

SHRI VENKATESHWARA UNIVERSITY



Syllabus

**Diploma
(Automobile Engineering)**

**III semester
(THREE Years Programme)**

(w.e.f. 2019-20)

**SCHOOL OF ENGINEERING &
TECHNOLOGY**

SEMESTER- III

Sl No.	Subject Codes	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	C T	T A	Tot al	P S	TE	P E		
1	PAE – 301	Automotive Engines	3	0	0	20	10	30		70		100	3
	PAE -302	Automotive Chassis –I	3	0	0	20	10	30		70		100	3
3	PME -303	Thermal Engineering - I	3	0	0	20	10	30		70		100	3
4	PME - 304	Material Science & Engineering	3	0	0	20	10	30		70		100	3
5	PME -305	Basic Mechanical Engineering	3	1	0	20	10	30		70		100	4
6	PAE -311	Automotive Engines Lab	0	0	4				10		15	25	2
7	PAE -312	Automotive Chassis –I Lab	0	0	2				10		15	25	1
8	PME -313	Thermal Engineering Lab-I	0	0	2				10		15	25	1
9	PME -314	Computer Aided Machine Drawing Practice	0	0	4				10		15	25	2
10	PAE-315	Summer Internship - I		0	4				50			50	2
												650	24
Summer Internship-I (4 weeks) after IInd Sem													

Course Code	:	PAE-301
Course Title	:	Automotive Engine
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	Automobile Engine

Objectives:

Students will be able to :

- To understand the construction and working of petrol and diesel engines and its components.
- To acquire the knowledge about the lubrication and cooling systems of automotive engines.
- To understand the working principle of fuel feed system of petrol and diesel engines.
- To understand engine power calculation & analyse engine performance by testing.
- To understand engine specification parameters.

Content [Theory] :

Chapter	Name of the Topic	Hours	Marks
01	<p>Engine Principles and fundamentals:</p> <p>1.1 Introduction- Engines, History of development of engines, I.C. Engine & E.C. Engine, Classification of I.C. Engines, Basic engine nomenclature.</p> <p>1.1 Working Principle of I.C. Engine. Concepts of 2-stroke and 4-stroke Petrol and Diesel Engines, Comparison.</p> <p>1.3 Merits and Demerits of vertical and horizontal engines. Applications.</p>	04	--

<p style="text-align: center;">02</p>	<p>Constructional features, function and working of automobile engine components:</p> <p>2.1 Cylinder block, cylinder liners, types of liner, function, comparison of dry and wet liner, cylinder head, Crankcase & Materials.</p> <p>2.2 Piston, Piston slap, Piston clearance, Piston material [C.I. & Al alloy], Comparison between C.I & Al alloy piston, Piston rings, types, function, Piston ring joints, arrangement of ring gap in 4-S & 2-S engines & Materials, Piston pin, types of piston pin & Materials.</p> <p>2.3 Connecting Rod, Crank shaft, Cam shaft, Materials, Types of Camshaft drives, Timing gears, Timing sprocket, Timing toothed belt, Applications.</p> <p>2.4 Valve, side valve, overhead valve (Single and Double), Valve operating mechanism, Valve clearance, Rotary valve, sleeve valve mechanism, Use of Reed Valve in the two-stroke engine,</p> <p>2.5 Valve timing and port timing diagram.</p> <p>2.6 Manifolds [Inlet and exhaust], function, Silencers, types. Working Principle of silencer, Flywheel, Dampers, working principle.</p>	<p style="text-align: center;">10</p>	<p style="text-align: center;">--</p>
<p style="text-align: center;">03</p>	<p>Engine Cooling System:</p> <p>3.1 Introduction - Necessity of cooling, Types of cooling systems- Air cooling system, Water-cooling system / Liquid cooling system. Components of air-cooling system, uses.</p> <p>3.2 Water-cooling system./ Liquid cooling system, layout working principle, different components of water / liquid cooling system. Thermostat valve, types, construction and working principle of Thermostat valve, Cooling pump & cooling fan – engine driven and Electric driven. Radiator-Construction and type of radiator cores. Pressure Cap- construction and working, use of expansion tank.</p> <p>3.3 Comparison between Air-cooling and water / liquid cooling system.</p> <p>3.4 Properties of coolants, Anti freeze solution, types, purpose of using, additives, Valve Cooling, Effect of Under cooling & over cooling, troubleshooting.</p>	<p style="text-align: center;">06</p>	<p style="text-align: center;">--</p>
<p style="text-align: center;">04</p>	<p>Engine Lubrication System:</p> <p>4.1 Introduction, Purpose of lubrication, parts to be lubricated.</p> <p>4.2 Function and Properties of engine lubricating oil, Classification of lubricants and their makes, Grading or Rating of lubricants, additives for lubricants.</p> <p>4.3 Different methods of lubrication – Petro-oil lubrication system, Wet sump lubrication [layout] and Dry sump lubrication [layout]. Splash lubrication, Semi pressure lubrication, Pressurized lubrication system, Working principle & Applications.</p> <p>4.4 Components of wet sump lubrication system like strainer, fuel pump, filter [fine & coarse], pressure gauge, Dipstick, relief valve, oil coolers.</p> <p>4.5 Causes of oil consumption and oil contamination, Crank case Ventilation, Troubleshooting.</p>	<p style="text-align: center;">06</p>	<p style="text-align: center;">--</p>

