGN OF CYLINDER AND PISTON 9+3 Hours
Choice of material for cylinder and piston, design assumptions and procedure for cylinder and piston. Design of cylinder, piston, piston pin, piston rings, piston failures, lubrication of piston assembly.

DESIGN OF CONNECTING ROD 9+3 Hours
Design of Connecting Rod-determining minimum length of connecting rod, small end design, shank design, design of big end cap bolts.

DESIGN OF CRANKSHAFT 9+3 Hours
Balancing of I.C. engines, significance of firing order. Material for crankshaft, design of crankshaft under bending and twisting, balancing weight calculations, development of short and long crank arms. Front and rear-end details.

DESIGN OF CLUTCH 9+3 Hours
Design of single plate clutch, multiplate clutch, design of centrifugal clutch, and cone clutch, energy dissipated, torque capacity of clutch, design of Clutch Components, Design details of roller and sprag type of clutches.
DESIGN OF VALVES AND VALVE TRAIN 9+3 Hours

Theory: 45 Hr  Tutorial: 15 Hr  Total Hours: 60

References:
1. Engine Design – Giles J. G., Lliffe Book Ltd.1968
2. Engine Design – Crouse, Tata McGraw Publication, Delhi

Other references:
Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Understand the purpose of clutch, gear box and drive train
CO2: Compare various types of transmission system
CO3: Understand the various types of drives

Pre-requisite:
1. Automotive Chassis

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CLUTCH AND GEAR BOX
9 Hours
Problems on performance of automobile - such as resistance to motion, tractive effort, engine speed, engine power and acceleration. Requirement of transmission system. Different types of clutches, principle, Construction and torque capacity. Determination of gear ratios for vehicles. Different types of gearboxes such as Sliding mesh gearbox, Constant mesh gearbox and Synchromesh gearbox.

HYDRODYNAMIC DRIVE
9 Hours

PLANETARY GEAR BOXES
9 Hours
AUTOMATIC TRANSMISSION APPLICATIONS 9 Hours

HYDROSTATIC AND ELECTRIC DRIVE 9 Hours

Theory :45 Hr Total Hours: 45

References:

Other references:
Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Familiarize the norms of pollution standards
CO2: Analyze the sources of pollution from automobiles
CO3: Understand the pollution control methods and apply.

Pre-requisite:
1. Environmental Science and Engineering

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INTRODUCTION
6 Hours

POLLUTANT FORMATION IN SI ENGINES
9 Hours
Chemistry of SI engine combustion – HC and CO formation in SI engines – NO formation in SI engines – Smoke emissions from SI engines – Effect of operating variables on emission formation.

POLLUTANT FORMATION IN CI ENGINES
10 Hours
Basics of diesel combustion – Smoke emission and its types in diesel engines – NOx emission and its types from diesel engines – Particulate emission in diesel engines. Odor, sulfur and Aldehyde emissions from diesel engines – effect of operating variables on emission formation.

CONTROL OF EMISSIONS FROM SI AND CI ENGINES
10 Hours
MEASUREMENT TECHNIQUES EMISSION STANDARDS AND TEST PROCEDURE


Theory : 45 Hr

Total Hours: 45

References:

Other references:
Course Outcomes
After successful completion of this course, the students should be able to:
CO1: Apply the concept of embedded systems in the automobile applications.
CO2: Outline the stability and safety systems used in automobiles.

Pre-requisite:
1. Nil

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EMBEDDED CONTROL SYSTEMS 9 Hours
Introduction to Embedded control systems, Microcontroller and processors used in Automotive systems, need for electronics in automobiles, Engine control unit, Electronic– Input devices- Sensors- wheel speed sensor, Crash sensor etc.

ELECTRONIC FUEL INJECTION & IGNITION SYSTEM 9 Hours
Introduction, feedback carburettor system, throttle body injection, advanced GDI and multi point fuel injection system, injection system controls, advantage of electronic ignition systems, types of solid state ignition system and their principles of operation, electronic spark timing control.

BRAKING AND ELECTRONIC STABILITY CONTROL 9 Hours
Vehicle motion control, collision avoidance control – cruise control, Adaptive cruise control, Electronic transmission control. Vehicle stabilization system -Antilock braking system, Traction control system, Anti slip regulation, Electronic stability program. On-board diagnosis system.

PASSIVE SAFETY SYSTEMS 9 Hours
Air bags and seat belt pretensioner systems: Sensor functions, Distributed front air bag sensing systems, Single-point sensing systems, Side-impact sensing – driver monitoring systems.

Signature of the Chairman
BOS/Automobile Engineering
INFOTAINMENT SYSTEMS

9 Hours

Global positioning systems, geographical information systems, navigation systems, Voice Command Systems, automotive vision system, lane departure warning system, driver assistance systems such as power seats, Power windows, and Remote keyless entry systems.

Theory : 45 Hr

Total Hours: 45

References:

Other references:
3. Telematics Communication Technologies and Vehicular Networks: Wireless Architectures and Applications-Chung-Ming Huang, National Cheng Kung University, Taiwan; Yuh-Shyan Chen, National Taipei University, Taiwan

Signature of the Chairman
BOS/Automobile Engineering
Course Outcomes
After successful completion of this course, the students should be able to:

**CO1:** Design and analyze the Chassis components using Modeling / FEA tools
**CO2:** Design and analyze the Engine components using Modeling / FEA tools

Pre-requisite:
1. Nil

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<th>CO/PO Mapping</th>
<th>S-Strong, M-Medium, W-Weak</th>
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<td>3. End Semester Practical Examinations</td>
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**LIST OF EXPERIMENTS:**

**DESIGN OF FOLLOWING CHASSIS COMPONENTS:**
1. Chassis Frame
2. Helical spring
3. Leaf Spring
4. Clutch
5. Propeller Shaft

**DESIGN OF FOLLOWING ENGINE COMPONENTS:**
1. Cylinder
2. Piston
3. Connecting Rod
4. Crank Shaft
5. Valve

(Note: Experiments beyond the syllabus should be conducted)

Total Hours 30
U14AUP602
AUTOMOTIVE SYSTEMS
LABORATORY

Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Apply the knowledge of sensors in the management of the vehicle control.
CO2: Interface and simulate various sensors used in automotive systems to different software’s.

Pre-requisite:
1. Nil

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LIST OF EXPERIMENTS:

1. RPM Measurement Using
   (i) Hall effect Sensor
   (ii) Inductive Type Sensor
2. Brake Pedal Position measurement
   (i) using Hall Eeffect sensor
   (ii) Designing of P, PI, PID controllers using performance criteria
3. Labview Programming :
   (i) Temperature Conversion
   (ii) Debugging and Sub-VI creation
   (iii) Loops and Waveform Charts
   (iv) Case statements, Arrays and Clusters
   (v) Strings and File Input/output
4. Data Acquisition Systems using Lab view
   (i) Strain measurement system
   (ii) Temperature measurement system
   (iii) Pressure measurement system
5. Modeling and simulation of Automotive sub systems

Signature of the Chairman
BOS/Automobile Engineering
(i) mathematical modeling of elementary systems
(ii) Engine Model,
(iii) Anti-Lock Braking System,
(iv) Suspension System,
(v) Hydraulic System

(Note: Experiments beyond the syllabus should be conducted)

Total Hours 30
Course Outcomes
On successful completion of the course the learner would be able to:

CO1: Identify an innovative or creative idea/concept/solution to a problem
CO2: Demonstrate their report writing and presentation skills

Pre-requisite:
1. Design and Manufacturing

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<td>2. Project Report - 10%</td>
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<td>3. Viva-voce - 50%</td>
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GUIDELINES:

1. The Mini Project-2 will essentially contain a detailed design and fabrication of a model or a prototype of a mechanism or a subsystem of automotive system.
2. The project work may include literature review, modeling, analysis, simulation, fabrication, testing and analysis of test data etc.
3. Can be individual or a group project, with maximum of 3 students per group.
4. The progress of the project is evaluated based on a minimum of three reviews and final viva-voce examination.
5. A project report is required to be submitted at the end of the semester in the required format.
6. The review presentations and project report should contain the individual work allocation & contribution, estimated & actual time schedule with charts (PERT/GANTT), FMEA/DFMEA charts, prototype cost estimations, drawings, 3D models, manufacturing process charts, in addition to the details of project work carried out.

Total Hours 60
Course Outcomes
On successful completion of the course the learner would be able to:
CO1: Recollect and appreciate the basics of automobile and mechanical engineering concepts by self learning.
CO2: Prepare a presentation on the technical topic chosen in the proper format
CO3: Effectively communicate the contents to the target audience and handle questions with confidence

Pre-requisite:
1. Nil

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<td>2. Report writing</td>
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GUIDELINES:
1. The students would study and recollect the mechanical and automobile engineering fundamental theory subjects and the relevant application automotive product/technology by self learning through Curriculum Plus system.
2. The students would go through all the relevant chapters and answer the online quiz for the relevant chapters, which will be evaluated by the faculty coordinator as a continuous assessment.
3. The student will prepare a presentation individually on the topic from the relevant chapter chosen by him related to Automobile and approved by the faculty coordinator.
4. The contents of the presentation will include theory fundamentals, applicable automotive products/technology, mathematics involved, experiments required for understanding the theory etc.
5. The student should be able to answer the questions asked by the audience during the presentation.

Total Hours 30

Signature of the Chairman
BOS/Automobile Engineering
SEMESTER VII
**Course Outcomes**
After successful completion of this course, the students should be able to:

**CO1:** Understand the concept of mechanical vibrating system.

**CO2:** Analyze the performance, ride and handling mode of the vehicle.

**CO3:** Analyze the stability and noise of vehicle.

**Pre-requisite:**
1. Nil

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<td>3. Semester Exam</td>
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**INTRODUCTION**
9+3 Hours

**PERFORMANCE MODE**
9+3 Hours
Acceleration - free body diagram of accelerating vehicle, maximum transferable tractive force, gradability, deceleration - maximum decelerating rates, stopping distance, maximum braking force, adhesion utilization - Straight line motion - aerodynamic forces and moments, viscosity effects - separation and its control - aerodynamic lift and its control - ground effect - profile for minimum drag.