05	Part-I 5.1	Fuel feed system [petrol engine]: 5.1.1 Fuel feed system in petrol engines layout], types- Gravity and Pump feed. 5.1.2 Mechanical fuel pump and Electrical fuel pump – construction, working principle & use. 5.1.3 Air cleaner- types, dry & oil bath/wet type air cleaner, Construction, working principle & use. 5.1.4 Stoichiometric air-fuel ratio, Mixture strength, A/F mixture requirement at different operating condition, working of simple carburettor, defects and remedies. 5.1.5 Carburettor used in four wheelers and two wheelers, construction and working of carburettor used in two wheelers. 5.1.6 Different circuits of carburettor [e.g. choke, ideal, accelerating circuits],	07	--
	Part-II 5.2	Fuel feed system [Compression ignition engine]: 5.2.1 Introduction - Requirement of fuel injection system. Various components of diesel fuel injection system- Fuel tank, fuel lines, fuel filters, Priming Pump, fuel injection pump (inline for single or multiple and distributor type), types of fuel injectors, and types of nozzle (single orifice, multiple orifice etc.). 5.2.2 Types of diesel fuel injection system, Individual pump, Unit injection system, Distributor system and common rail system. Layout and working principle. 5.2.3 Working principle of Mechanical Governor in Fuel Injection Pump. 5.2.3 Faults and troubleshooting.	06	--
06		Engine Performance and Testing: 7.1 Engine Performance parameters- Engine torque, Brake power Indicated power, Frictional power, Mean effective pressure [on IP & BP], Fuel Consumption, Specific fuel consumption. 7.2 Engine efficiency – indicated thermal efficiency, Brake thermal efficiency, Mechanical Efficiency, Efficiency ratio, Air standard efficiency, Volumetric Efficiency [on mass & volume], Air-Fuel ratio, relative A/F ratio. 7.3 Measurement of Indicated power with the help of Engine Indicator. Measurement of frictional power- Of single cylinder or multi cylinder engines with the help of Morse test and Motoring test. 7.4 Measurement of brake power- Dynamometer (Mechanical, Hydraulic, Electrical dynamometers). 7.5 Making a heat balance sheet. 7.6 Effect of temperature and altitude on engine power. 7.7 Performance-characteristics curves, Factor affecting the engine Performance, Engine specification. [Simple problems]	09	--

Learning Resources :

Text Books :

Author	Title	Publisher
Dr. Kirpal Singh	Automobile Engg. Vol.-2	Standard Publishers
R.B. Gupta	Automobile Engineering	Satya Prakashan

Course Code	:	PAE-302
Course Title	:	Automotive Chasis -I
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	Automobile Engine