**RIDE MODE**
9+3 Hours
Effects of damping the vibration, vibration absorbers, pitch and bounce motion, oscillation centers - active and semi active suspension - Orthogonality of mode shapes, modal analysis, vehicle performance testing.
HANDLING MODE

9+3 Hours

Tyres - mechanics, testing and modeling, vehicle control - low speed cornering and static steering - Ackerman steering geometry, steady-state cornering - steering factors, vehicle control parameters (under steer, neutral steer and over steer), steady state handling – lateral acceleration gain, characteristic speed, yaw velocity gain and critical speed - effect of braking on vehicle handling - constant radius testing - fish hook measurement testing.

VEHICLE STABILITY AND NOISE

9+3 Hours

Load distribution. Calculation of Tractive effort and reactions for different drives - Stability of a vehicle on a slope, on a curve and a banked road.
Properties of sound – sound level designation and measurements techniques - Sound isolation and absorption - machine enclosures, silencers and mufflers.

Theory: 45 Hr  Tutorial: 15 Hr  Total Hours: 60

References:


Other references:

Course Outcomes
After successful completion of this course, the students should be able to:

**CO1:** Understand various category of vehicle frames

**CO2:** Understand various types of vehicle body construction

**CO3:** Familiarize various aerodynamic effects of vehicle body shape

Pre-requisite:
1. Nil

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<td>2. Continuous assessment tests</td>
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**CAR BODY DETAILS**
9 Hours

**BUS BODY DETAILS**
9 Hours
Classification of bus bodies – Based on distance traveled, Based on capacity of the bus and based on style & shape. Types of metal section used in the construction and regulations. Construction of conventional and integral type buses & comparison.

**COMMERCIAL VEHICLE DETAILS**
9 Hours
Classification of commercial vehicle bodies. Construction of Tanker body and Tipper body. Dimensions of driver seat in relation to controls. Driver cabin design for compactness.

**VEHICLE AERODYNAMICS**
9 Hours
BODY MATERIALS, TRIM AND MECHANISMS


Theory : 45 Hr

Total Hours: 45

References:

Other references:
Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Understand special type of vehicles based on the need and purpose.
CO2: Understand the working of power take off shaft
CO3: Understand various types of wheels for off road vehicles

Pre-requisite:

1. Nil

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CLASSIFICATION AND REQUIREMENTS OF OFF ROAD VEHICLES
6 Hours

Construction layout, capacity and applications. Power Plants, Chassis and Transmission, Multiaxle vehicles.

EARTH MOVING MACHINES
10 Hours

Earthmovers like dumpers, loaders - single bucket, Multi bucket and rotary types - bulldozers, excavators, backhoe loaders, scrappers, drag and self powered types, Bush cutters, stumpers, tree dozer, rippers etc. – Power and capacity of earth moving machines.

SCRAPPERS, GRADERS, SHOVELS AND DITCHERS
10 Hours


FARM EQUIPMENTS, MILITARY AND COMBAT VEHICLES
8 Hours

Power take off, special implements. Special features and constructional details of tankers, gun carriers and transport vehicles.

Signature of the Chairman
BOS/Automobile Engineering
VEHICLE SYSTEMS, FEATURES


Theory :45 Hr

Total Hours: 45

References:

Other references:

Signature of the Chairman
BOS/Automobile Engineering
U14GS7007            PROFESSIONAL ETHICS

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Course Outcomes
After successful completion of this course, the students should be able to:
CO1: Understand the ethical theories and concepts
CO2: Understanding an engineer’s work in the context of its impact on society
CO3: Understand and analyze the concepts of safety and risk
CO4: Understand the professional responsibilities and rights of Engineers
CO5: Understand the concepts of ethics in the global context

Pre-requisite:
1. Nil

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ENGINEERING ETHICS AND THEORIES
9 Hours
Definition, Moral issues, Types of inquiry, Morality and issues of morality, Kohlberg and Gilligan’s theories, consensus and controversy, Professional and professionalism, moral reasoning and ethical theories, virtues, professional responsibility, integrity, self respect, duty ethics, ethical rights, self interest, egos, moral obligations.

SOCIAL ETHICS AND ENGINEERING AS SOCIAL EXPERIMENTATION
9 Hours
Engineering as social experimentation, codes of ethics, Legal aspects of social ethics, the challenger case study, Engineers duty to society and environment.
SAFETY 9 Hours

RESPONSIBILITIES AND RIGHTS OF ENGINEERS 9 Hours

GLOBAL ISSUES AND ENGINEERS AS MANAGERS, CONSULTANTS AND LEADERS 9 Hours
Multinational Corporations – Environmental ethics – computer ethics – weapons development – engineers as managers – consulting engineers – engineers as expert witnesses and advisors – moral leadership – Engineers as trend setters for global values.

Theory :45 Hr  Total Hours: 45

References:

Other references:
Course Outcomes
After successful completion of this course, the students should be able to:
CO1: Analyze the Dynamic modeling and simulations of road vehicles and their subsystems.

Pre-requisite:
1. Nil

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LIST OF EXPERIMENTS:

1. Study on automotive systems simulation
2. Simulation and analysis of Rigid Axle Suspension system
3. Simulation and analysis of Independent Suspension system
4. Simulation and analysis of hydraulic brake system
5. Simulation and analysis of air brake system
6. Simulation of steady state cornering characteristics of vehicle
7. Modeling of tires and analysis of cornering characteristics
8. Roll stability and Rollover threshold analysis
9. Simulation of a half car model for pitch and bounce
10. Crash Test Simulation Analysis of a four wheeler.

(Note: Experiments beyond the syllabus should be conducted)

Total Hours 30

Signature of the Chairman
BOS/Automobile Engineering
VEHICLE MAINTENANCE AND TESTING LABORATORY

Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Prepare the Workshop layout and statements
CO2: Understand about the tools and Equipments used in Automotive workshop
CO3: Troubleshoot and service various sub systems in the vehicle
CO4: Test the Vehicle performance

Pre-requisite:
1. Nil

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LIST OF EXPERIMENTS:

1. Experimental Study and layout of an automobile repair, service and maintenance shop.
2. Experimental Study and preparation of different statements/records required for the repair and maintenance works.
3. Experimental Study about Tools and instruments used in the maintenance shop
4. Experimental Study about Gearbox, Braking, Steering, Suspension system Maintenance
5. Fault Diagnostics of LCV using Diagnostic kit
6. Lighting System Trouble shooting & Servicing and Head Lights- Beam alignment
7. Fault diagnostics of Air-Conditioning system
8. Gearbox Trouble shooting & Servicing.
9. Braking System Troubleshooting & Servicing

Signature of the Chairman
BOS/Automobile Engineering
10. Removal, fitting of tire and tube and Testing wheel balance
11. Testing of camber, caster, kingpin inclination, toe-in and toe-out
13. Performance Testing of Four Wheeler using 4-Wheeler Chassis Dynamometer
14. On-road Braking, Acceleration and Fuel economy test
15. On-road Vehicle handling test
16. Emission test on vehicles using Gas Analyzer and smoke meter

(Note: Experiments beyond the syllabus should be conducted)

Total Hours 30
Course Outcomes
After successful completion of this course, the students should be able to:
CO1: Identify a practical problems and find a solution related to automotive
CO2: Understand the project management techniques
CO3: Demonstrate their report writing and presentation skills

Pre-requisite:
1. Minimum of Six semester of courses

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<td>3. End Semester review -30%</td>
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GUIDELINES:
1. The Project work in Phase-I and II may contain a theoretical study and analysis, experimental analysis, design, modeling & simulation, fabrication of a model or a prototype or a combination of the above related to automotive area.
2. The project work may include literature review, modeling, analysis, simulation, fabrication, testing and analysis & correlation of test data etc.
3. Can be individual or a group project, with maximum of 3 students per group.
4. The progress of the project is evaluated based on a minimum of three reviews and end semester review.
5. In Phase-I of the project, literature survey, projects task plan and design phases should have been completed.
6. A project report is required to be submitted at the end of the semester in the required format.
7. The review presentations and project report should contain the individual work allocation & contribution, estimated & actual time schedule with charts (PERT/GANTT), literature survey, drawings in addition to the details of project work carried out.

Total Hours 60

Signature of the Chairman
BOS/Automobile Engineering
Course Outcomes
On successful completion of the course the learner would be able to:
CO1: Gain knowledge of fast and rapid changing automotive technology by self learning.
CO2: Prepare a presentation on an emerging technology chosen in the proper format
CO3: Effectively communicate the contents to the target audience and handle questions with confidence

Pre-requisite:
1. Nil

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GUIDELINES:
1. The students will select topics on their own, the topics may be on any aspect of the automotive technology but normally beyond the curriculum and get it approved by faculty coordinator considering its importance, originality, challenging and within capability of the student.
2. The student will prepare a presentation individually on the approved topic for 15 minutes duration.
3. The presentation should cover the chosen technology topic, literature survey, application to automotive products, current and future scope for the technology, references etc.
4. The student should be able to answer the questions asked by the audience during the presentation.
5. A technical report on the chosen topic will be prepared with minimum 15 pages containing the details from the above presentation and will be submitted at the time of presentation.

Total Hours 30
SEMESTER VIII

Signature of the Chairman
BOS/Automobile Engineering
Course Outcomes
After successful completion of this course, the students should be able to:
CO1: Identify a practical problems and find a solution related to automotive
CO2: Understand the project management techniques
CO3: Demonstrate their report writing and presentation skills

Pre-requisite:
1. Minimum of Six semester of courses

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CO/PO Mapping
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GUIDELINES:
1. To continue the Phase- I project and executing the same in consultation with the project coordinator and project guide
2. A Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment is a must to complete and an effort leading to paper publication or patenting is desired.
3. A working model or prototype is to be submitted for end semester evaluation
4. A project report is required to be submitted at the end of the semester in the required format.
5. The review presentations and project report should contain the individual work allocation & contribution, estimated & actual time schedule with charts (PERT/GANTT), literature survey, drawings, analysis report, DFMEA/FMEA charts in addition to the details of project work carried out.
6. Project work done at Industry should be duly supported by certificate from the Industry.
7. The progress of the project is evaluated based on a minimum of three reviews and end semester viva-voce examination.

Total Hours 270
ELECTIVES
AUTOMOTIVE DESIGN & THERMAL
Course Outcomes
On successful completion of the course the learner would be able to:

CO1: Understand the importance aerodynamics for automobiles
CO2: Apply the concept of wind tunnel for aerodynamic design of automobiles.
CO3: Analyze various aerodynamic shapes of car.

Pre-requisite:
1. Fluid Mechanics
2. Vehicle Body Engineering

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INTRODUCTION
Scope, historical developments, fundamental of fluid mechanics, flow phenomenon related to vehicles, external and Internal flow problem, resistance to vehicle motion, performance, fuel consumption and performance potential of vehicle aerodynamics, engine cooling requirement, air flow to passenger compartment, duct for air conditioning, cooling of transverse engine and rear engine.

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

SHAPE OPTIMIZATION OF CARS
Front end modification, front and rear wind shield angle, boat tailing, hatch back, fast back and square back, dust flow patterns at the rear, effects of gap configuration, effect of fasteners.
VEHICLE HANDLING 9 Hours
The origin of forces and moments on a vehicle, lateral stability problems, methods to calculate forces and moments – vehicle dynamics under side winds, the effects of forces and moments, characteristics of forces and moments, dirt accumulation on the vehicle, wind noise, drag reduction in commercial vehicles.

WIND TUNNELS FOR AUTOMOTIVE AERODYNAMICS 9 Hours
Introduction, principle of wind tunnel technology, limitation of simulation, stress with scale models, full scale wind tunnels, measurement techniques, equipment and transducers, road testing methods, numerical methods.

Theory: 45 Hr

Total Hours: 45

References:

Other references:
U14AUTE02  COMPUTATIONAL FLUID DYNAMICS

Course Outcomes
On successful completion of the course the learner would be able to:
CO1: Understand discretisation process of governing equation
CO2: Understand grid generation and its application
CO3: Understand different mathematical modules used in CFD
CO4: Understand Turbulence Energy Equation in mathematical form
CO5: Able to model and analyse fluid flow and heat transfer problems using commercial CFD packages.

Pre-requisite:
1. Fluid Mechanics
2. Numerical Methods

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INTRODUCTION
8 Hours
Application areas of CFD, Basic concepts of fluid flow - Governing equations, conservation of mass, momentum and energy – Navier-stokes and energy equation for Newtonian fluid, Mathematical classification of flow - Hyperbolic, parabolic, elliptic and mixed flow types.

DISCRETISATION
13 Hours
CFD TECHNIQUES  
Lax - Wendroff technique, MacCormack’s technique, relaxation technique. ADI technique, pressure correction technique, SIMPLE algorithm. Fluid flow and convection problems - Upwind scheme and stability criteria.

TURBULENCE MODELING  
Turbulence energy equation - One-equation model, k-ω model and k-ε model.

CASE STUDIES  
Modelling and analysis of heat transfer, fluid flow and automobile components using CFD packages

Theory : 45 Hr  
Total Hours: 45

References:

Other references:
Course Outcomes
On successful completion of the course the learner would be able to:

CO1: Understand the difference between geometric versus naturalistic drawing
CO2: Ability to create and innovate different Automotive shapes and to validate them
CO3: Able to visually present by using different colors, sketches and to increase the aesthetic sense of vehicles.

Pre-requisite:
1. Nil

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INTRODUCTION
9 Hours
Drawing in product design, drawing by hand, drawing by computer, mass production, geometric versus naturalistic drawing, modernist design. Basic drawing skills - Perspectives, metric projections, spherical projections, orthographic projections, sections and scrap views. Tools and materials - Pencils, pens, erasers, markers, paints, ink, airbrush, drawing instruments, paper and aboard.

COMPUTER SYSTEMS
9 Hours
The computer processor, system software, the central processing unit, memory, frame buffers, display, input devices, hardcopy output, 3D output devices, networking, health and safety. Concept design - Satisfying the client, sketch, schematic, evaluating the design, 3D modelling concepts, hybrid approach, commercial computer solutions, drawing in space, creating organic forms.

PRESENTATION DRAWING AND VISUALS
9 Hours
From water colour washes to markers, painting by numbers, the art of design, visual tricks, making marker drawing, 2D computer programs: paint and vector, 3D computer aided styling (CAS),

Signature of the Chairman
BOS/Automobile Engineering
creating virtual reality, shading a computer model, ray tracing and radiosity, adding texture, fractals and commercial modelers.

**FROM GENERAL ARRANGEMENTS DRAWING TO PRODUCTION**  
9 Hours
Technical production documentation, the general arrangement drawing, drafting standards, computer aided drafting, geometric constructions, controlling curves, parametric design, CAD data - Exchange standards and all change in the CAD market.

**TECHNICAL ILLUSTRATION**  
9 Hours
Art of technical illustration, techniques of technical illustration, thick and thin lines, sections, cutaways and ghosting, photo-tracing, annotation and labeling, computer aided illustration, interactive technical illustration and commercial solutions.

**Theory : 45 Hr**

**Total Hours: 45**

**References:**

**Other references:**
Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Understand the basic background of DFM and related concepts
CO2: Understand the fundamentals of GD &T
CO3: Understand tolerance charting
CO4: Apply the concept of DFM
CO5: Understand the concept of selective assembly

Pre-requisite:
1. Manufacturing Technology

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DFM APPROACH, SELECTION AND SUBSTITUTION OF MATERIALS IN INDUSTRY  9 Hours
DFM approach, DFM guidelines, standardisation, group technology, value engineering, comparison of materials on Cost basis.

GEOMETRIC DIMENSIONING & TOLERANCE INTRODUCTION  9 Hours
Process capability, process capability metrics, Cp, Cpk , Cost aspects, feature tolerances, geometric tolerances, surface finish, review of relationship between attainable tolerance grades and different machining process, cumulative effect of tolerances, sure fit law, normal law and truncated normal law, $6\sigma$ concept.

TOLERANCE CHARTING TECHNIQUE  9 Hours
Operation sequence for typical shaft type of components, preparation of process drawings for different operations, tolerance worksheets and centrality analysis, examples.
DESIGN FOR MANUFACTURE 9 Hours
Design features to facilitate machining, datum features - Functional and manufacturing, component design-machining considerations, redesign for manufacture, examples Redesign of castings based on parting line considerations, minimising core requirements, redesigning cast members using weldments, use of welding symbols – Case studies.

SELECTIVE ASSEMBLY 9 Hours
Interchangeable and selective assembly, deciding the number of groups, Model-I: group tolerances of mating parts equal; Model-II: total and group tolerances of shaft, control of axial play-introducing secondary machining operations, laminated shims, examples

Theory :45 Hr Total Hours: 45

References:

Other references:

Signature of the Chairman
BOS/Automobile Engineering
Course Outcomes
After successful completion of this course, the students should be able to:

**CO1:** Understand simulating IC engine combustion processes.

**CO2:** Apply the simulation techniques for modification of combustion chamber

**CO3:** Apply the simulation techniques to develop new engines

Pre-requisite:
1. Thermodynamics and Thermal Engineering

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### INTRODUCTION

9 Hours


### COMBUSTION AND STOICHIOMETRY

9 Hours

Reactive processes, Heat of reaction, measurement of URP, measurement of HRP. Introduction - combustion equation for hydrocarbon fuels. Calculation of minimum air required for combustion, excess air supplied and stoichiometric air required for complete combustion. Conversion of volumetric analysis to mass analysis.

### ADIABATIC FLAME TEMPERATURE

9 Hours

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. SI Engine simulation with air as working medium, deviation between actual and ideal cycle.
SIMULATION OF IC ENGINES 9 Hours
SI and CI engine simulation – Air standard cycle, fuel-air cycle, progressive combustion cycle and actual cycle simulation – Part throttle, full throttle and supercharged conditions

SIMULATION OF NEW ENGINE CONCEPT 9 Hours
Dual fuel engine, low heat rejection engine, lean burn engine, variable compression ratio engine, homogeneously charged compression ignition engine and controlled auto ignition engine.

Theory: 45 Hr Total Hours: 45

References:

Other references:
Course Outcomes
After successful completion of this course, the students should be able to:
CO1: Understand the theory of sound.
CO2: Analyze various sources of vibration and methods of damping
CO3: Apply the concept of design of interiors to maintain NVH levels.

Pre-requisite:
1. Engineering Mechanics

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FUNDAMENTALS OF ACOUSTICS, NOISE AND VIBRATION
8 Hours

EFFECT OF NOISE, BLAST, VIBRATION AND SHOCK ON PEOPLE
7 Hours
TRANSPORTATION NOISE AND VIBRATION – SOURCES, PREDICTION AND CONTROL

INTERIOR TRANSPORTATION NOISE AND VIBRATION – PREDICTION AND CONTROL

NOISE AND VIBRATION TRANSDUCERS, ANALYSIS EQUIPMENT, SIGNAL PROCESSING AND MEASURING TECHNIQUES

Theory :45 Hr  Total Hours: 45

References:

Other references:
Course Outcomes
After successful completion of this course, the students should be able to:
CO1: Design and implement refrigeration and air conditioning systems using standards
CO2: Apply the concept of psychometry to estimate the heating and cooling load for automobiles
CO3: Check the operation of automatic HVAC control systems and diagnose it.

Pre-requisite:
1. Thermodynamics and Thermal Engineering

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(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

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REFRIGERATION 9 Hours
Introduction - Methods of refrigeration - Air Refrigeration System and its applications – Vapour compression refrigeration system - Vapour absorption refrigeration system - Applications of refrigeration & air conditioning - Automobile air conditioning - Air conditioning for passengers, isolated vehicles, transport vehicles - Applications related with very low temperatures Classification, properties and selection criteria - Commonly used refrigerants – Alternative refrigerants - Eco-friendly refrigerants - Applications of refrigerants - Refrigerants used in automobile air conditioning

PSYCHOMETRY 9 Hours
Psychometric properties, tables, charts - Psychometric processes - Comfort charts – Factor affecting comfort - Effective temperature - Ventilation requirements.

AIR CONDITIONING SYSTEMS AND LOAD ANALYSIS 9 Hours
Classification and layouts - Central / unitary air conditioning systems - Components like compressors, evaporators, condensers, expansion devices, fan blowers, heating systems etc. Load Analysis: Outside & inside design consideration - Factors forming the load on refrigeration
& air conditioning systems - Cooling & heating load calculations - Load calculations for automobiles - Effect of air conditioning load on engine performance.