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Objectives:			
Students will be able to:			
<ol style="list-style-type: none"> 1. Understand construction, working and functions of Automobile Chassis. 2. Understand construction, working and functions of steering, braking and suspension. 3. Compare the developments in body engineering, control systems and safety equipment. 			
Content [Theory] :			
Chapter	Name of the Topic	Hours	Marks
01	Vehicle layout and Chassis frame : 1.1 Vehicle layout <ul style="list-style-type: none"> • Definition of an automobile, layout of a vehicle. Layout of the front engine rear wheel driven vehicle, and explain location and function of major vehicle components and systems in brief. (With Sketch) • Classification & comparison of vehicle layout with respect to i) Location of engine, ii) No of live axles, iii) Arrangement of Engine, Passenger and Luggage section, iv) Application. & comparison. [Sketch of layout] 	07	--
	1.2 Chassis Frames: <ul style="list-style-type: none"> • Introduction – Necessity of frame and its functions. Loads acting on frame. Types of frames- conventional (ladder and x-member type), semi integral and integral types. Frame sections-channel, box and tubular sections, Back bone type Chassis frame, Materials of frames. Sub frame, Defects in frames. 	07	--

02	Body Engineering: <ul style="list-style-type: none"> Types of bodies and materials used in body construction. Protective and anticorrosive treatments, painting and repainting procedure. Effect of stream lining [aerodynamic shape] on vehicles' performance. Comparison between Integral body and Framed Construction. 	07	--
03	Front Axle : <ul style="list-style-type: none"> Types of front axle - Dead axle, live axle. Type of stub axle arrangements- Elliot, reverse Elliot, Lamoine, reverse Lamoine. Front wheel assembly. 	06	--
04	Steering system. : <ul style="list-style-type: none"> Steering linkages& Steering column. Steering geometry and its effects – Caster, camber, king pin inclination, toe in– toe out, Correct Steering angle, suspension height & it's effects on stability, steering effort & vehicle control etc. Understeering and oversteering, Turning radius & it's effects. Tilt & Telescoping steering wheels, Collapsible steering column, construction & working Principle. Construction, working and application of Steering gear box – Rack and Pinion type, Recirculating ball type, Worm and Roller type. Ackerman Principle and linkage. Defects & Troubleshooting. 	11	--
05	Power Steering : <ul style="list-style-type: none"> Principles of Power Steering. Comparison between Conventional Steering System and Power Steering System. Power Steering System Types (Hydraulic and electrical) Construction and working principle of different power steering system, Power Steering Pumps, Four Wheeled Steering. Power Steering System – Troubleshooting. 	10	--
Total		48 hrs	70 Marks

Text Books :		
Author	Title	Publisher
Dr. Kirpal Singh	Automobile Engg. Vol.-1	Standard Publishers
R.B. Gupta	Automobile Engineering	Satya Prakashan
Crouse & Angline	Automotive Mechanics	Tata McGraw Hill
Joseph Heitner	Automotive Mechanics	East West Press, New Delhi
John B. Heywood	Internal Combustion Engine Fundamentals	McGraw-Hill International Edition
Automotive Mechanics	N.K. Giri vol-2	Khanna Publishers, New Delhi
K.K. Ramlingam	Automobile Engineering	Scitech Publications

Course Code	:	PME-303
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Course Title	:	THERMAL ENGINEERING - I
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	Basic Mechanical Engineering (MEPC102)
Course Category	:	PC

Course Objectives:

- To give a good understanding of and thorough insight into all important aspects of thermal systems, energy control and the general issue of energy.
- To understand the principles & working of various power producing & power absorbing devices.
- To study, analyze and evaluate the operation and the performance of I.C. engines, compres-

Course Content:

UNIT-I: Sources of Energy: Brief description of energy Sources: Classification of energy sources - Renewable, Non-Renewable; Fossil fuels, including CNG, LPG; Solar Energy: Flat plate and concentrating collectors & its applications (Solar Water Heater, Photovoltaic Cell, Solar Distillation); Wind Energy; Tidal Energy; Ocean Thermal Energy; Geothermal Energy; Biogas, Biomass, Bio-diesel; Hydraulic Energy, Nuclear Energy; Fuel cell.

Unit-II: Internal Combustion Engines: Assumptions made in air standard cycle analysis; Brief description of Carnot, Otto and Diesel cycles with P-V and T-S diagrams; Internal and external combustion engines; advantages of I.C. engines over external combustion engines; classification of I.C. engines; neat sketch of I.C. engine indicating component parts; Function of each part and materials used for the component parts - Cylinder, crank case, crank pin, crank, crank shaft, connecting rod, wrist pin, piston, cooling pins cylinder heads, exhaust valve, inlet valve; Working of four-stroke and two-stroke petrol and diesel engines; Comparison of two stroke and four stroke engines; Comparison of C.I. and S.I. engines; Valve timing and port timing diagrams for four stroke and two stroke engines.