AIR DISTRIBUTION SYSTEMS
9 Hours
Distribution duct system, sizing, supply / return ducts - Types of grills, diffusers, ventilation, air noise level - Layout of duct systems for automobiles and their impact on load calculations. Air Routine & Temperature Control: Objectives - evaporator care air flow - Through the dash recirculating unit - Automatic temperature control - Controlling flow - Control of air handling systems.

AIR CONDITIONING SERVICE AND CONTROL
9 Hours
Air conditioner maintenance & service - servicing heater system - Removing & replacing components - Trouble shooting of air conditioning system - Compressor service, methods of dehydration, charging & testing.
Air Conditioning Control: Common control such as thermostats- Humidistat us – Control dampers - Pressure cutouts and relays.

Theory: 45 Hr

Total Hours: 45

References:

Other references:
1. Paul Lung, "Automotive Air Conditioning", C.B.S. Publisher & Distributor, (Delhi. 1991)

Signature of the Chairman
BOS/Automobile Engineering
Course Outcomes
After successful completion of this course, the students should be able to:
CO1: Understand Types and properties of fuel
CO2: Understand basic thermodynamics and kinetics of combustion

Pre-requisite:
1. Engineering Chemistry
2. Thermodynamics and Thermal Engineering

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INTRODUCTION
9 Hours

FUEL TYPES
9 Hours
Gaseous Fuels: Classification and characterization.
THERMODYNAMICS AND KINETICS OF COMBUSTION  9 Hours

COMBUSTION OF SOLID FUELS  8 Hours
Drying - devolatilization - char combustion. Fixed bed combustion - suspension burning - fluidized bed combustion.

COMBUSTION OF LIQUID AND GASEOUS FUELS  10 Hours

Theory :45 Hr  Total Hours: 45

References:

Other references:
Course Outcomes
After successful completion of this course, the students should be able to:
CO1: Understand and identify the alternatives to conventional gasoline and diesel fuels
CO2: Performance investigation and comparison of alternate fuels
CO3: Understand the working of multi fuel engine

Pre-requisite:
1. Fuels and Lubricants

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**GASEOUS FUELS**
10 Hours
Properties, composition, production, storage, engine modifications, combustion, performance and emission characteristics in SI and CI engines, advantages and disadvantages of compressed natural gas (CNG), liquefied petroleum gas (LPG), hydrogen and ammonia.

**ALCOHOL FUELS**
10 Hours
Properties, composition, production, storage, engine modifications, blends, combustion, performance and emission characteristics in SI and CI engines, advantages and disadvantages of methanol ethanol and butanol.

**BIO-FUELS**
9 Hours
Properties, composition, production, engine modifications, treatment, blends, performance and emission characteristics, advantages and disadvantages of straight vegetable oils, bio-diesel and biogas.

**SYNTHETIC FUELS**
8 Hours
Properties, composition, material compatibility, engine modifications, performance and emission characteristics, advantages and disadvantages of hydrogen with CNG, dimethyl ether (DME), diethyl ether (DEE), syngas, producer gas and plastic fuel.
DUAL-FUEL AND MULTI-FUEL ENGINES 8 Hours
Technology, working principle, conversion of engine, operation, combustion, performance and emission characteristics, advantages and disadvantages.

Theory :45 Hr Total Hours: 45

References:

Other references:
AUTOMOTIVE TECHNOLOGY & MANUFACTURING

Signature of the Chairman
BOS/Automobile Engineering
Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Understand the graphical representation, construction and working of the components of the pneumatic and hydraulic systems

CO2: Understand and build pneumatic and hydraulic circuits

CO3: Understand the working of Automotive pneumatic and hydraulic systems

CO4: Analyze and correlate the circuits and programming

Pre-requisite:
1. Fluid Mechanics and Machinery

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

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

FLUID POWER ELEMENTS
12 Hours
Control valves- pressure, flow direction- working principles and construction- Special type valves- cartridge, modular, proportional and servo- Selection and actuation methods.
Actuators- Selection and specification, cylinders- mounting, cushioning, pipe fittings- Fluid conditioning elements- Accumulators. Case study related to automotive application.
HYDRAULICS AND PNEUMATICS CIRCUITS DESIGN  
9 Hours

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

Theory :45 Hr  
Total Hours: 45

References:

Other references:

Signature of the Chairman  
BOS/Automobile Engineering
Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Familiarize with the history, concept development and key components of robotics technologies.

CO2: understand basic mathematic manipulations of spatial coordinate representation and transformation.

CO3: understand and able to solve basic robot forward and inverse kinematics problems.

Pre-requisite:
1. Mechanics of Machines
2. Engineering Mechanics

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FUNDAMENTALS OF ROBOT
7 Hours

ROBOT DRIVE SYSTEMS AND END EFFECTORS
10 Hours

SENSORS AND MACHINE VISION
10 Hours
Requirements of a sensor, Principles and Applications of the following types of sensors – Position of sensors (Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, Pneumatic Position Sensors),

ROBOT KINEMATICS AND ROBOT PROGRAMMING 9 Hours
Forward Kinematics, Inverse Kinematics and Differences – Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional), Four Degrees of Freedom (In 3 Dimensional) – DH matrices - Deviations and Problems.
Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effector commands, and Simple programs

IMPLEMENTATION AND ROBOT ECONOMICS 8 Hours
RGV, AGV; Implementation of Robots in Industries – Various Steps; Safety Considerations for Robot Operations; Economic Analysis of Robots – Pay back Method, EUAC Method, Rate of Return Method

Theory :45 Hr

References:

Other references:

Total Hours: 45
Course Outcomes
On successful completion of the course the learner would be able to:
CO1: Become familiar with Need for Vehicle Maintenance
CO2: Apply the concepts of scheduling
CO3: Trouble shoot and Repair

Pre-requisite:
1. Automotive Chassis
2. Automotive Transmission

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MAINTENANCE OF RECORDS AND SCHEDULES 9 Hours
Importance of maintenance, preventive (scheduled) and breakdown (unscheduled) maintenance, requirements of maintenance, preparation of check lists. Inspection schedule, maintenance of records, log sheets and other forms, safety precautions in maintenance, service schedule (Manufacture Km service) and service history maintenance

ENGINE MAINTENANCE REPAIR AND OVERHAULING 9 Hours
Dismantling of engine components and cleaning, cleaning methods, visual and dimensional inspections, minor and major reconditioning of various components, reconditioning methods, engine assembly, special tools used for maintenance overhauling, engine tune up.- Need for overhauling- Preparation of Cost sheets (estimation)- Engine performance analysis-Troubleshoot and Remedies

CHASSIS MAINTENANCE REPAIR AND OVERHAULING 9 Hours
Mechanical and automobile clutch and gear box, servicing and maintenance, maintenance servicing of propeller shaft and differential system. Maintenance servicing of suspension systems. Brake
systems, types and servicing techniques. Steering systems, overhauling and maintenance. Wheel alignment, computerized alignment and wheel balancing. How to diagnose troubles and Remedies.- Road Test

**ELECTRICAL SYSTEM MAINTENANCE SERVICING AND REPAIRS**

9 Hours

Testing methods for checking electrical components, checking battery, starter motor, charging systems, DC generator and alternator, ignitions system, lighting systems. Fault diagnosis and maintenance of modern electronic controls, checking and servicing of dash board instrument- Diagnose troubles and Remedies

**MAINTENANCE OF FUEL SYSTEM, COOLING SYSTEMS, LUBRICATION SYSTEM AND VEHICLE BODY**

9 Hours

Servicing and maintenance of fuel system of different types of vehicles, calibration and tuning of engine for optimum fuel supply. Cooling systems, water pump, radiator, thermostat, anticorrosion and antifreeze additives. Lubrication maintenance, lubricating oil changing, greasing of parts. Vehicle body maintenance, minor and major repairs. Door locks and window glass actuating system maintenance. Manufacture recommended fluids- Kaizen method on schedule services, how to increase productivity and efficiency- Case studies. Field surveys.- Latest technologies in servicing

**Theory :45 Hr**

**Total Hours: 45**

**References:**


**Other references:**

1. Service Manuals from Different Vehicle Manufacturers.
Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Understand the Advantages and Properties of Composite Materials.
CO2: Apply the composite materials in Automotive Application.
CO3: Analyze the Material properties and Failure criteria for Composites
CO4: Select the Materials and Design the Sandwich Construction
CO5: Understand the fabrication of fibers

Pre-requisite:
1. Materials Science

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STRESS STRAIN RELATION
6 Hours

METHODS OF ANALYSIS
12 Hours

LAMINATED PLATES
12 Hours
Governing differential equation for a general laminate, angle ply and cross ply laminates. Failure criteria for composites.
SANDWICH CONSTRUCTIONS 8 Hours
Basic design concepts of sandwich construction - Materials used for sandwich construction - Failure modes of sandwich panels.

FABRICATION PROCESS 7 Hours
Various Open and closed mould processes. Manufacture of fibers - Types of resins and properties and applications – Netting analysis.

Theory :45 Hr  Total Hours: 45

References:

Other references:
Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Understand the Automotive Engine and Transmission system components Manufacturing Process

CO2: Understand the Heat Treatment and surface treatment process used for Engine and Transmission system Components Manufacturing

CO3: Understand the Automotive vehicle Body and Electrical system Components Manufacturing Process

CO4: Understand the surface Coating Process used in Automotive Industry

Pre-requisite:
1. Materials Science
2. Automotive Manufacturing Technology

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ENGINE COMPONENTS

TRANSMISSION COMPONENTS-I
TRANSMISSION COMPONENTS-II 8 Hours
Continuous casting of propeller shaft, extrusion of propeller shaft, extrusion dies, heat treatment and surface hardening of propeller shaft, composite propeller shaft manufacturing. Forging of rear axles, casting of rear axle casing, wheels, brake drum, tyre manufacturing

BODY COMPONENTS 10 Hours

SURFACE COATINGS AND ELECTRICAL COMPONENTS 9 Hours
Chemical vapour deposition, physical vapour deposition, sol-gel processing, spraying, plating, paining in paint booth.
Starter motor, alternator, regulator, battery, lamps, control switches, electronic gauges.

Theory :45 Hr Total Hours: 45

References:

Other references:
Course Outcomes
After successful completion of this course, the students should be able to:
CO1: Understand the Basics of tyres and its Components  
CO2: Understand the Fabric preparation & Calendaring process  
CO3: Understand the Thread Extrusion & Bead Construction  
CO4: Understand the building & curing of tyres.

Pre-requisite:
1. Nil

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INTRODUCTION TO BASICS OF TYRES  
5 Hours
Types of tyres, tyre components and its role, tread patterns, outline of production of tires, Requirements and function of tyres - Major departments of a Tyre Industry - An explanation of their function and relation to other departments. Factors influencing the performance of tyre: Compound design, degree of mixing: (open mill & internal mixing), parameters (temperature, time, speed), degree of vulcanization - Testing and Despatch of mixes, Basic quality control and mill room control Laboratory.

FABRIC PREPARATION  
8 Hours

Signature of the Chairman  
BOS/Automobile Engineering
CALENDERING  8 Hours

THREAD EXTRUSION AND BEAD CONSTRUCTION  8 Hours
Cross head extruder wire coating process - Bias cutting and pocket making: Bias angle specification and the significance Horizontal and vertical laying of coated wore. Apex preparation on extruder and profile calender Bead wrapping and flipping operations. Single and double bead concept and preliminary calculation of bead safety factors. Width and angle adjustments splicing and identification. Bias plies pocket 3-3-2 4-4-2 ply constructions Defects of pockets wrong identification over splicing wrinkles, parallel plies etc.

TYRE BUILDING  8 Hours
Tyre building inputs: Inner liners, plies, beads, tread, side wall and gum strips – their inspection Drum inspection for drumset, drum circumference Significance of parameters for tyre building. Size making on finished tyre and the relation to building specifications. Tyre building specifications sequence of building. Intermittent consolidation use of various cements and gum strips. Importance of the state of the Art Technology. Appraisal of Tyre building as most crucial operation correlation of some of the cured tyre & service returned tyres to the lack of building skill. Green tyre inspection procedures weight tolerance techno-commercial importance of green tyre weight. Green tyre storage considerations.

GREEN TYRE PREPARATION & CURING  8 Hours

Theory :45 Hr  
Total Hours: 45
References:

Other references:
2. Different tyre manufacturer’s websites.
Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Understand the need for the processes and classification
CO2: Understand the processes that use Mechanical energy
CO3: Understand the processes that use Electrical energy
CO4: Understand the processes that use chemical and Electro-chemical energy
CO5: Understand the processes that use Thermal energy

Pre-requisite:
1. Manufacturing Technology

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INTRODUCTION

MECHANICAL ENERGY BASED PROCESSES

ELECTRICAL ENERGY BASED PROCESSES

Signature of the Chairman
BOS/Automobile Engineering
CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES


THERMAL ENERGY BASED PROCESSES

Laser Beam machining and drilling (LBM), plasma Arc machining (PAM) and Electron Beam Machining (EBM). Principles – Equipment –Types - Beam control techniques – Applications.

Theory :45 Hr

Total Hours: 45

References:


Other references:

Rapid Prototyping Tooling and Manufacturing

Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Understand the stages of product development
CO2: Understanding the concepts of STEREO LITHOGRAPHY AND DIRECT METAL LASER SINTERING processes
CO3: Understanding the concepts of FUSION DEPOSITION MODELING AND LAMINATED OBJECT MANUFACTURING and the machine details
CO4: Understanding the concepts of SOLID GROUND CURING and 3D printing processes and the machine details
CO5: Understanding the concepts of Rapid Tooling and the medical applications of RPT

Pre-requisite:
1. Manufacturing Technology

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CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

Course Assessment methods:

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PRODUCT DEVELOPMENT STAGES
9 Hours
Introduction: Need for time compression in product development, Product development - conceptual design - development - detail design - prototype - tooling.

STEREO LITHOGRAPHY AND DIRECT METAL LASER SINTERING
9 Hours

Signature of the Chairman
BOS/Automobile Engineering
FUSION DEPOSITION MODELING AND LAMINATED OBJECT MANUFACTURING 9 Hours

SOLID GROUND CURING 9 Hours
Solid Ground Curing - Principle - process parameters - process details - machine details, Applications. 3-Dimensional printers - Principle - process parameters - process details - machine details, Applications, and other concept modelers like thermo jet printers, Sander's model maker, JP system 5, Object Quadra system.

RAPID TOOLING 9 Hours
Laser Engineering Net Shaping (LENS), Ballistic Particle Manufacturing (BPM) - Principle. Introduction to rapid tooling - direct and indirect method, software for RP - STL files, Magics, Mimics. Application of Rapid prototyping in Medical field.

Theory :45 Hr Total Hours: 45

References:

Other references:
Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Understanding the jigs and fixtures and need for them
CO2: Understand and design the different types of jigs
CO3: Understand and design the different types of Fixtures
CO4: Understand the different types of presses and their elements
CO5: Design of different types of dies

Pre-requisite:
1. Manufacturing Technology

CO/PO Mapping
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PURPOSE TYPES AND FUNCTIONS OF JIGS AND FIXTURES


JIGS

Drill bushes –different types of jigs-plate latch, channel, box, post, angle plate, angular post, turnover, pot jigs-Automatic drill jigs-Rack and pinion operated. Air operated Jigs components. Design and development of Jigs for given components.

FIXTURES

General principles of boring, lathe, milling and broaching fixtures- Grinding, planning and shaping fixtures, assembly, Inspection and welding fixtures- Modular fixtures. Design and development of fixtures for given component

Signature of the Chairman
BOS/Automobile Engineering
PRESS WORKING TERMINOLOGIES AND ELEMENTS OF DIES 10 Hours
AND STRIP LAY OUT

DESIGN AND DEVELOPMENT OF DIES 9 Hours
Design and development of progressive and compound dies for Blanking and piercing operations. Bending dies – development of bending dies-forming and drawing dies-Development of drawing dies. Design considerations in forging, extrusion, casting and plastic dies.

Theory :45 Hr

Total Hours: 45

References:

Other references:
AUTOMOTIVE ELECTRONICS & SYSTEMS
Course Outcomes
After successful completion of this course, the students should be able to:
CO1: Understand the different communication protocols used in automobiles
CO2: Make use of communication protocols for interfacing sensors and automotive subsystems with that of microcontrollers.

Pre-requisite:
1. Nil

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EMBEDDED NETWORKING 9 Hours

CONTROLLER AREA NETWORK (CAN) PROTOCOL 9 Hours
History and foundation of CAN, CAN Applications, Main characteristics of CAN, CAN in OSI Reference Model, CAN Data Link Layer, Principles of data exchange in CAN, Arbitration, Data Frame, Remote Frame, Error detection and management in CAN, CAN physical Layer, Bit encoding, Bit timing and synchronization, Relationship between data rate and bus length, Single wire and twin wire media, CAN repeaters, Medium-to-medium gateway, Protocol handlers, Microcontrollers and line drivers, Time-Triggered CAN (TTCAN), Comparison with other IVN protocols, CAN based applications development
LOCAL INTERCONNECT NETWORK (LIN) PROTOCOL  9 Hours
Introduction to LIN, LIN consortium, LIN specification, LIN features, Technical overview, Workflow concept, LIN operation, LIN frame format, Scheduling table, Network management of LIN cluster, LIN Transport Layer, LIN node configuration and identification, LIN diagnostics, LIN physical layer, Comparison with other IVN protocols and Case Study

FLEXRAY PROTOCOL  9 Hours
Future on board systems, Need for FlexRay, Origin of FlexRay, FlexRay consortium, FlexRay Objectives, Flex Ray Features, Application requirements, Working of FlexRay, Network topologies, ECU architecture, Segment Configuration, Communication Cycles, FlexRay frame format, Timing of configuration protocol, Error control, and FlexRay core mechanisms, Coding and Decoding, Medium Access Control, Frame and Symbol Processing, Clock Synchronization, FlexRay Components, Comparison with other IVN protocols and Case Study

IN VEHICLE NETWORK DIAGNOSTICS  9 Hours

Theory: 45 Hr  Total Hours: 45

References:

Other references:
1. Jan Axelson, ‘Parallel Port Complete’, Penram publications

Signature of the Chairman
BOS/Automobile Engineering
Virtual Instrumentation

Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Understand the Labview programming and its interfacing
CO2: Model Automotive systems

Pre-requisite:
   1. Nil

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

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

COMMUNICATION NETWORKED MODULES

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

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

Theory :45 Hr

Total Hours: 45

References:

Other references:
Course Outcomes
After successful completion of this course, the students should be able to:
CO1: Understand the concept of fuel cells in automobiles
CO2: Understand the various characteristic components of fuel cell
CO3: Analyze the Performance of fuel cell in automobile application.

Pre-requisite:
1. Nil

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INTRODUCTION TO FUEL CELLS 9 Hours
Introduction – working and types of fuel cell – low, medium and high temperature fuel cell, liquid and methanol types, proton exchange membrane fuel cell solid oxide, hydrogen fuel cells – thermodynamics and electrochemical kinetics of fuel cells.

FUEL CELLS FOR AUTOMOTIVE APPLICATIONS 9 Hours

FUEL CELL COMPONENTS AND THEIR IMPACT ON PERFORMANCE 9 Hours
Fuel cell performance characteristics – current/voltage, voltage efficiency and power density, ohmic resistance, kinetic performance, mass transfer effects – membrane electrode assembly components, fuel cell stack, bi-polar plate, humidifiers and cooling plates. 
FUELING  9 Hours

FUEL CYCLE ANALYSIS  9 Hours
Introduction to fuel cycle analysis – application to fuel cell and other competing technologies like battery powered vehicles, SI engine fueled by natural gas and hydrogen and hybrid electric vehicle.

Theory :45 Hr  
Total Hours: 45

References:

Other references:
Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Understand and remember the fundamentals of safety during body design
CO2: Applying the knowledge for selecting the suitable active & passive systems
CO3: Applying the knowledge for selecting the suitable safety equipments for designing a vehicle
CO4: Creating the advanced system for increasing the safety in special purpose vehicles

Pre-requisite:
1. Nil

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INTRODUCTION
9 Hours
Design of the body for safety, energy equation, engine location, deceleration of vehicle inside passenger compartment, deceleration on impact with stationary and movable obstacle, concept of crumble zone, safety sandwich construction.