Unit-III: I.C. Engine Systems: Fuel system of Petrol engines; Principle of operation of simple and Zenith carburetors; Fuel system of Diesel engines; Types of injectors and fuel pumps; Cooling system - air cooling, water cooling system with thermo siphon method of circulation and water cooling system with radiator and forced circulation (description with line diagram). Comparison of air cooling and water cooling system; Ignition systems – Battery coil ignition and magneto ignition (description and working). Comparison of two systems; Types of lubricating systems used in I.C. engines with line diagram; Types of governing of I.C. engines – hit and miss method, quantitative method, qualitative method and combination methods of governing; their applications; Objective of super charging.

Unit-IV: Performance of I.C. Engines: Brake power; Indicated power; Frictional power; Brake and Indicated mean effective pressures; Brake and Indicated thermal efficiencies; Mechanical efficiency; Relative efficiency; Performance test; Morse test; Heat balance sheet; Methods of determination of B.P., I.P. and F.P.; Simple numerical problems on performance of I.C. engines.

Unit-V: Air Compressors: Functions of air compressor; Uses of compressed air; Types of air compressors; Single stage reciprocating air compressor - its construction and working (with line diagram) using P-V diagram; Multi stage compressors – Advantages over single stage compressors; Rotary compressors: Centrifugal compressor, axial flow type compressor and vane type compressors.

Refrigeration & Air-conditioning: Refrigeration; Refrigerant; COP; Air Refrigeration system: components, working & applications; Vapour Compression system: components, working &

applications; Air conditioning; Classification of Air-conditioning systems; Comfort and Industrial Air-Conditioning; Window Air-Conditioner; Summer Air-Conditioning system, Winter Air-Conditioning system, Year-round Air-Conditioning system.

Reference Books:

1. Introduction to Renewable Energy – Vaughn Nelson, CRC Press
2. Thermal Engineering – P.L. Ballaney, Khanna Publishers, 2002
3. A Course in Thermal Engineering – S. Domkundwar & C.P. Kothandaraman, Dhanpat Rai.
4. Thermal Engineering – R.S. Khurmi and J.K. Gupta, 18th Edition, S. Chand & Co, New Delhi.
5. Thermal Engineering – R. K. Rajput, 8th Edition, Laxmi publications Pvt Ltd, New Delhi.

Course outcomes:

At the end of the course, the student will be able to:

CO1	Know various sources of Energy and their applications.
CO2	Classify I.C. engines and understand their working and constructional features.
CO3	Draw the energy flow diagram of an I.C. engine and evaluate its performance.
CO4	Describe the constructional features of air compressor and working of different air compressors.
CO5	Know the applications of refrigeration and Classify air-conditioning systems.

Course Code	:	PME-304
Course Title	:	MATERIAL SCIENCE & ENGINEERING
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	NIL
Course Category	:	PC

Course Objectives:

- To understand crystal structures and atomic bonds.
- To understand the properties of different types of ferrous metals and alloys.
- To understand the properties of different types of non-ferrous metals and alloys.
- To understand various metallic failures and acquire the knowledge of testing of materials.
- To understand the concept of corrosion and its prevention.

Course Content:

UNIT-I: Crystal structures and Bonds: Unit cell and space lattice: Crystal system: The seven basic crystal systems; Crystal structure for metallic elements: BCC, FCC and HCP; Coordination number for Simple Cubic, BCC and FCC; Atomic radius: definition, atomic radius for Simple Cubic, BCC and FCC; Atomic Packing Factor for Simple Cubic, BCC, FCC and HCP; Simple problems on finding number of atoms for a unit cell.

Bonds in solids: Classification - primary or chemical bond, secondary or molecular bond; Types of primary bonds: Ionic, Covalent and Metallic Bonds; Types of secondary bonds: Dispersion bond, Dipole bond and Hydrogen bond.

Unit-II: Phase diagrams, Ferrous metals and its Alloys: Isomorphs, eutectic and eutectoid systems; Iron-Carbon binary diagram; Iron and Carbon Steels; flow sheet for production of iron and steel; Iron ores – Pig iron: classification, composition and effects of impurities on iron; Cast Iron: classification, composition, properties and uses; Wrought Iron: properties, uses/applications of wrought Iron; comparison of cast iron, wrought iron and mild steel and high carbon steel; standard commercial grades of steel as per BIS and AISI; Alloy Steels – purpose of alloying; effects of alloying elements – Important alloy steels: Silicon steel, High Speed Steel (HSS), heat resisting steel, spring steel, Stainless Steel (SS): types of SS, applications of SS – magnet steel – composition, properties and uses

Unit-III: Non-ferrous metals and its Alloys: Properties and uses of aluminium, copper, tin, lead, zinc, magnesium and nickel; Copper alloys: Brasses, bronzes – composition, properties and uses; Aluminium alloys: Duralumin, hinalium, magnelium – composition, properties and uses; Nickel alloys: Inconel, monel, nicPerome – composition, properties and uses. Anti-friction/Bearing alloys: Various types of bearing bronzes - Standard commercial grades as per BIS/ASME.

Unit-IV: Failure analysis & Testing of Materials: Introduction to failure analysis; Fracture: ductile fracture, brittle fracture; cleavage; notch sensitivity; fatigue; endurance limit; characteristics of fatigue fracture; variables affecting fatigue life; creep; creep curve; creep fracture; Destructive testing: Tensile testing; compression testing; Hardness testing: Brinell, Rockwell; bend test; torsion test; fatigue test; creep test. Non-destructive testing: Visual Inspection; magnetic particle inspection; liquid penetrant test; ultrasonic inspection; radiography.

Unit-V: Corrosion & Surface Engineering: Nature of corrosion and its causes; Electrochemical reactions; Electrolytes; Factors affecting corrosion: Environment, Material properties and physical conditions; Types of corrosion; Corrosion control: Material selection, environment control and design; Surface engineering processes: Coatings and surface treatments; Cleaning and mechanical finishing of surfaces; Organic coatings; Electroplating and Special metallic plating; Electro polishing and photo-etching; – Conversion coatings: Oxide, phosphate and chromate coatings; Thin film coatings: PVD and CVD; Surface analysis; Hard-facing, thermal spraying and high-energy processes; Process/material selection. Pollution norms for treating effluents as per standards.

Reference Books:

1. A Text Book of Material Science & Metallurgy – O.P. Khanna, Dhanpath Rai and Sons, New Delhi, 2003.
2. Material Science & Engineering – R.K. Rajput, S.K. Kataria & Sons, New Delhi, 2004.
3. Material Science – R.S. Khurmi, S. Chand & Co. Ltd., New Delhi, 2005.

Course outcomes

At the end of the course, the student will be able to:

CO1	Explain about crystal structures and atomic bonds.
CO2	Describe about classification of ferrous metals and their properties.
CO3	Explain about non-ferrous metals, cutting tool materials and composites along with their properties.
CO4	Describe about the various metallic failures and knowledge in testing of materials.
CO5	Explain the principle of corrosion, their types and its prevention methods along with the various surface engineering processes.

Course Code	:	PME-305
Course Title	:	BASIC MECHANICAL ENGINEERING
Number of Credits	:	4 (L: 3, T: 1, P: 0)
Prerequisites	:	NIL
Course Category	:	PC

Course Learning Objectives:

- To understand General Principles of Mechanical Engineering
- To understand laws of thermodynamics, thermal and thermodynamic Processes
- To understand working principles of Thermal Machines and Power Transmitting Devices
- To understand basic materials and manufacturing processes

Course Content:

UNIT-I: Introduction to Thermodynamics - Role of Thermodynamics in Engineering and Science, Types of Systems, Thermodynamic Equilibrium, Properties, State, Process and Cycle, Elementary introduction to Zeroth, First and Second laws of thermodynamics, Heat and Work Interactions for various non-flow and flow processes; Concept of Heat Engine, Heat Pump & Refrigerator, Efficiency/ COP; Kelvin-Planck and Clausius Statements, Carnot Cycle, Carnot Efficiency, T-S and P-V Diagrams, Concept of Entropy (Definition only).

Unit-II: Heat transfer & Thermal Power Plant: Modes of Heat Transfer; Conduction: Composite Walls and Cylinders, Combined Conduction and Convection: Overall Heat Transfer Co-efficient, Simple Numerical Problems: Thermal Power Plant Layout; Rankine Cycle; Fire Tube and Water Tube boilers, Babcock & Wilcox, Cochran Boilers;

Unit-III: Steam Turbines: Impulse and Reaction Turbines; Condensers: Jet & Surface Condensers, Cooling Towers; **Internal Combustion Engines and Refrigeration:** Otto, Diesel and Dual cycles; P-V and T-S Diagrams; IC Engines: 2 - Stroke and 4 - Stroke I.C. Engines, S.I. and C.I. Engines.

Unit-IV: Materials and Manufacturing Processes: Engineering Materials, Classification and their Properties; Metal Casting, Moulding, Patterns, Metal Working: Hot Working and Cold Working, Metal Forming: Extrusion, Forging, Rolling, Drawing, Gas Welding, Arc Welding, Soldering, and Brazing.

Unit-V: Machine Tools and Machining Processes: Machine Tools: Lathe Machine and types, Lathe Operations, Milling Machine and types, Milling Operations, Shaper and Planer Machines: Differences, Quick-Return Motion Mechanism, Drilling Machine: Operations, Grinding Machine: Operations

Reference Books:

1. Basic Mechanical Engineering – M.P. Poonia & S.C. Sharma, Khanna Publishing House
2. Elements of Mechanical Engineering – M. L. Mathur, F.S. Mehta and R. P. Tiwari, Jain Brothers, New Delhi
3. Engineering Heat Transfer – Gupta & Prakash, Nem Chand & Brothers, New Delhi
4. Workshop Technology (Vol. 1 and 2) – B. S. Raghuvanshi, Dhanpath Rai and Sons, New Delhi.
5. Basic Mechanical Engineering – J Benjamin

Course Code	:	PME-311
Course Title	:	Automotive Engines Lab
Number of Credits	:	2(L: 0, T: 0, P: 4)
Prerequisites	:	NIL
Course Category	:	PC

List of Practicals:	Total periods : 64
hrs.	
Skills to be developed :	
<ol style="list-style-type: none"> 01. Operate Cut Section Models of two stroke Engine to understand Engine Nomenclature, Identify and Observe Location of Various Components and explain it's operation. 02. Operate Cut Section Models of four stroke Petrol Engine to understand Engine Nomenclature, Identify and Observe Location of Various Components and explain it's operation. 03. Operate Cut Section Models of four stroke Diesel Engine to understand Engine Nomenclature, Identify and Observe Location of Various Components and explain it's operation. 04. Identifying Tools & Special Tools used for Dismantling and assembling the engine. 05. Dismantle & Assemble an Engine and practice the same. 06. Dismantle Cooling System; Identify Components and Their Functions, Draw Layout. 07. Removing the radiator from vehicle, checking it for leak, flushing the radiator and refitting. 08. Removing the thermostat valve & the pressure cap checking and refitting. 09. Dismantle Lubrication System, Identify Components. Draw Layout. 10. To study the fuel supply system of petrol & diesel engines and represent the same in sketch. 11. Removing the carburettor from the engine, identifying and checking the components, sketch of the circuit and refitting. 12. Repairing of fuel injectors of a diesel engine, identifying components and refitting. 13. Conduct Morse Test on Multi-cylinder Engine & Calculate Frictional Power, I.P & B.P. 14. Conduct engine performance testing in engine Test Rig and find other engine performance parameters, prepare heat balance sheet. 15. Draw and analyze the engine performance curves. 	
Notes:	Engine practical / testing may be performed by the batch.

Course Code	:	PME-311
Course Title	:	Automotive Chasis-I Lab
Number of Credits	:	1(L: 0, T: 0, P: 2)
Prerequisites	:	NIL
Course Category	:	PC

List of Practicals:	Total Periods : 32
hrs.	
Skills to be developed :	
<ol style="list-style-type: none"> 1. Safety precautions to be followed and knowledge of first aid in an automobile workshop. 2. Identification of general tools in an automobile workshop and purposes of them. 3. Study of different types of front and rear axles and their sketches. 4. Observe the steering linkages, draw its layout. Dismantle the steering gear box, identify its type, sketch its components and assemble it. 5. Checking of wheel alignment – Suspension height, Caster, Camber, KPI, Toe-in & Toe-out. 6. Study of Tilt & Telescoping steering wheels, Collapsible steering column. 7. Visit to Automobile Body Building and Body Manufacturing Industry, Prepare a report considering following points – Layouts, Body Construction, Body Materials, Body Repairs and Painting Procedure. 	

Course Code	:	PME-313
Course Title	:	Thermal Engineering Lab – I
Number of Credits	:	1 (L:0; T:0; P:2)
Prerequisites	:	Thermal Engineering – I (MEPC207)
Course Category	:	PC

Course Objectives:

- To understand the importance of fuel properties and learn the methods of determination of various properties of fuels.
- To understand the working principles of various methods used in determination of properties of fuels.
- To observe different parts of I.C. engine and understand their working.
- To identify the physical differences between S.I. and C.I. engines and 2-S and 4-S engines.

Course Content:

S.No.	Topics for practice
I	Flash & Fire point tests using Able's/Cleveland/Pensky Martin Apparatus
II	Viscosity measurement using Saybolt viscometer
III	Calorific value tests using Bomb Calorimeter (Solid and Liquid fuels) and Junkers Gas Calorimeter (Gaseous fuels)
IV	Carbon residue test using Conradson's apparatus.
V	Assembling and disassembling of I.C. Engines
VI	Port timing diagram of Petrol engine
VII	Port timing diagram of Diesel engine
VIII	Valve timing diagram of Petrol engine
IX	Valve timing diagram of Diesel engine
X	Study of petrol and diesel engine components and Models

Course Code	:	PME-314
Course Title	:	COMPUTER AIDED DESIGN AND MANUFACTURING
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	Computer Aided Machine Drawing Practice (MEPC104)
Course Category	:	PE

Course Objectives: To provide an overview of how computers are being used in design, development of manufacturing plans and manufacture.

- To understand concepts of drafting and modelling using CAD.
- To understand the need for integration of CAD and CAM.
- To understand the concepts of flexible manufacturing system.

Course Content:

UNIT-I: Fundamentals of CAD/CAM: Automation; Design process; Application of computers for design; Benefits of CAD; Computer configuration for CAD applications; Design workstation; Graphic terminal; CAD Software: Definition of system software and application software; CAD database and structure.

Geometric Modeling: 3D-Wire frame modeling; Wire frame entities and their definitions; Interpolation and Approximation of curves; Concept of Parametric and Non-parametric representation of curves; Curve fitting techniques.

Unit-II: Surface Modeling: Algebraic and Geometric form; Parametric space of surface; Blending functions; Parametrization of surface patch; Subdividing; Cylindrical surface; Ruled surface; Surface of revolution; Spherical surface; Composite surface; Bezier surface; Solid Modelling: Definition of cell composition and spatial occupancy enumeration; Sweep representation; Constructive solid geometry; Boundary representations.

Unit-III: NC Control Production Systems: Numerical control; Elements of NC system; NC part programming; Methods of NC part programming; Manual part programming, Computer assisted part programming; Post processor; Computerized part program.

Unit-IV: Group Technology: Part families; Parts classification and coding; Production analysis; Machine cell design; Computer aided process planning: Retrieval type and Generative type; Machinability data systems; MRP and its Benefits.

Unit-V: Flexible manufacturing system: F.M.S equipment; Layouts; Analysis methods and benefits; Computer aided quality control; Automated inspection: Off-line, On-line, Contact, Non-contact; Coordinate measuring machines; Machine vision; CIM system and Benefits

Reference Books:

1. CAD/CAM Principles and Applications, P.N.Rao, Tata McGraw-Hill
2. Computer Aided Design and Manufacturing, Groover M.P. & Zimmers Jr, Prentice hall of India
3. CAD/CAM/CIM, RadhaKrishna P. & Subramanyam, Wiley Eastern Ltd

Course outcomes:

At the end of the course, the student will be able to:

CO1	Develop mathematical models to represent curves and surfaces and Model engineering components using solid modeling techniques.
CO2	Understand geometric transformation techniques in CAD.
CO3	Develop programs for CNC to manufacture industrial components.
CO4	Understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Manufacturing cost, Layout & Material Handling system.
CO5	Utilize Flexible manufacturing system tools.