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

SAFETY EQUIPMENTS
9 Hours
Seat belt, regulations, automatic seat belt tightener system, collapsible steering column, tiltable steering wheel, air bags, electronic system for activating air bags, bumper design for safety.
COLLISION WARNING AND AVOIDANCE  
9 Hours  
Collision warning system, causes of rear end collision, frontal object detection, rear vehicle object detection system, object detection system with braking system interactions.

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

Theory :45 Hr  
Total Hours: 45

References:

Other references:
Course Outcomes
After successful completion of this course, the students should be able to:
CO1: Differentiate electric and hybrid vehicles
CO2: Understand the subsystems and components used in electric and hybrid vehicles

Pre-requisite:
1. Nil

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INTRODUCTION TO ELECTRIC VEHICLES 9 Hours
Layout of an electric vehicle, performance of electric vehicles – traction motor characteristics, tractive effort, transmission requirements, vehicle performance, energy consumption, advantage and limitations, specifications, system components, electronic control system.

HYBRID VEHICLES 8 Hours
Concepts of hybrid electric drive train, types, architecture of series and parallel hybrid electric drive train, merits and demerits, series and parallel hybrid electric drive train design.

ELECTRIC PROPULSION SYSTEMS, GENERATORS, MOTOR CONTROLLERS AND CONTROL SYSTEMS 10 Hours
DC motors, AC motors, permanent magnet motors, brushless DC and reluctance motors, characteristics, regenerative braking.
DC generators, AC generators, voltage and frequency regulations.
Control system principles, speed and torque control – DC motors and AC motors.

ENERGY STORAGES 9 Hours
Electromechanical batteries- types of batteries – lead acid batteries, nickel based batteries, lithium based batteries, electrochemical reactions, thermodynamic voltage, specific energy, specific power, energy efficiency, ultracapacitors.
FUEL CELLS & SOLAR CARS
Fuel cell, construction, working, equations, possible fuel sources, fuel reformer, design. Solar cars-photovoltaic cells, tracking, efficiency and Cost comparison

Theory :45 Hr

Total Hours: 45

References:

Other references:

Signature of the Chairman
BOS/Automobile Engineering
Course Outcomes
After successful completion of this course, the students should be able to:
CO1: Understand the concept of vehicle and engine performance evaluation
CO2: Understand about the Laboratory and On road testing of vehicles
CO3: Understand the various mechanical measurement devices used in vehicle testing

Pre-requisite:
1. Measurements & Metrology

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

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

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

ENGINE EXPERIMENTAL TECHNIQUES
9 Hours
VEHICLE EXPERIMENTAL TECHNIQUES  
9 Hours
Laboratory tests- test tracks - Endurance Tests- crash tests- Vehicle performance test – Brake tests.

Theory :45 Hr  

Total Hours: 45

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

Other references:  
Course Outcomes
After successful completion of this course, the students should be able to:
CO1: Understand the Engine & Chassis Management system
CO2: Understand the Heating and Air-Conditioning
CO3: Understand the Comfort, Convenience, Safety & Security Systems

Pre-requisite:
1. Automotive Chassis
2. Automotive Engine Systems

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ENGINE MANAGEMENT SYSTEMS 9 Hours
Electronically controlled SI and CI engine fuel injection systems, related hardware and software. Closed loop ignition system. Catalytic converters and particulate traps.

CHASSIS 9 Hours
Active suspension control, Pneumatic suspensions, Power train monitoring, safety views-Modern development in Chassis management of vehicles.

HEATING AND AIR CONDITIONING 9 Hours

COMFORT AND CONVENIENCE 9 Hours
Adaptive cruise control, car entertainment, power windows, navigation system, adaptive noise control, electric seats, driver information system. Power windows, power steering.

Signature of the Chairman
BOS/Automobile Engineering
SAFETY AND SECURITY SYSTEMS 9 Hours
Airbags, seat belt tightening system, collapsible and tiltable steering column, Anti-theft system, anti-lock braking system, electronic stability control system/traction control system, roll over protection system.

Theory : 45 Hr  Total Hours: 45

References:

Other references:

Signature of the Chairman
BOS/Automobile Engineering
Course Outcomes
After successful completion of this course, the students should be able to:
CO1: Analyze himself on entrepreneurial traits
CO2: Analyze various business opportunities
CO3: Prepare a project report on a project idea

Pre-requisite:
1. Nil

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ENTREPRENEURSHIP 9 Hours
Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur, Multipreneur, Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth

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

BUSINESS 9 Hours

Signature of the Chairman
BOS/Automobile Engineering
FINANCING AND ACCOUNTING 9 Hours

SUPPORT TO ENTREPRENEURS 9 Hours

Theory :45 Hr  Total Hours: 45

References:

Other references:

Signature of the Chairman
BOS/Automobile Engineering
Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Understand the concepts of project definition, life cycle, and systems approach
CO2: Develop competency in project planning, scheduling and related activities.
CO3: Handle the complex tasks of time estimation and project scheduling, including PERT and CPM.
CO4: Develop competencies in project Costing, budgeting, and financial appraisal
CO5: Gain exposure to project control and management, using standard tools of Cost and schedule variance analysis.

Pre-requisite:
1. Nil

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

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PROJECT MANAGEMENT CONCEPTS 9 Hours
Introduction, project characteristics, taxonomy of projects, project identification and formulation. Establishing the project and goals. Nature & context of project management; phases of PM, A framework for PM issues, PM as a conversion process, project environment & complexity. Organizing human resources, organizing systems & procedures for implementation. Project direction.

PROJECT ORGANIZATION & PROJECT CONTRACTS 9 Hours
Introduction, functional organization, project organization, matrix organization, modified matrix organization, pure project organization, selection of project organization structure, project breakdown structures, project contracts, types of contracts, types of payments to contractors.
PROJECT APPRAISAL & COST ESTIMATION  9 Hours
Introduction, technical appraisal, commercial appraisal, economic appraisal, financial appraisal, management appraisal, social Cost/benefit analysis, project risk analysis. Cost analysis of the project, components of capital Cost of a project, modern approach to project performance analysis

PROJECT PLANNING & SCHEDULING  9 Hours
Introduction to PERT & CPM, planning and scheduling networks, time estimation, determination of critical path, CPM model, event slacks & floats, PERT model, expected time for activities, expected length of critical path, calculating the project length and variance, PERT & CPM Cost accounting systems, lowest Cost schedule, crashing of networks, linear programming formulation of event oriented networks, updating of networks, LOB technique

MODIFICATION & EXTENSIONS OF NETWORK MODELS  9 Hours
Complexity of project scheduling with limited resources, resource leveling of project schedules, resource allocation in project scheduling - heuristic solution. Precedence networking- examples with algorithm, decision networks, probabilistic networks, computer aided project management- essential requirements of PM software, software packages for CPM. Enterprise- wide PM, using spread sheets for financial projections.

Theory :45 Hr  Total Hours: 45

References:

Other references:
Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Understand statistical quality control techniques
CO2: Predict the life of components based on their reliability
CO3: Analyze the failure data using various methods

Pre-requisite:
1. Nil

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CO/PO Mapping
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STATISTICAL PROCESS CONTROL 9 Hours

ACCEPTANCE SAMPLING 9 Hours
Lot by lot sampling types – probability of acceptance in single, double, multiple sampling plans – OC curves – Producer’s risk and consumer’s risk. AQL, LTPD, AOQL, Concepts Design of single sampling plan – standard sampling plans for AQL and LTPD – Use of standard sampling plans – Sequential sampling plan

EXPERIMENTAL DESIGN & TAGUCHI METHOD 9 Hours
RELAIBILITY AND ITS PREDICTION  9 Hours
Life testing – Failure characteristics – MTBA MTTF – System reliability – OC curve Availability and Maintainability – Reliability Improvement techniques

FAILURE DATA ANALYSIS  9 Hours
Real time distribution, exponential, normal, log normal, gamma and weibull – reliability data requirements – Graphical evaluation

Theory :45 Hr  Total Hours: 45

References:

Other references:
Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Understand the need for global energy demand
CO2: Apply energy conservation techniques
CO3: Understand energy policy and energy Cost.

Pre-requisite:
1. Nil

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ENERGY SOURCES
9 Hours
Fossil fuels, Nuclear fuels, hydel, solar, wind and bio fuels in India, Energy conservation, Nuclear energy through fission and fusion processes.

ENERGY CONVERSION
9 Hours
Energy conversion from source to utility, Solar, Nuclear, Geothermal, Tide and Wind Energies.

GLOBAL ENERGY SCENARIO
9 Hours
Role of energy in economic development and social transformation, Overall energy demand, availability and consumption, Depletion of energy resources and its impact on economy, Non proliferation of nuclear energy. International energy policies of G-8, G-20, OPEC and European union countries.

INDIAN ENERGY SCENARIO
9 Hours
Commercial and noncommercial forms of energy, Utilization pattern in the past, present and also future prediction, Sector wise energy consumption.
ENERGY POLICY

9 Hours


Theory : 45 Hr

Total Hours: 45

References:


Other references:

Course Outcomes
After successful completion of this course, the students should be able to:
CO1: Understand the basic concepts of dealership.
CO2: Apply a strategic perspective of the retailing industry
CO3: Apply the concept of management in parts ordering, servicing.

Pre-requisite:
1. Nil

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DEALERSHIP

SHOWROOM MANAGEMENT
Contemporary showroom management. Institutionalising, structuring and monitoring the sales process, managing the showroom floor and the sales team. Retail developments and industry trends

SERVICE MANAGEMENT
Service management, process and fundamentals, repair order analysis, productivity and efficiency, scheduling, loading, warranties and service retention.

PARTS MANAGEMENT
Parts management, inventory control, staffing and productivity, ordering parameters, parts marketing, merchandising, retailing and trade activities.
CASE STUDY

Applying theory in practice working case study of an actual dealership, group presentations and action planning.

Theory : 45 Hr

Total Hours: 45

References:
3. KVS Madaan (2009), Fundamentals of Retailing, Tata McGraw Hill, New Delhi

Other references:
1. Gibson G.Vedamani (2003), Retail Management, Jaico Publishing House, New Delhi

Signature of the Chairman
BOS/Automobile Engineering
Course Outcomes
After successful completion of this course, the students should be able to:
CO1: Understand the concept of personal Management and selection process
CO2: Understand the Passenger and Good Transport management Systems
CO3: Understand the Motor Vehicle Act
CO4: Understand the Automobile vehicle Maintenance.

Pre-requisite:
1. Nil

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INTRODUCTION
9 Hours
Personnel management; objectives and functions of personnel management, psychology, sociology and their relevance to organization, personality problems. Selection process: job description, employment tests, interviewing, introduction to training objectives, advantages, methods of training, training procedure, psychological tests.

PASSENGER TRANSPORT OPERATION
9 Hours
Structure of passenger transport organizations- Typical depot layouts- Requirements and Problems on fleet management- Fleet maintenance- Planning -Scheduling operation & control- Personal & training-training for drivers & conductors- Public relations, Propaganda, publicity and passenger amenities-
Parcel traffic.- Theory of fares-Basic principles of fare charging- Differential rates for different types of services- Depreciation & debt charges- Operation Cost and Revenues- Economics & records
GOODS TRANSPORT OPERATION 9 Hours

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

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

Theory :45 Hr Total Hours: 45

References:

Other references:
U14AUTE32 MICROPROCESSOR BASED SYSTEM DESIGN

**Course Outcomes**
After successful completion of this course, the students should be able to:

**CO1:** Understand the basics about microprocessors and its programming
Understand the microprocessor based system design

**Pre-requisite:**
1. Basics of Electrical and Electronics Engineering

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**INTRODUCTION**
9 Hours
Need for microprocessor based system design – Design cycle – dimensions of the design problem – Hardware design and software design – System integration.

**INPUT AND OUTPUT ALGORITHMIC PROCESSES**
9 Hours

**TROUBLESHOOTING SYSTEMS – LOGIC ANALYSERS**
9 Hours

**8086 /8088 BASED MULTIPROCESSING SYSTEM**
9 Hours

Signature of the Chairman
BOS/Automobile Engineering
SYSTEM DESIGN APPLICATIONS
9 Hours

Theory :45 Hr

Total Hours: 45

References:

Other references:
Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Understand the role of textiles and fabrics used in Automotive
CO2: Understand the developments of composites for Automotive interior
CO3: Apply the knowledge of special fabrics to be used in Automotives

Pre-requisite:
1. Nil

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AUTOMOTIVE TEXTILES 9 Hours
Requirements for automotive textiles, design demands, woven & knitted, non-woven fabrics used in automotive interiors, Recycling of automotive textiles –Future trends

SMART TEXTILES IN AUTOMOTIVE INTERIORS 9 Hours
Car seats- Types of materials used as cushions. Technology for replacing polyurethane foams in car seats. Smart textiles: definition, textile sensors, textile actuators- heating fabrics for car interior, Shape memory alloys for car seats.

TRANSPORTATION TEXTILES 9 Hours
Materials used in automobiles – tire cord, filter, air bag- future applications, belt, seat cover, acoustic textiles for noise insulation; Design and development of textile reinforced composites in automobile industry

AUTOMOTIVE TEXTILE STRUCTURES & COMPOSITES 9 Hours
2D and 3D textile structures for load bearing applications in automobiles, future trends in applications of textile structures in automobiles, composite structural components

Signature of the Chairman
BOS/Automobile Engineering
SAFETY APPLICATIONS & FUTURE TRENDS

9 Hours

Recent developments in fibre/textile reinforcements used in tyres, fibre-rubber adhesion in tyres resent advances in tyre design.

Theory: 45 Hr

Total Hours: 45

References:

Course Outcomes
After successful completion of this course, the students should be able to:
CO1: Understand quality concepts and philosophies of TQM
CO2: Apply TQM principles and concepts of continuous improvement
CO3: Apply and analyze the quality tools, management tools and statistical fundamentals to improve quality
CO4: Understand the TQM tools as a means to improve quality
CO5: Remember and understand the quality systems and procedures adopted

Pre-requisite:
1. Nil

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INTRODUCTION
Definition of Quality, Dimensions of Quality, Quality Costs, Top Management Commitment, Quality Council, Quality Statements, Barriers to TQM Implementation, Contributions of Deming, Juran and Crosby, Team Balancing

TQM PRINCIPLES
Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Continuous Process Improvement,5S, Kaizen, Just-In-Time and TPS
STATISTICAL PROCESS CONTROL 9 Hours
The seven tools of quality, New seven Management tools, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Concept of six sigma

TQM TOOLS 9 Hours
Quality Policy Deployment (QPD), Quality Function Deployment (QFD), Benchmarking, Taguchi Quality Loss Function, Total Productive Maintenance (TPM), FMEA

QUALITY SYSTEMS 9 Hours

Theory :45 Hr Total Hours: 45

References:

Other references:
Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Understand the concepts of management, administration and the evolution of management thoughts.

CO2: Understand and apply the planning concepts

CO3: Analyze the different organizational structures and understand the staffing process.

CO4: Analyze the various motivational and leadership theories and understand the communication and controlling processes.

CO5: Understand the various international approaches to management

Pre-requisite:
1. Nil

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CO/PO Mapping
(S/M/W indicates strength of correlation)  S-Strong, M-Medium, W-Weak

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MANAGEMENT CONTEXT
9 Hours

PLANNING
9 Hours
ORGANISING 9 Hours

DIRECTING & CONTROLLING 9 Hours

CONTEMPORARY ISSUES IN MANAGEMENT 9 Hours

Theory : 45 Hr

Total Hours: 45

References:

Other references:
Course Outcomes

After successful completion of this course, the students should be able to:

CO1: Apply linear programming model and assignment model to domain specific situations

CO2: Analyze the various methods under transportation model and apply the model for testing the closeness of their results to optimal results

CO3: Apply the concepts of PERT and CPM for decision making and optimally managing projects

CO4: Analyze the various replacement and sequencing models and apply them for arriving at optimal decisions

CO5: Analyze the inventory and queuing theories and apply them in domain specific situations.

Pre-requisite:

1. Nil

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

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LINEAR MODEL

9 Hours

The phases of OR study – formation of an L.P model – graphical solution – simplex algorithm – artificial variables technique (Big M method, two phase method), duality in simplex

TRANSPORTATION AND ASSIGNMENT PROBLEM

9 Hours


Assignment model – formulation – balanced and unbalanced assignment problems
PROJECT MANAGEMENT BY PERT & CPM  
9 Hours
Basic terminologies – Constructing a project network – Scheduling computations – PERT - CPM – Resource smoothening, Resource leveling, PERT Cost

REPLACEMENT AND SEQUENCING MODELS  
9 Hours
Replacement policies - Replacement of items that deteriorate with time (value of money not changing with time) – Replacement of items that deteriorate with time (Value of money changing with time) – Replacement of items that fail suddenly (individual and group replacement policies). Sequencing models- n job on 2 machines – n jobs on 3 machines – n jobs on m machines, Traveling salesman problem

INVENTORY AND QUEUING THEORY  
9 Hours
Variables in inventory problems, EOQ, deterministic inventory models, order quantity with price break, techniques in inventory management.
Queuing system and its structure – Kendall’s notation – Common queuing models - M/M/1: FCFS/$\infty$/\$\infty$ - M/M/1: FCFS/n/$\infty$ - M/M/C: FCFS/$\infty$/\$\infty$ - M/M/1: FCFS/n/m

Theory :45 Hr  
Total Hours: 45

References:

Other references:
ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT

Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Evaluate the economic theories, Cost concepts and pricing policies
CO2: Understand the market structures and integration concepts
CO3: Understand the measures of national income, the functions of banks and concepts of globalization
CO4: Apply the concepts of financial management for project appraisal
CO5: Understand accounting systems and analyze financial statements using ratio analysis

Pre-requisite:
1. Nil

CO/PO Mapping
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ECONOMICS, COST AND PRICING CONCEPTS 9 Hours

CONCEPTS ON FIRMS AND MANUFACTURING PRACTICES 9 Hours
NATIONAL INCOME, MONEY AND BANKING, ECONOMIC ENVIRONMENT 9 Hours

CONCEPTS OF FINANCIAL MANAGEMENT 9 Hours

ACCOUNTING SYSTEM, STATEMENT AND FINANCIAL ANALYSIS 9 Hours

Theory : 45 Hr

Total Hours: 45

References:
1. Prasanna Chandra, “Financial Management (Theory & Practice) TMH
2. Weston & Brigham, “Essentials of Managerial Finance”
5. Financial Management & Policy -James C. Van Horne

Other references:
2. Management Accounting Principles & Practice -P. Saravanavel

Signature of the Chairman
BOS/Automobile Engineering
Course Outcomes
After successful completion of this course, the students should be able to:
CO1: Understand the process to plan and develop products
CO2: Understand the process of collecting information and developing product specifications
CO3: Understand the concept generation, selection and testing processes
CO4: Understand the concepts of product architecture, industrial design and design for manufacture
CO5: Understand the basics of prototyping, economic analysis and project planning and execution processes

Pre-requisite:
1. Nil

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INTRODUCTION - DEVELOPMENT PROCESSES AND ORGANIZATIONS - PRODUCT PLANNING
9 Hours
Characteristics of successful product development to Design and develop products, duration and Cost of product development, the challenges of product development.
A generic development process, concept development: the front-end process, adapting the generic product development process, the AMF development process, product development organizations, the AMF organization.
The product planning process, identify opportunities. Evaluate and prioritize projects, allocate resources and plan timing, complete pre project planning, reflect all the results and the process.
IDENTIFYING CUSTOMER NEEDS - PRODUCT SPECIFICATIONS 9 Hours
Gathering raw data from customers, interpreting raw data in terms of customer needs, organizing the needs into a hierarchy, establishing the relative importance of the needs and reflecting on the results and the process.
Specifications, establish specifications, establishing target specifications setting the final specifications.

CONCEPT GENERATION - CONCEPT SELECTION - CONCEPT TESTING 9 Hours
The activity of concept generation clarify the problem search externally, search internally, explore systematically, reflect on the results and the process.
Overview of methodology, concept screening, concept scoring, caveats.
Purpose of concept test, choosing a survey population and a survey format, communicate the concept, measuring customer response, interpreting the result, reflecting on the results and the process.

PRODUCT ARCHITECTURE - INDUSTRIAL DESIGN - DESIGN FOR MANUFACTURING 9 Hours
Meaning of product architecture, implications of the architecture, establishing the architecture, variety and supply chain considerations, platform planning, related system level design issues.
Assessing the need for industrial design, the impact of industrial design, industrial design process, managing the industrial design process, is assessing the quality of industrial design.
Definition, estimation of manufacturing Cost, reducing the Cost of components, assembly, supporting production, impact of DFM on other factors.

PROTOTYPING - PRODUCT DEVELOPMENT ECONOMICS - MANAGING PROJECTS 9 Hours
Prototyping basics, principles of prototyping, technologies, planning for prototypes.
Elements of economic analysis, base case financial mode, Sensitive analysis, project trade-offs, influence of qualitative factors on project success, qualitative analysis.
Understanding and representing task, baseline project planning, accelerating projects, project execution, and postmortem project evaluation.

Theory: 45 Hr Total Hours: 45

References:
2. Product Design and Manufacturing: A C Chitale and R C Gupta, PHI

Other references:
1. Product Design for Manufacture and Assembly: Geoffery Boothroyd, Peter Dewhurst and Winston Knight.
Course Outcomes
After successful completion of this course, the students should be able to:

CO1: Analyze various global trends and decide on the scope of a new product [K4]
CO2: Outline the product development methodologies and management.[K2]
CO3: Develop product management plan for a new product based on the type of the new product and development methodology.[K3]
CO4: Summarize requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them into design specification.[K3]
CO5: Conceptualize new product integrating the hardware, software, controls, electronics and mechanical systems.[K6]
CO6: Develop test specifications and coordinate the respective activities with the testing group, validate the product and confirm its performance as per design specification. [K3]
CO7: Develop product documentation as required.[K3]

Pre-requisite:
1. Nil

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FUNDAMENTALS OF PRODUCT DEVELOPMENT

Global Trends Analysis and Product decision: Types of various trends affecting product decision - Social Trends (Demographic, Behavioral, Psychographic), Technical Trends (Technology, Applications, Tools, Methods), Economical Trends (Market, Economy, GDP, Income Levels, Spending Pattern,
target Cost, TCO), Environmental Trends (Environmental Regulations and Compliance), Political/Policy Trends (Regulations, Political Scenario, IP Trends and Company Policies); PESTLE Analysis

**Introduction to Product Development Methodologies and Management:** Overview of Products and Services (Consumer product, Industrial product, Specialty products etc); Types of Product Development (NPD/ Re-Engineering (Enhancements, Cost Improvements)/ Reverse Engineering/ Design Porting & Homologation); Overview of Product Development methodologies (Over the Wall/ Waterfall/ V-Model/ Stage-Gate Process/ Spiral/Systems Engineering/ Agile); Product Life Cycle (S-Curve, Reverse Bathtub Curve); Product Development Planning and Management (Budgeting, Risk, Resources and Design Collaboration, Scheduling, Change Management, Product Cost Management).

**REQUIREMENTS AND SYSTEM DESIGN**

9 Hours

**Requirement Engineering:** Types of Requirements (Functional, Performance, Physical, Regulatory, Economical, Behavioral, Technical, Stakeholder, Environmental, Industry specific, Internal-Company Specific); Requirement Engineering (Gathering (VOC), Analysis (QFD), Design Specification); Traceability Matrix and Analysis; Requirement Management. **System Design & Modeling:** Introduction to System Modeling; System Optimization; System Specification; Sub-System Design; Interface Design.

**DESIGN AND TESTING**

15 Hours

**Conceptualization:** Industrial Design and User Interface Design; Introduction to Concept generation Techniques; Concept Screening & Evaluation - Concept Design, S/W Architecture, Hardware Schematics and simulation.

**Detailed Design:** Component Design and Verification: High Level Design/Low Level Design of S/W Programs, S/W Testing; Hardware Schematic, Component design, Layout and Hardware Testing. **Prototyping:** Types of Prototypes (Mockups, Engineering Assessment Prototype, Alpha, Beta, Gama); Introduction to Rapid Prototyping and Rapid Manufacturing. **System Integration, Testing,** **Certification and Documentation:** Manufacturing/Purchase and Assembly of Systems; Integration of Mechanical, Embedded and S/W systems; Introduction to Product verification processes and stages – Industry specific (DFMEA, FEA, CFD); Introduction to Product validation processes and stages - Industry specific (Sub-system Testing/ Integration Testing/ Functional Testing/ Performance Testing / Compliance Testing); Product Testing standards and Certification – Industry specific; Product Documentation (Compliance Documentation, Catalogue, Brochures, user manual, maintenance Manual, Spares Parts List, Warranty, Disposal Guide, IETMS, Web Tools).

**SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT**

6 Hours

Sustenance: Maintenance and Repair; Enhancements. **Product EoL:** Obsolescence Management; Configuration Management; EoL Disposal.

**BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY**

6 Hours

**The Industry:** Engineering Services Industry – Overview; Product development in Industry versus Academia.

**The IPD Essentials:** Introduction to vertical specific product development processes; Product development Trade-offs; Intellectual Property Rights and Confidentiality; Security and Configuration

**Theory :45 Hr**

**Total Hours: 45**

**References:**

1. Foundation Skills in Integrated Product Development (FSIPD), 1st Edition, 2013, Published by NASSCOM.

**Other references:**


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Signature of the Chairman
BOS/Automobile Engineering
ONE CREDIT COURSES
U14AU/N01

OVERVIEW OF MOTORSPORTS ENGINEERING

Course Outcomes
On successful completion of the course the learner would be able to:
CO1: Understand the various events of motorsport engineering
CO2: Understanding the rules and regulation for the different motor sports events
CO3: Understanding the career opportunities in motor sports engineering

Pre-requisite:
1. Nil

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INTRODUCTION TO MOTORSPORT ENGINEERING  2 Hours
The history of motorsport engineering-Review of motorsport engineering-Pioneers of Motorsport engineering -Motorsport technology evolution review.

LIST OF MOTORSPORT COMPETITIONS FOR STUDENTS  3 Hours
A brief look at all the events students can take part to develop their skills - Formula SAE - Baja SAE - SAE Super mileage.

PROFESSIONAL MOTORSPORT EVENTS  4 Hours
The various types of professional motorsport events that take place around the world - Cars – Formula One, World rally championship, Touring car championship, GP2, GP3, World Endurance Racing Championship, dirt track racing, NASCAR, Indy Car, Cross Country rallies, drag racing - Motorcycles – MotoGP, Superbike, Endurance, Motocross, Supermoto, Freestyle, Trials, Cross-country rallies, Speedway, Board track, drag racing

RULES AND REGULATIONS OF MOTORSPORTS  3 Hours
Introduction about the rule book - About - the world governing bodies of the sport - Why the rule book keeps changing - How to interpret the rule book- Rules for car races - Rules for bikes races

CAREER IN MOTORSPORTS ENGINEERING  3 Hours
Motorsport Engineer Race Driver / Rider - Test Driver / Rider - Design engineer - Race technician -Aerodynamics Engineer - Race official / steward

Total Hours: 15

Signature of the Chairman
BOS/Automobile Engineering

182
Course Outcomes
On successful completion of the course the learner would be able to:

**CO1:** Understand the design trends of concept cars

**CO2:** Apply the concept of ergonomics in designing concept cars

**Pre-requisite:**
1. Nil

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### DESIGN EXPRESSIONS
Design methodology, Lifestyle board, Mood board, Theme board, Design trends, Design movements, Application of design principles and product aesthetics

### INTRODUCTION TO CONCEPT CARS
Importance of concept cars, Blending technology, Form in concept cars

### CAR DESIGN
Art and colour, Product styling, Introduction to human factors engineering, Digital design, Concept to reality, Auto show vehicles

### VISUAL FACTORS IN DESIGN
Colour harmony, Colour in design, Artist’s spectrum, Basic color schemes

**Total Hours: 15**
Course Outcomes
On successful completion of the course the learner would be able to:

**CO1:** Familiarize the importance of ECU for better performance of engines.

**Pre-requisite:**
1. Nil

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**Topics covered**
- An overview of Engine Management System
- Current trends in automotive electronic engine management system
- Control of SI & CI engines for better performance and low emissions
- Closed loop control of engine parameters of fuel injection and ignition.
- Digital control techniques – Dwell angle calculation, Ignition timing calculation and Injection duration calculation.
- Electronics emission control techniques

**Total Hours** 15
U14AU/N04 VEHICLE SERVICE MANAGEMENT

Course Outcomes
On successful completion of the course the learner would be able to:

**CO1:** Understand the Automotive vehicle servicing

**CO2:** Understand the parts Ordering management

**Pre-requisite:**
1. Nil

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**SERVICE MARKETING**

4 Hours

Services economy— evolution and growth of service sector, service quality, Focus on Customers - customer expectations, building service customer relationship, Service market segmentation

**SERVICE DESIGN AND DELIVERY**

4 Hours

Service life cycle, service core process – distributing service direct distribution, channel functions, channels selection, impact of information technology, service recovery, Repair order analysis.

**PARTS MANAGEMENT**

4 Hours

Parts management, inventory control, staffing and productivity, ordering parameters, parts marketing, merchandising, retailing and trade activities.

**BUSINESS PLANNING**

3 Hours

Audits- for performance Management
SoP’s for process compliance
How to conduct Daily Management meeting for service.

**Total Hours: 15**

**References:**

Course Outcomes
On successful completion of the course the learner would be able to:

**CO1:** Understand the Basics of maintenance & workshop statements preparation
**CO2:** Understand the Engine, Chassis, Electrical Maintenance systems

**Pre-requisite:**
1. Nil

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<th>Direct</th>
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<td>1. Test</td>
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<td>2. Quiz</td>
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<td>3. Assignment / Case study</td>
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MAINTENANCE OF RECORDS AND SCHEDULES  
2 Hours
Preventive (scheduled) and breakdown (Unscheduled) maintenance, requirements of maintenance, preparation of check Lists, Inspection schedule, maintenance of records, log sheets.

ENGINE MAINTENANCE  
4 Hours
List of Engine components and cleaning methods, visual and Inspections, minor reconditioning of various components, Reconditioning methods, special tools used for maintenance.

CHASSIS MAINTENANCE  
6 Hours
Maintenance of Automobile clutch, gear box, drive, suspension, Brake and Steering systems.

ELECTRICAL SYSTEM MAINTENANCE  
3 Hours

Total Hours: 15

References: