

### Automobile Component Design

<b>Name of the Course : Diploma in Automobile Engineering</b>		
Course Code: AE	Semester :	Fifth
Duration: 17 Weeks	Maximum Marks :	100 Marks
Teaching Scheme :	Examination Scheme :	Theory
Theory: 02hrs / week	Internal Examination :	10 Marks
Tutorial: Nil	TA [Attendance, Assignment, Interaction etc.]:	05 Marks
Practical: 02hrs / week	End Semester Exam :	35 Marks
Credit : 3		
<b>Aims :</b>		
<ul style="list-style-type: none"> <li>• To impart knowledge of fundamental concept of machine design applied to automobile components.</li> <li>• To impart exposure to standard codes of practices, CAD &amp; Use of Design Data Book.</li> <li>• To impart knowledge concerned to Automobile Component Design.</li> </ul>		
<b>Objectives:</b>		
Students will be able to:		
<ol style="list-style-type: none"> <li>1. Analyze the loads, type of induced stresses, resisting areas &amp; hence the modes of failure.</li> <li>2. Identify modes of failure &amp; relevant theory for problem solving.</li> <li>3. Analyze practical problems &amp; make use of materials, strength equations, factor of safety etc.</li> <li>4. Use design data book to standardize component dimensions, and to select dimensional tolerances.</li> </ol>		
<b>Pre-requisite :-</b>		
Knowledge of Mechanisms, Strength of materials, Material sciences- Manufacturing processes & Mechanical engineering drawing.		
<b>Examination Scheme : Theoretical</b>		<b>Total Marks : 50</b>
<b>Content : Theory</b>		
<b>Chapter</b>	<b>Name of the Topics</b>	<b>Hours</b>
<b>01</b>	<b>Basic concepts of Design :</b> 1.1 Introduction to design, Classification of design, Design consideration & Design procedure. 1.2 Stress analysis: 1.2.1 Types of external loads. 1.2.2 Types of induced stresses: tensile, compressive, shear, Crushing and bearing pressure, bending, torsion, thermal stresses, creep, proof stresses, resilience, principal stresses. 1.2.3 Variable stresses in machine parts, fatigue & endurance limit, stress–Time diagrams for variable stresses. 1.2.4 Working stresses for static load, variable or fatigue load. 1.2.5 Factor of safety, selection of factor of safety. 1.2.6 Stress concentration causes and remedies. 1.2.7 Introduction to theories of failure –Maximum principle stress theory,	<b>10</b>

	<p>Maximum shear stress theory, Distortion energy theory.</p> <p>1.3 Designation of materials as per IS and introduction to International standards &amp; advantages of standardization, use of design data book, use of standards in design and preferred numbers series.</p> <p>1.4 Selection of material and justifications for Automobile components. Advanced Materials for automotive components.</p> <p>1.5 Bearings-Classification, location in Automobiles systems &amp; selection of bearings.</p> <p>1.6 Post design aspects - Ergonomic aspect, Aesthetic consideration (Shape, color, surface finish) for Automobile.</p>				
<b>02</b>	<p><b>Design of shaft, keys &amp; levers:</b></p> <p>2.1 Conceptual understanding of shaft, axles &amp; spindles.</p> <p>2.2 Design of shaft for torsion, rigidity, bending, combined torsion &amp; bending.</p> <p>2.3 Design of propeller shaft, whirling &amp; critical speed.</p> <p>2.4 Design of rear axle.</p> <p>2.5 Types of keys, design of Sunk Rectangular Key, Effect of keyways on strength of shaft.</p> <p>2.6 Types of levers.</p> <p>2.7 Design of following levers for rectangular cross-section &amp; fulcrum pin only:-a) Rocker arm &amp; b) Bell crank lever.</p>			<b>08</b>	
<b>03</b>	<p><b>Design of Chassis &amp; engine components:</b></p> <p>3.1 Design of clutch- Single plate &amp; Multi plate.</p> <p>3.2 Data of engine specifications and calculations of cylinder dimensions for given power.</p> <p>3.3 Design of cylinder head thickness and bolts.</p> <p>3.4 Design of piston crown by bending strength and thermal considerations.</p> <p>3.5 Design of piston rings and skirt length.</p> <p>3.6 Design of piston pin for bearing, bending &amp; shear considerations.</p> <p>3.7 Design of connecting rod cross -section (I section).</p> <p>3.8 Design of big end, cap and bolts.</p>			<b>14</b>	
<b>Total</b>			<b>32 hrs.</b>		
<b>Total Classes</b>			<b>17 weeks [34 lecture hrs.]</b>		
<b>Examination Scheme: (Theoretical)</b>			<b>Total Marks = 35</b>		
Group	Chapter	Objective Questions			Total Marks
		To be Set	To be Answered	Marks per Question	
A	01	05	Any ten	01	10 x 01 = 10
B	02	03			
C	03	07			
Group	Chapter	Objective Questions			Total Marks
		To be Set	To be Answered	Marks per Question	
A	01	03	Any five	05	05 x 5 = 25
B	02	02			
C	03	04			
<b>Practical:</b>					
<b>Skills to be developed:</b>					

<b>Intellectual Skills:</b>		
<ol style="list-style-type: none"> <li>1) Analyze the loads, resisting areas, types of induced stresses on automobile components.</li> <li>2) Analyze the modes of failure of different automobile components &amp; identify the methods, strength equations to overcome the failures.</li> <li>3) Calculate the dimensions of automobile components.</li> <li>4) Identify different engine &amp; chassis components.</li> </ol>		
<b>Motor Skills:</b>		
<ol style="list-style-type: none"> <li>1) Draw various automobile components as per the designed dimensions.</li> <li>2) Use advanced materials for automobile components.</li> <li>3) Use design data book to standardize component dimensions.</li> <li>4) Prepare bill of materials.</li> <li>5) Use CAD software to draw automobile components.</li> </ol>		
<b>Examination Scheme : Practical</b>		<b>Total Marks : 50</b>
<ul style="list-style-type: none"> <li>• <b>Continuous Internal Sessional Assessment:</b> - - 25 marks.</li> </ul> <p>I) Attending classes, doing practicals &amp; submitting respective note book in time = 20 marks.  II) Viva-Voce = 05 marks  III) Total (I + II) = 25 Marks.</p> <ul style="list-style-type: none"> <li>• <b>External Sessional Assessment:</b> - 25 marks.</li> </ul> <p><b>Examiner :</b> External Teacher [Lect.]</p>		
<b>Sl. No.</b>	<b>List of Design Practical [for Continuous Internal Assessment]</b>	<b>Hours</b>
<b>01</b>	Identify the different engine & chassis components which may fail due to stress concentration, observe & state remedy to reduce stress concentration.	<b>02</b>
<b>02</b>	Use of advanced materials with justifications for components like gears, piston, piston rings, leaf springs, cylinder head & block etc.	<b>02</b>
<b>03</b>	Design any one machine elements (socket & spigot type cotter joint / Knuckle joint) for specified data, select suitable materials, prepare assembly-detail, drawing one on CAD indicating overall dimensions, tolerances, hardness & surface finish, also Prepare bill of material.	<b>08</b>
<b>04</b>	Design any one coupling (Muff coupling / bush pin type flexible coupling) for specified data, select suitable materials, prepare assembly-detail, drawing one on CAD indicating overall dimensions, tolerances, hardness & surface finish, also Prepare bill of material.	<b>08</b>
<b>05</b>	<b>DESIGN PROJECT: (any one)</b> A. Design of Power train [for a given engine power]: (Piston, Piston rings, piston pin, connecting rod, crankshaft) B. Design of Transmission train [for a given engine power]: (clutch, teeth calculations of gear box, propeller shaft and rear axle). <b>Notes:</b> Select suitable materials, prepare drawing indicating overall dimensions, tolerances, hardness & surface finish.	<b>12</b>
<b>Total Periods</b>		<b>32 hrs.</b>
<b>Note :-</b>		
<ul style="list-style-type: none"> <li>➤ Design project activity should be completed in a small group of 5-6 students.</li> <li>➤ Use of design data book is compulsory.</li> </ul>		
<b>Scheme for continuous Internal Assessment:</b> Total Marks = 25.		
Sl. No.(01 & 02) = 5 marks, Sl. No. (03 & 04) = 10 (i.e.5x2) marks & Sl. No. 05 = 10 marks.		
<b>Learning Resources :</b>		

<b>Text Books :</b>		
<b>Author</b>	<b>Title</b>	<b>Publisher</b>
P C Sharma & D K Aggarwal	Machine Design	S K KATARIA & sons
R.S.Khurmi & J.K.Gupta	Machine Design	Eurasia Publication House
R.K.Jain	Machine Design	Khanna publication
Pandya & shah	Machine Design	Dhanpat rai & sons
U.C. Jindal	Machine Design	Pearson
R B Gupta	Auto design	Satya prakashan
V.B.Bhandari	Design of Machine Elements	Mc. Graw Hill
N.K Giri.	Problems in Automobile Engineering	Khanna publication
K M Aggarwal	Auto design problems	Satya prakashan
Griles	Automobile Design Vol,2,3	----
J.E. Shigley	Machine Design	McGraw Hill
	Design data Book	P S G Coimbatore

### Automobile Chassis-II

<b>Name of the Course : Diploma in Automobile Engineering</b>			
Course Code: AE	Semester :		Fifth
Duration: 17 Weeks	Maximum Marks :		150 Marks
Teaching Scheme :		Examination Scheme :	
Theory: 3 hrs / week	Internal Examination :		20 Marks
Tutorial: Nil	T.A [Attendance, Assignment & Interaction]:		10 Marks
Practical: 2 hrs / week	End Semester Exam :		70 Marks
Credit : 4			
<b>Aims :</b>			
<ul style="list-style-type: none"> <li>• To impart knowledge to construction, working and functions of Automobile Systems.</li> <li>• To impart knowledge concerned to Automobile Component Design, Vehicle maintenance, vehicle testing.</li> <li>• To impart knowledge concerned to latest developments in braking system.</li> </ul>			
<b>Objectives:</b>			
Students will be able to:			
<ol style="list-style-type: none"> <li>1. Understand construction, working and functions of Automobile control systems such as Air Conditioning, steering, braking and suspension.</li> <li>2. Understand construction and working of different braking system.</li> <li>3. Know the comfort conditions of the occupants.</li> <li>4. Understand the effects of resistances on a vehicle.</li> <li>5. Understand the various types wheels and its' specification.</li> </ol>			
Pre-requisite :-			
<b>Content [Theory] :</b>			
Chapter	Name of the Topic	Hours	Marks
01	<b>Brakes and Braking system:</b> 1.1 Introduction, Principle of braking. 1.2 Function and necessity of brakes, Braking Effect- weight transfer. 1.3 Classification of brakes and braking systems. 1.4 Construction and working of - Drum brake. 1.5 Concept of Leading Shoe & Trailing Shoe. 1.6 Friction materials used for brake shoes and pads. Characteristics of friction material- brake fade, coefficient of friction, dry friction and wet friction. 1.7 Disc brake, types, construction and working principle, use. 1.8 Solid and ventilated disk brakes. 1.9 Comparison between Drum Brake and Disc Brakes 1.10 Construction and working of - Mechanical braking system. 1.11 Hydraulic Braking system, construction & working principle. 1.12 Master cylinder, wheel cylinder construction & working principle, bleeding of Brakes. 1.13 Properties of Brake Fluid and their specifications.	11	--

	<p>1.14 Air braking system - construction and working principle.  1.15 Parking brake, Adjustments of Brakes, Brake Test.  1.16 Brake System Troubleshooting.</p>		
02	<p><b>Power Brakes:</b>  2.1 Necessity of Power Brakes, Types of Power Brakes.  2.2 Construction and working principle of power brakes (pedal assisted &amp; combined unit type).  2.3 Hydraulic operated air braking system and vacuum assisted braking system, vacuum pump, manifold vacuum..  2.4 Concept and working of Antilock Brake System (ABS).  2.5 Power Brake Troubleshooting.</p>	06	
03	<p><b>Suspension Systems:</b>  3.1 Functions of suspension system. Sprung weight, unsprung weight.  3.2 Types of suspension system - Rigid and independent Suspension.  3.3 Types of Independent suspension system - McPherson strut and Wishbone type.  3.4 Semi-elliptical Leaf spring, Helper springs (variable rate springs), coil spring , torsion bar arrangement,  3.5 Construction and working of Air Suspension System.  3.6 Construction and working of-  Shock absorbers -Telescopic and Gas filled.  3.7 Comparison between Rigid and independent Suspension.  3.8 Anti roll bar or stabilizer bar.</p>	09	--
04	<p><b>Wheels and Tyres:</b>  4.1 Wheels:  Functions, Wheel Specification, Types of wheels-wired spoke wheel, disc and alloy Wheels.  4.2 Tyres: Necessity of tyres, Construction, working and comparison of a Tubed tyre and Tubeless tyres.  4.3 Types of Tyres -radial, cross ply &amp; belted bias type.  4.4 Specification of tyres, concept of Aspect ratio.  4.5 Types of tread patterns  4.6 Effect of inflation pressure on the life of tyre and tyre rotation.  4.7 Factors affecting tyre performance and life.  4.8 Balancing of wheel tyre assembling (static and dynamic).  a. Tyre Rotation.  b. Tyre Retreading.  c. Tube Vulcanizing.</p>	09	
05	<p><b>Automotive air conditioning System:</b>  5.1 Principles of automotive air conditioning.  5.2 Layout and operation of Heating, Ventilation and Air Conditioning System (HVAC) in a vehicle.  5.3 Type of refrigerants used in car air conditioning and their properties.  5.4 Human comfort conditions.  5.5 Temperature control system, humidity control.  5.6 Causes of failure of automotive air conditioners.</p>	07	--

06	<b>Vehicle Performance &amp; Safety Devices:</b> 6.1 Resistance faced by the vehicle- Air resistance, rolling resistance, gradient resistance. 6.2 Definitions- traction, tractive efforts, drawbar pull, gradeability, acceleration, pitching, bouncing, rolling, sway and yaw. 6.3 Stability of vehicle on turn and slopes 6.4 Safety devices –air bags, exhaust brake, emergency brake, central locking, Safety Belts.	06	
<b>Total</b>		<b>48 hrs</b>	<b>70 Marks</b>
<b>Total Classes</b>		17 weeks [51 lecture hrs]	
<b>Practical :</b>			
<b>SL. No.</b>	<b>Skills to be developed</b>		
01	<b>Intellectual Skills:</b> <ul style="list-style-type: none"> <li>• To develop knowledge to Select proper tools and their range.</li> <li>• To develop knowledge on construction and working of the system under consideration..</li> <li>• To develop knowledge on safety and performance of the vehicles.</li> </ul>		
02	<b>Motor Skills:</b> Students will be able to: <ul style="list-style-type: none"> <li>✓ Sketch the different systems and their components..</li> <li>✓ Handle tools, equipment and instruments.</li> <li>✓ Dismantle and assemble various system assemblies.</li> </ul>		
<b>Examination Scheme : Practical</b>		<b>Maximum Marks : 50</b>	
<ul style="list-style-type: none"> <li>• <b>Continuous Internal Assessment:</b> - 25 marks.</li> </ul> I) Attending classes, doing practicals & submitting respective report in time = 20 marks. II) Viva-Voce = 05 marks III) Total (I + II) = 25 Marks. <ul style="list-style-type: none"> <li>• <b>External Assessment:</b> – 25 marks.</li> </ul> <b>Examiner : External Lecturer.</b>			
<b>List of Practicals:</b>		<b>Total Periods : 32 hrs.</b>	
<b>Skills to be developed :</b>			
<ol style="list-style-type: none"> <li>1. Know your Automobile Systems laboratory through, listing the systems, working models, and charts in laboratory with their purpose. <ul style="list-style-type: none"> <li>• Listing the tools used in dismantling and assembly of various Automobile systems.</li> </ul> </li> <li>2. Observe and draw the layout of hydraulic braking system. Dismantle master cylinder, wheel cylinder and remove brake drum, identify and sketch the components and assemble it.</li> <li>3. Observe and draw the layout of Air braking system. Dismantle all the components like Brake valve, proportionate valve, wheel cylinder and remove brake drum, identify and sketch the components and assemble it.</li> <li>4. Observe and draw the layout of hydraulically operated air/vacuum assisted braking system.</li> </ol>			

5. Observe and sketch the construction of Mc. Pherson and wishbone type suspension with label.
6. Study the working principle and Testing of Anti Lock Braking (ABS) system.
7. Dismantle semi elliptical leaf spring, sketch its components with labels and understand its working.
8. Dismantle telescopic shock absorber, identify components and draw sketches of components with labels and understand its working principle.
9. Observe and draw the layout of automobile Air conditioning system. Measure the ambient temperature and temperature at various locations inside the car. Describe the control systems.

**Notes:**

1. The practicals shall be performed with a small group of students.
2. Multiple practicals will be conducted simultaneously with different groups.

**Examination Scheme: Theoretical**

Group	Chapter	Objective Questions			Total Marks
		To be Set	To be Answered	Marks per Question	
A	01 & 02	05	Any twenty	01	20 x 1 = 20
B	03 & 04	10			
C	05 & 06	05			

Group	Chapter	Subjective Questions			Total Marks
		To be Set	To be Answered	Marks per Question	
A	01 & 02	03	Any five	10	10 x 5 = 50
B	03 & 04	05			
C	05 & 06	03			

**Learning Resources :**

**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



## Hydraulics & Pneumatics

<b>Name of the Course : Diploma in Automobile Engineering</b>			
Course Code: AE	Semester :		Fifth
Duration: 17 Weeks	Maximum Marks :		100 Marks
Teaching Scheme :		Examination Scheme : Theoretical	
Theory: 3 hrs / week	Internal Examination :		20 Marks
Tutorial: Nil	T.A [Attendance, Assignment, Interaction etc.]:		10 Marks
Practical: Nil	End Semester Exam :		70 Marks
Credit : 3			
<b>Aims :</b>			
<ul style="list-style-type: none"> <li>• To impart knowledge of working principle of various hydraulic machines.</li> <li>• To provide insight to the students in understanding fundamentals of fluid mechanics and its applications to industrial and mobile hydraulics and pneumatics.</li> <li>• To impart knowledge to construct the hydraulics and pneumatics circuits for various applications.</li> </ul>			
<b>Objectives:</b>			
Students will be able to:			
<ol style="list-style-type: none"> <li>1) Understand the basic properties of fluid, important principles of hydraulics with their applications and hydraulic devices used in practice.</li> <li>2) Identify fluid power system components.</li> <li>3) Select appropriate tools to dismantle and assemble the components.</li> <li>4) Diagnose probable causes of failure of components of hydraulic and pneumatic circuits.</li> <li>5) Verifying the conditions of fittings, oil, pipes, seals &amp; packing of hydraulic systems in automobile vehicles.</li> <li>6) Construct the Hydraulic and Pneumatic circuits for various applications.</li> </ol>			
<b>Pre-requisite :-</b>			
Fundamental knowledge of fluid mechanics.			
<b>Content [Theory] :</b>			
Chapter	Name of the Topic	Hours	Marks
01	<b>Fluid Mechanics:</b> 1.1 Fluid, Ideal fluid & Real Fluid. 1.2 Overview of fluid properties: Specific Weight, Specific gravity, Surface tension, Capillarity, Viscosity (Definitions, units and applications). 1.3 Definition of Pressure and its unit. Pascal's law and its application, 1.4 Measurement of Pressure: Relation between Pressure, Height and Density, Pressure head, Concept of atmospheric pressure, gauge pressure, absolute Pressure and relation. 1.5 Pressure Gauges - Piezometer tube, simple and differential Manometer. (Problems on Manometers) 1.6 Bourdon tube pressure gauge.	<b>07</b>	

02	<p><b>Hydrodynamics:</b> (simple numerical from below)</p> <p>2.1 Law of continuity and its applications.</p> <p>2.2 Bernoulli's Theorem (assumptions and explanation): Energy Possessed by the liquid in motion. Measurement of flow through Venturimeter, Orifice meter and pitot tube in a pipe, stagnation pressure.</p> <p>2.3 Hydraulic coefficients: Concept of Vena Contracta, Coefficient of contraction, coefficient of velocity, coefficient of discharge. Relation between the hydraulic coefficients.</p> <p>2.4 Types of fluid flow: Steady, unsteady, rotational, irrotational, laminar, turbulent, Uniform &amp; non uniform flow. Reynolds's number (definition &amp; expression).</p> <p>2.5 Head losses in pipe flow, Major &amp; Minor head loss.</p>	08	--
03	<p><b>Hydraulic Machines:</b></p> <p>3.1 Centrifugal Pumps: 3.1.1 Types, Construction and working of centrifugal pump. 3.1.2 Types of casing, Heads, Manometric head. 3.1.3 Losses and Efficiencies of Centrifugal Pump. 3.1.4 Cavitation, need of priming.(simple problem) 3.1.5 Pumps are connected in series &amp; parallel, Pump Selection.</p> <p>3.2 Reciprocating Pumps: 3.2.1 Construction &amp; Working of single &amp; Double Acting reciprocating pump. 3.2.2 Discharge, Positive &amp; Negative slip, Power and Efficiencies of Reciprocation Pump, Indicator diagram. 3.2.3 Air vessels - their function &amp; Advantage. 3.2.4 Reasons of cavitations or separation. (simple problem)</p>	07	
04	<p><b>3.3 Miscellaneous Fluid Machines &amp; Devices:</b></p> <p>3.3.1 Gear pumps, Vane type, Screw Pumps used in hydraulic circuits, comparison &amp; applications.</p> <p>3.3.2 Rotary air compressor used in pneumatic circuits.</p> <p>3.4 Simple Hydraulic Devices: 3.4.1 Hydraulic jack, Hydraulic ram, Hydraulic lift, Hydraulic press- Working principles, construction and applications.</p>	06	
05	<p><b>Basic Components of Hydraulic &amp; Pneumatic Systems:</b></p> <p>4.1 Hydraulic &amp; Pneumatic symbols.</p> <p>4.2 Air Motors: Type, construction &amp; working principle.</p> <p>4.3 Hydraulic Motors: Type, construction, working principle.</p> <p>4.4 Valves (Function, construction &amp; working): Classifications of valves, pressure control valve, pressure relief valve, Flow control valve, poppet valve, throttle valve, proportionate valve, Unloading valve, Non return valve.</p>	08	--
06	<p><b>Accessories and Hydro Pneumatic Systems &amp; Circuits:</b></p> <p>Accessories- Filters, pipes, Hoses, Fittings, Seals &amp; Gaskets. (Types, construction, function and symbols of all components)</p> <p>6.1 Comparison of Hydraulic and pneumatic circuits.</p> <p>6.2 Hydraulic Circuits: Meter in, Meter out, Bleed off &amp;</p>	12	

	Sequencing. (working principle & use) 6.3 Applications of hydraulic circuits: 3.1 Hydraulic power steering circuit & Hydraulic brake circuit. 6.4 Simple Pneumatic Circuits : (working principle & use) Speed control circuits & Sequencing circuits. 6.5 Applications of pneumatic circuits – Air brake & Pneumatic power tools.				
<b>Total</b>				<b>48 hrs</b>	<b>70 Marks</b>
<b>Total Classes</b>				17 weeks [51 lecture hrs]	
<b>Examination Scheme: Theoretical</b>					
Group	Chapter	Objective Questions			Total Marks
		To be Set	To be Answered	Marks per Question	
A	01 & 02	06	Any twenty	01	20 x 1 = 20
B	03 & 04	06			
C	05 & 06	08			
Group	Chapter	Subjective Questions			Total Marks
		To be Set	To be Answered	Marks per Question	
A	01 & 02	03	Any five	10	10 x 5 = 50
B	03 & 04	03			
C	05 & 06	04			
<b>Learning Resources :</b>					
<b>Text Books :</b>					
Author	Title			Publisher	
R.K.Bansal	Fluid Mechanic & Machines			Laxmi Publication	
Dr. D.S. Kumar	Fluid Mechanics and Fluid Power Engg.			S.K.Kataria & Sons	
M M Das	Fluid Mechanics and Turbomachines			PHI Learning Private Ltd.	
S K Agrawal	Fluid Mechanics and Machinery			Tata McGraw Hill Co.	
S. R. Mujumdar	Oil Hydraulic System – Principle and Maintenance			Tata McGraw Hill Co.	
S. R. Mujumdar	Pneumatics Systems – Principle and Maintenance			Tata McGraw Hill Co.	
S. Ramamrutham	Hydraulics, Fluid Mechanics & Fluid Machinery			Dhanpat Rai publishing company	
Dr. Jagdish Lal	Fluid Mechanics and Hydraulics			Metropolitan books Co. private Ltd. Delhi	



### Earth Moving Equipments & Farm Machinery

Name of the Course : <b>Diploma in Automobile Engineering</b>					
Course Code:	AE	Semester :	Fifth		
Duration:	17 Weeks	Maximum Marks :	100 Marks		
Teaching Scheme :		Examination Scheme : Theory			
Theory:	3 hrs / week	Internal Examination :	20 Marks		
Tutorial:	Nil	T.A [Attendance, Assignment & Interaction]:	10 Marks		
Practical:	Nil	End Semester Exam :	70 Marks		
Credit :	3				
<b>Aim:</b>					
<ul style="list-style-type: none"> <li>• To understand importance of Earth Moving Equipments &amp; Farm Machinery.</li> <li>• To impart knowledge about various system &amp; subsystems for servicing of these vehicles.</li> </ul>					
<b>Objectives:</b>					
Students will be able to :					
<ul style="list-style-type: none"> <li>➤ Explain working &amp; construction of various systems &amp; subsystems in earth moving machines &amp; agricultural machines.</li> <li>➤ To carry out preventive maintenance of earth moving machines &amp; agricultural machines.</li> </ul>					
<b>Pre-requisite :-</b>					
<ul style="list-style-type: none"> <li>✓ Fundamental concept of Automobile.</li> <li>✓ Fundamental concept of system of Automobile.</li> </ul>					
<b>Examination Scheme: Theory</b>					
Group	Chapter	Objective Questions			Total Marks
		To be Set	To be Answered	Marks per Question	
A	01 & 02	08	20	01	20 x 1 = 20
B	03 & 04	12			
Group	Chapter	Subjective Questions			Total Marks
		To be Set	To be Answered	Marks per Question	
A	01 & 02	03	Any five	10	10 x 5 = 50
B	03 & 04	06			
<b>Content [Theory] :</b>					
Chapter	Name of the Topic	Hours	Marks		
<b>01</b>	<b>Earth moving equipments:</b> 1.1 Introduction, function. 1.2 Types of earth moving equipments and outlined their uses. 1.3 General specifications of a typical Earth Moving Machine. 1.4 Comparison between General Automobile and Earth Moving Machine on the following Parameters: a) Working condition. b) Travelling speed. c) Steering system	<b>10</b>	--		

	<ul style="list-style-type: none"> <li>d) Suspension system.</li> <li>e) Power take off.</li> <li>f) Power transmission.</li> <li>g) Braking system</li> <li>h) Driving License and RTO registration.</li> </ul>		
<b>02</b>	<p><b>Tractors:</b></p> <ul style="list-style-type: none"> <li>2.1 Comparison of tractor with an automobile.</li> <li>2.2 General Layout of a tractor.</li> <li>2.3 Comparison between tyred and Crawler Tractor.</li> <li>2.4 Power train &amp; transmission layout of a tractor.</li> <li>2.5 Tractor power take off its working &amp; construction.</li> <li>2.6 Counterweight &amp; its importance.</li> <li>2.7 Factors of selection of tractors &amp; uses.</li> <li>2.8 Trouble shooting, care &amp; maintenance.</li> <li>2.9 Power tiller- Comparison with tractors.</li> </ul>	<b>08</b>	--
<b>03</b>	<p><b>Different other earth moving equipments &amp; farm machineries [functions, working principle, detail constructional features (with power flow layout &amp; special features) and uses]:</b></p> <ul style="list-style-type: none"> <li>a) Dozer</li> <li>b) Dump Trucks</li> <li>c) Loader</li> <li>d) Roller</li> <li>e) Shovel</li> <li>f) Cranes</li> <li>g) Fork Lift</li> <li>h) Scrapers</li> <li>i) Rippers</li> <li>j) Excavator</li> <li>k) Tanker/Trailer/carrier</li> </ul>	<b>22</b>	--
<b>04</b>	<p><b>Plant protection equipments &amp; Harvesting equipments:</b></p> <ul style="list-style-type: none"> <li>4.1 Sprayer and Duster (types)– Construction, Function, working principle &amp; applications.</li> <li>4.2 Mowers, Reapers, Binders, Forge Harvester, Vegetable and Food Harvester – Construction, Function, working principle &amp; applications.</li> </ul>	<b>08</b>	
<b>Total</b>		<b>48</b>	<b>70 Marks</b>
<b>Total Classes</b>		17 weeks [51 lecture hrs]	
<b>Learning Resources :</b>			
<b>Text Books :</b>			
<b>Author</b>	<b>Title</b>	<b>Publisher</b>	
Jagman Singh	Art of earth moving		
Radichev	Tractors and automobile.		
Burge	Tractors and their power units		
Trucker	Earth moving plant		



### Mechatronics (Elective - I)

Name of the Course : <b>Diploma in Automobile Engineering</b>					
Course Code:	AE	Semester :	Fifth		
Duration:	17 Weeks	Maximum Marks :	125 Marks		
Teaching Scheme :	Examination Scheme : Theory				
Theory:	02 hrs / week	Internal Examination :	20 Marks		
Tutorial:	01hr / week	T.A. [Attendance & Interaction]:	10 Marks		
Practical:	Nil	End Semester Exam :	70 Marks		
Credit :	03				
<b>Aim:</b>					
<ul style="list-style-type: none"> <li>• To impart knowledge the process of integration of electronics engineering, electrical engineering, computer technology and control engineering with mechanical engineering.</li> <li>• Impart knowledge to diploma engineers to understand systems used in automation.</li> </ul>					
<b>Objectives:</b>					
Students will be able to :					
<ol style="list-style-type: none"> <li>1. Identify various input and output devices in an automated system.</li> <li>2. Understand and draw ladder diagrams.</li> <li>3. Write simple programs for PLCs.</li> <li>4. Interpret and use operations manual of a PLC manufacturer.</li> <li>5. Use simulation software provided with the PLC.</li> <li>6. Understand interfacing of input and output device.</li> </ol>					
<b>Pre-requisite :-</b>					
✓ Basic Knowledge of electronics engineering, electrical engineering & computer technology.					
<b>Examination Scheme:</b>					
Group	Chapter	Objective Questions			Total Marks
		To be Set	To be Answered	Marks per Question	
A	01 & 02	06	20	01	20 x 1 = 20
B	03 & 04	10			
C	05 & 06	04			
Group	Chapter	Subjective Questions			Total Marks
		To be Set	To be Answered	Marks per Question	
A	01 & 02	03	Any five	10	10 x 5 = 50
B	03 & 04	04			
C	05 & 06	02			
<b>Content [Theory] :</b>					
Chapter	Name of the Topic		Hours	Marks	
<b>01</b>	<b>Introduction to Sensors, Transducers and Actuators:</b> 1.1 Principle, working and applications of-Limit switches, proximity switches like inductive, capacitive and optical (deflecting and through beam type), Thumb wheel switches, magnetic reed		06		



	<p>switches, Optical encoders-displacement measurement, rotary, incremental, opto-couplers.</p> <p>1.2 Actuator – solenoids – on-off applications, latching, triggering.</p> <p>1.3 Types of relays- solid state</p> <p>1.4 Types of motors – DC motors, DC brushless motors, AC motors, stepper motors, servo motors.</p>		
<b>02</b>	<p><b>8085 Microprocessor:</b></p> <p>2.1 Architecture, Pin configuration, working of microprocessor, and applications.</p> <p>2.2 Introduction to ICs used for interfacing such as–Programmable peripheral devices, USART, memory, keyboard, display –LCD, LED, I/O device, ADC, DAC etc</p> <p>2.3 8051 Microcontroller</p> <p>2.4 Architecture, Pin configuration, working of microcontroller, Applications. Comparison of microprocessor and microcontroller, advantages and disadvantages</p>	08	
<b>03</b>	<p><b>Programmable Logic Controller (PLC):</b></p> <p>3.1 Introduction, PLC definition, PLC block diagram.</p> <p>3.2 Difference between relay panel and PLC, power supply, input / Output modules (analog, digital) concepts of sink/source, set/ reset, latch / unlatch.</p> <p>3.3 Advantages and disadvantages, installation, troubleshooting and Maintenance.</p>	08	
<b>04</b>	<p><b>Selection of a PLC Programming equipment, Programming Formats:</b></p> <p>4.1 Ladder diagrams and sequence listing, large process ladder diagram construction, flowcharting as a programming method.</p> <p>4.2 Basic PLC functions, Register basics, timer functions, counter functions, Intermediate functions – Arithmetic functions, number comparison and number conversion functions.</p> <p>4.3 Data handling functions- SKIP, Master control relay, Jump, Move, Block move, Table to register and register to table move functions. FIFO and LIFO functions, File Arithmetic and Logic function.</p>	16	
<b>05</b>	<p><b>ONS and CLR functions and their applications:</b></p> <p>5.1 PLC digital bit functions and applications.</p> <p>5.2 Sequencer functions and cascading of sequencers.</p> <p>5.3 PLC matrix functions.</p> <p>5.4 Discrete and analog operation of PLC, Networking of PLCs.</p> <p>5.5 PLC auxiliary commands and functions.</p>	06	
<b>06</b>	<p>6.1 Online, offline, stop/run modes of operations.</p> <p>6.2 Uploading/downloading between PLC and PC, Introduction to SCADA and DCS.</p>	04	
<b>Total</b>		<b>48 hrs.</b>	<b>70 Marks</b>
<b>Total Classes</b>		17 weeks [51 lecture hrs]	

<b>Term work :</b>		<b>Total Marks = 25</b>
<b>Examination Scheme:</b>		
<ul style="list-style-type: none"> <li>• <b>Continuous internal Sessional assessment of Term Work = 25 Marks.</b></li> <li>I. Submission of reports on assignment in time = 20 Marks.</li> <li>II. End semester viva-voce = 05 Marks.</li> <li>III. Total = 25 Marks.</li> </ul>		
<b>List of Assignments:</b>		
Term work shall consist of detailed report on the following experiments:		
1. Identification and demonstration of different sensors and actuators.		
2. Demonstration of the working of various digital to analog and analog to digital converters.		
3. Development of ladder diagram, programming using PLC for		
a) Measurement of speed of a motor		
b) Motor start and stop by using two different sensors		
c) Simulation of a pedestrian traffic controller		
d) Simulation of four road junction traffic controller		
e) Lift / elevator control		
f) Washing machine control		
g) Tank level control		
h) Soft drink vending machine control		
4. Trace, interpret and demonstrate working of at least two electro pneumatic systems.		
5. Trace, interpret and demonstrate working of at least two electro hydraulic systems.		
<b>Learning Resources :</b>		
<b>Text Books :</b>		
<b>Author</b>	<b>Title</b>	<b>Publisher</b>
Appuu Kuttan K.k	Introduction to Mechatronics	Oxford publishing House
Bolton W.	Mechatronics- Electronic control systems in Mechanical and Electrical Engineering	Pearson Education Ltd.
Histand B.H. and Alciatore D.G.	Introduction to Mechatronics and Measurement systems	Tata McGraw Hill Publishing
John W. Webb and Ronald Reis	Programmable Logic Controllers	Prentice Hall of India
NIIT	Programmable Logic Control – Principles and Applications	Prentice Hall of India
Kolk R.A. and Shetty D.	Mechatronics systems design	Vikas Publishing, New Delhi
Mahalik N.P.	Mechatronics principles, concepts and applications	Tata McGraw Hill Publishing

### VEHICLE AERODYNAMICS AND DESIGN (ELECTIVE-I)

Name of the Course : <b>Diploma in Automobile Engineering</b>					
Course Code:	AE	Semester :	Fifth		
Duration:	17 Weeks	Maximum Marks :	125 Marks		
Teaching Scheme :	Examination Scheme : Theory				
Theory:	02 hrs / week	Internal Examination :	20 Marks		
Tutorial:	01hr / week	T.A. [Attendance & Interaction] :	10 Marks		
Practical: Nil	End Semester Exam :		70 Marks		
Credit : 3					
<b>Aim:</b>					
<ul style="list-style-type: none"> <li>• To impart knowledge on aerodynamic shape in automobile in order to increase fuel efficiency and allowing driving high speed with minimum air drag.</li> <li>• To impart indepth knowledge involving vehicle stability &amp; vehicle dynamics.</li> <li>• To impart knowledge on how vehicles performance depends upon aerodynamics principles.</li> </ul>					
<b>Objectives:</b>					
Students will be able to :					
<ul style="list-style-type: none"> <li>➤ Understand concepts of aerodynamics.</li> <li>➤ Know the stability of vehicle on slope &amp; turns.</li> <li>➤ Calculate various forces &amp; moments acting on moving vehicles.</li> <li>➤ Get concepts of vehicle model testing in wind tunnel for estimating drag coefficients.</li> <li>➤ Estimate tractive effort required to propel the vehicle &amp; parameters which decide vehicle performance.</li> </ul>					
<b>Pre-requisite :-</b>					
✓ Knowledge of auto systems, auto chassis & transmission etc.					
<b>Examination Scheme:</b>					
Group	Chapter	Objective Questions			Total Marks
		To be Set	To be Answered	Marks per Question	
A	01 & 02	05	20	01	20 x 1 = 20
B	03	09			
C	04 & 05	06			
Group	Chapter	Subjective Questions			Total Marks
		To be Set	To be Answered	Marks per Question	
A	01 & 02	02	Any five	10	10 x 5 = 50
B	03	04			
C	04 & 05	03			
<b>Content [Theory] :</b>					
Chapter	Name of the Topic			Hours	Marks
<b>01</b>	<b>Aerodynamics:</b> 1.1 Introduction of aerodynamics: Historical Examples and future trends. 1.2 Classification & practical objectives of aerodynamics			<b>06</b>	

		1.3 Fundamental aerodynamic variables like Pressure, Density, Temperature, Flow velocity. 1.4 Aerodynamic forces & moments like Relative Wind, Free Stream, Lift, Drag. 1.5 Concept of airfoil and air dam.		
02	<b>Part I 2.1</b>	<b>Ergonomic consideration:</b> 2.1.1 Concept of Visibility 2.1.2 Concept of Blind spot 2.1.3 Driver seat design requirement 2.1.4 Passenger seat design requirement 2.1.5 Child seat design requirement 2.1.6 Aerodynamic properties	<b>04</b>	
	<b>Part II 2.2</b>	<b>Concepts in Aerodynamic:</b> 2.2.1 Lift & pitching. 2.2.2 Side forces & yaw moment. 2.2.3 Rolling moment.	<b>02</b>	
03	<b>Part I 3.1</b>	<b>Fundamentals of Aerodynamic Drag:</b> 3.1.1 Types of car bodies. 3.1.2 Flow field around the car -Air flow pattern, Pressure Distribution. 3.1.3 Local origins of flow field - Front end, windshield wiper, A-pillar, Roof, Rear end. 3.1.4 Water and dirt accumulation on the body -Safety, water flow, Dirt Deposits.	<b>08</b>	
	<b>Part II 3.2</b>	<b>Aerodynamic Drag testing &amp; its' Design features:</b> 3.2.1 Wind tunnels: 3.2.2 Concept (no analytical treatment) 3.2.3 Construction 3.2.4 Existing wind tunnels:- Large, Small full scale wind tunnel, Wind tunnel for scale model, Climatic tunnel, Climatic wind Chamber. 3.2.5 Wind noise: 3.2.6 Wind noise sources: - Leak noise, Cavity noise, Wind rush Noise. 3.2.7 Design features of A-pillar, Outside rear view mirror, Wind Shield wipers, Radio antenna, Roof racks, Doors.	<b>12</b>	
04		<b>Directional Stability:</b> 4.1 Concept of aerodynamic stability 4.2 Distribution of weight : i) In case of three wheeled vehicle. ii) In case of four wheeled vehicle 4.3 Driving with trailer 4.4 Stability of vehicle on slope (derivation & numerical problems). 4.5 Stability of vehicle on turns (derivation & numerical problems).	<b>08</b>	

<b>05</b>	<b>Vehicle Performance (numerical problems):</b> 5.1 Various resistances faced by vehicle (air, rolling & gradient). 5.2 Power required to propel the vehicle. 5.3 Maximum Drawbar pull. 5.4 Tractive efforts, Traction. 5.5 Relation between vehicle & engine speed. 5.6 Acceleration and gradeability.	<b>08</b>	
<b>Total</b>		<b>48 hrs.</b>	<b>70 Marks</b>
<b>Total Classes</b>		17 weeks [51 lecture hrs]	
<b>Term work :</b>		<b>Total Marks = 25</b>	
<b>Examination Scheme: Practical</b>			
<ul style="list-style-type: none"> <li>• <b>Continuous internal Sessional assessment = 25 Marks.</b></li> <li>I. Submission of reports on assignments in time = 20 Marks.</li> <li>II. End semester viva-voce / viva-voce = 05 Marks.</li> <li>III. Total = 25 Marks.</li> </ul>			
<b>List of Assignments:</b>			
<p>The following topics may be assigned to the students or the teacher concern may assign separate topic related to the subjects.</p> <ol style="list-style-type: none"> <li>1) Write a report on ergonomics of human body &amp; hence the design of driver's and passenger's seat.</li> <li>2) Comparison of visibility of different vehicles. Prepare a report.</li> <li>3) Procedure for measurement of various aerodynamic forces and moments.</li> <li>4) Write a report of wind tunnel and procedure for wind load distribution on various body structures.</li> <li>5) Case study of an accidental vehicle, which took place due to improper body rework / body building.</li> <li>6) Procedure of measurement of air drag in wind tunnel.</li> <li>7) Prepare aerodynamic shape with the help of Graphics Software.</li> <li>8) Simple sketches of modern passenger car, truck, bus etc with suitable design showing importance of Aerodynamics.</li> <li>9) Simple sketches of airflow patterns on various types of vehicle.</li> </ol>			
<b>Notes: Reports of the assignments should be of 5-6 pages.</b>			
<b>Learning Resources :</b>			
<b>Text Books :</b>			
<b>Author</b>	<b>Title</b>	<b>Publisher</b>	
John. D Anderson, Jr.	Fundamentals of aerodynamics	McGraw-Hill Books Company	
Wolf-Heinrich Hucho	Aerodynamics of road vehicles from fluid mechanics to vehicle	SAE International	
Butlerworths, by Wolf-Heinrich Hucho	Aerodynamics of road vehicles from fluid mechanics to vehicle	SAE International	
Richard stone, Jeffrey k. Ball	Automotive Eng. Fundamentals	SAE International	
John Fenton	Vehicle body layout and analysis	Hutchinson, London	
Joseph Heitner	Automotive mechanics		

William H. Crouze	Automotive mechanics	
Lanusz Powloski	Vehicle body engineering	Business books Ltd., London
N.K Giri	Problems in Automobile Engineering	Khanna publication

## Vehicle Testing (Elective - I)

<b>Name of the Course : Diploma in Automobile Engineering</b>					
<b>Course Code:</b>	AE	<b>Semester :</b>	Ffth		
<b>Duration:</b>	17 Weeks	<b>Maximum Marks :</b>	125 Marks		
<b>Teaching Scheme :</b>		<b>Examination Scheme : Theory</b>			
<b>Theory:</b>	02 hrs / week	<b>Internal Examination :</b>	20 Marks		
<b>Tutorial:</b>	01hr / week	<b>T.A. [Attendance &amp; Interaction]:</b>	10 Marks		
<b>Practical: Nil</b>		<b>End Semester Exam :</b>	70 Marks		
<b>Credit : 3</b>					
<b>Aim:</b>					
<ul style="list-style-type: none"> <li>• To ensure maximum performance and achieve quality standards.</li> <li>• To impart knowledge on the general test procedure for vehicle; its components and various quality standards.</li> <li>• To impart knowledge of various instruments and equipments needed for testing as well as their use and capabilities.</li> </ul>					
<b>Objectives:</b>					
Students will be able to :					
<ol style="list-style-type: none"> <li>1. Define and understand the terms efficiency, Vehicle performance, testing.</li> <li>2. Understand the meaning of vehicle testing and quality assurance.</li> <li>3. Classify vehicle testing as Component level and Vehicle level testing.</li> <li>4. Identify the various instruments and equipments required for testing and know their use and capabilities and analyze the parameters to be recorded.</li> <li>5. Use the proper instrument/equipment and measure the required quantity accurately.</li> <li>6. Use appropriate correlations to calculate efficiency, power, torque, fuel consumption etc.</li> <li>7. Get acquainted with standard test procedures and conduct the same.</li> <li>8. Evaluate and tabulate the test data in appropriate manner.</li> <li>9. Plot the performance Characteristics graphically and interpret the results.</li> </ol>					
Pre-requisite :-					
✓ Knowledge of automobile engine, auto systems & auto chassis.					
<b>Examination Scheme:</b>					
Group	Chapter	Objective Questions			Total Marks
		To be Set	To be Answered	Marks per Question	
A	01	05	20	01	20 x 1 = 20
B	02 & 03	09			
C	04 & 05	06			
Group	Chapter	Subjective Questions			Total Marks
		To be Set	To be Answered	Marks per Question	
A	01	02	Any five	10	10 x 5 = 50
B	02 & 03	04			

C	04 & 05	03			
<b>Content [Theory] :</b>					
<b>Chapter</b>	<b>Name of the Topic</b>			<b>Hours</b>	<b>Marks</b>
<b>01</b>	<b>Overview of Vehicle Testing:</b> 1.1 Need and importance of vehicle testing. 1.2 Classification, Accuracy, Test data. 1.3 Basis of tests- driving cycles, Homologation. 1.4 Requirements of test :- I. Test equipments. II. Procedure. III. Quality Personnel. 1.5 Testing instruments and equipments- Use, capabilities and Parameters of the following equipments to be recorded.... I. Engine dynamometer. II. Compression tester. III. Stroboscope. IV. Computerized engine analyzer. V. Petrol/Diesel engine scanner. VI. Infrared exhaust gas analyzer. VII. Diesel smoke meter. VIII. Vacuum tester. IX. Chassis dynamometer. 1.6 Testing Standards:- I. SAE standards, II. ASMT standards; III. ARAI standards. IV. CMVI regulations. 1.7 Significance of test. 1.8 Production part approval process.			<b>14</b>	
<b>02</b>	<b>Laboratory Testing of Vehicle Subsystems:</b> 2.1 Engine Performance parameters testing:- a) Power. b) Torque. c) Efficiency. d) Fuel consumption. e) Dry and wet compression test. f) Charging system test. g) Regulated voltage test. h) Starter motor voltage drop test. i) Ignition system oscilloscope test. 2.2 Cooling system tests:- a) Leakage test. b) Pressure test. c) Vacuum test of pressure cap. d) Corrosion test- Hot spots and cold spots. 2.3 Fuel Injection pump tests: – a) Pressure test.			<b>07</b>	



		<ul style="list-style-type: none"> <li>b) Injector testing.</li> <li>c) Spray pattern tests.</li> <li>d) Leakage tests.</li> <li>e) Calibration and Phasing.</li> </ul> <p>2.4 Engine emission testing as per Indian driving cycles.</p> <p>2.5 Lubricating oil pump pressure test.</p>		
<b>03</b>	<b>Part I 3.1</b>	<p><b>Vehicle comfort testing:</b></p> <ul style="list-style-type: none"> <li>a) Vehicle ride and handling parameters</li> <li>b) Effect of change in steering geometry,</li> <li>c) Change in suspension and handling characteristics</li> <li>d) Definitions of – Ride and comfort, Roll, Lurch, Tramp, Yaw, pitching, bouncing, Steady-state cornering,</li> <li>e) Steering characteristics.</li> </ul>	<b>07</b>	
	<b>Part II 3.2</b>	<p><b>Tyre Testing:-</b></p> <ul style="list-style-type: none"> <li>a) Tyre wears patterns, its identification and causes.</li> <li>b) Endurance test.</li> <li>c) Strength test.</li> <li>d) High speed performance test.</li> <li>e) Tubeless tyre resistance to bead unseating.</li> </ul>	<b>04</b>	
<b>04</b>		<p><b>Testing of Vehicles on road:-</b></p> <p>4.1 Introduction of sampling technique.</p> <p>4.2 Vehicle level performance parameters:-</p> <ol style="list-style-type: none"> <li>1. Acceleration.</li> <li>2. Driveability.</li> <li>3. Gradeability</li> <li>4. Restartability</li> <li>5. Brakes testing</li> <li>6. Steering effort Testing</li> <li>7. Speedometer and odometer testing.</li> </ol> <p>4.3 Accelerated endurance testing procedures:-</p> <ol style="list-style-type: none"> <li>I. Torture tracks (e.g. Belgian Pave, Corrugated, Long wave pitching, Pot hole, Sand patch, Mud patch, steering pad, High speed, Serpentine courses, Gradient, Shallow water trough, Deep wading trough, Cross Country, Step Climbing).</li> <li>II. Draw bar or winch pull test.</li> </ol>	<b>08</b>	
<b>05</b>		<p><b>Impact Testing:</b></p> <p>5.1. Noise, Vibration and Harshness (NVH) testing.</p> <p>5.2. Types of NVH:-</p> <ul style="list-style-type: none"> <li>a) Pass by noise.</li> <li>b) In cab noise.</li> <li>c) Floor vibrations.</li> </ul> <p>5.3 Moving barrier collision test:-</p> <ol style="list-style-type: none"> <li>1. Frontal impact.</li> <li>2. Rear impact.</li> <li>3. Side impact.</li> <li>4. Roof crash.</li> </ol> <p>5.4 Barrier Collision test with vehicle acceleration and occupant loading.</p>	<b>08</b>	

	5.5 Roll over test without collision. 5.6 Inverted vehicle drop test.		
<b>Total</b>		<b>48 hrs.</b>	<b>70 Marks</b>
<b>Total Classes</b>		17 weeks [51 lecture hrs]	
<b>Term work :</b>		<b>Total Marks = 25</b>	
<b>Examination Scheme: Practical</b>			
<ul style="list-style-type: none"> <li>• <b>Continuous internal Sessional assessment of Term Work = 25 Marks.</b></li> <li>I. Submission of reports on assignment in time = 20 Marks.</li> <li>II. End semester viva-voce = 05 Marks.</li> <li>III. Total = 25 Marks.</li> </ul>			
<b>List of Assignments:</b>			
<ol style="list-style-type: none"> <li>1. Write a report on use of any three test instruments and three equipments.</li> <li>2. Write a report on NVH testing.</li> <li>3. Write a report on testing procedures of any three engine performance parameters.</li> <li>4. Write a report on exhausts emission of petrol/ diesel vehicle.</li> <li>5. Prepare a report based on industrial visit to test tracks of any organization like Hindustan Motor, TATA Motors, Two wheeler industries etc.</li> </ol>			
<b>Learning Resources :</b>			
<b>Text Books :</b>			
<b>Author</b>	<b>Title</b>	<b>Publisher</b>	
R.B. Gupta	Automobile Engineering	Satya Prakashan	
SAE International Handbook	---	SAE Publication	
W.H. Crouse, D.L. Anglin	Automotive Mechanics	Tata Mc Graw Hill	
Anil Chikkara	Automobile Engineering, Vol. III	Satya Prakashan	
M. L. Mathur, R.P. Sharma	Internal Combustion Engines	Dhanpat Rai & Sons	
N. K. Giri	Automobile Mechanics	Khanna Publication.	
Ken Layne	Automotive Engine Performance	Prentice Hall career Technology	
Don Knowles	Automobile Mechanics: Understanding New Techniques	Prentice Hall career Technology	

## Environmental Pollution & Control (Elective - I)

Name of the Course : <b>Diploma in Automobile Engineering</b>					
Course Code:	AE	Semester :	Fifth		
Duration:	17 Weeks	Maximum Marks :	125 Marks		
Teaching Scheme :		Examination Scheme : Theory			
Theory:	02 hrs / week	Internal Examination :	20 Marks		
Tutorial:	01hr / week	T.A. [Attendance & Interaction]:	10 Marks		
Practical:	Nil	End Semester Exam :	70 Marks		
Credit :	3				
<b>Aim:</b>					
<ul style="list-style-type: none"> <li>• To impart knowledge of various pollutants, their effects, sampling and analyzing control techniques.</li> <li>• To impart knowledge of emission pollution control and requirements and operation of pollution control system for clean environment.</li> </ul>					
<b>Objectives:</b>					
Students will be able to :					
<ol style="list-style-type: none"> <li>1. Know the global importance of clean environment.</li> <li>2. Classify the pollutants</li> <li>3. Know the sources of pollutants.</li> <li>4. Understand effect of pollutants on environment &amp; economy.</li> <li>5. Know about environment &amp; control acts &amp; ISO 14000 standards.</li> <li>6. Operate pollution control devices.</li> <li>7. Measure level of pollutants with the help of experimental investigation</li> </ol>					
<b>Pre-requisite :-</b>					
✓ Knowledge of automobile engine, auto systems & auto chassis.					
<b>Examination Scheme:</b>					
Group	Chapter	Objective Questions			Total Marks
		To be Set	To be Answered	Marks per Question	
A	01& 02	05	20	01	20 x 1 = 20
B	03 & 04	09			
C	05	06			
Group	Chapter	Subjective Questions			Total Marks
		To be Set	To be Answered	Marks per Question	
A	01& 02	05	Any five	10	10 x 5 = 50
B	03 & 04	02			
C	05	02			
<b>Content [Theory] :</b>					
Chapter	Name of the Topic			Hours	Marks
<b>01</b>	<b>Introduction:</b> 1.1 Environment: Introduction, concept of hydrosphere, Lithosphere,			<b>09</b>	

		<p>atmosphere and biosphere and their Interrelationships.</p> <p>1.2 Ecosystem: Concept, biotic and abiotic components of Ecosystem, biological pyramids, fresh water ecosystem and estuarine ecosystem, forest ecosystem, tropical rain forests, grassland ecosystem, temperate deciduous forest ecosystem.</p> <p>1.3 Biodiversity: introduction, levels of biodiversity, Importance of biodiversity, value of biodiversity, causes of biodiversity loss, conservation strategies for biodiversity.</p> <p>1.4 Classification of pollution &amp; pollutants.</p> <p>1.5 Environment &amp; pollution control acts:</p> <p>1.6 ISO 14000 standards.</p> <p>1.7 Kyoto treaty / protocol, carbon units.</p>		
<b>02</b>	<b>Part I 2.1</b>	<p><b>Air Pollution:</b></p> <p>2.1 Sources &amp; classification of air pollution.</p> <p>2.2 Effects of air pollution on human health.</p> <p>2.3 Effects of air pollution on economy.</p> <p>2.4 Photochemical air pollution.</p> <p>2.5 Air pollution from major Industrial operations e.g. Fertilizer industries aluminum manufacturing plants, Cement industries, paper industries, Thermal Power Plant, Sponge Iron industries etc.</p>	<b>09</b>	
	<b>Part II 2.2</b>	<p><b>Air pollution due to Automobiles design and operating parameters and methods of control:</b></p> <p>2.2.1 Pollution due to S. I. Engines. Design &amp; operating parameters responsible for emission</p> <p>2.2.2 Pollution due to C. I. Engines. Design &amp; operating parameters responsible for emission.</p> <p>2.2.3 Methods of pollution control like E.G.R., Turbocharger, Catalytic converter, CRDI, Canister, P.C.V. system etc.</p> <p>2.2.4 Air quality &amp; emission standards of India &amp; Europe.</p> <p>2.2.5 Air pollution in Indian metro cities- Kolkata, Delhi &amp; Mumbai.</p>	<b>10</b>	
<b>03</b>		<p><b>Water Pollution:</b></p> <p>3.1 Sources of water pollution.</p> <p>3.2 Effects of water pollution.</p> <p>3.3 Water pollution analysis.</p> <p>3.3.1 Physical examination of water.</p> <p>3.3.2 Chemical characteristics of water.</p> <p>3.3.3 Biological investigation of water.</p> <p>3.4 Definitions of Important terms used in water pollution Dissolved O<sub>2</sub>. Chemical O<sub>2</sub> demand, Biological O<sub>2</sub> demand, Theoretical O<sub>2</sub> demand, Total solids, Total suspended solids, Total dissolved solids, Turbidity, Alkalinity, Acidity.</p>	<b>06</b>	

	3.5 Water quality standards. 3.6 Steps in Water treatment. 3.7 Sampling & analysis of water pollution.		
<b>04</b>	<b>Noise Pollution:</b> 4.1 Definition of noise 4.2 Sources of noise 4.3 Types of noise - Impulsive & sonic noise 4.4 Effects of noise on health 4.5 Noise measurement: Acceptable noise levels at various locations like residential buildings, schools, banks, libraries, factories, light and heavy vehicles, etc. Ambient noise standards in day and night time noise pollution levels and it's harmful effects. 4.6 Noise mapping.	<b>05</b>	
<b>05</b>	<b>Other Types Of Pollution:</b> 5.1 Solid waste: 5.1.1 Classification of solids. 5.1.2 Solid waste management. 5.1.3 Method of solid waste disposal. 5.1.4 Reuse, Recycling & recovery of materials from refuse. 5.2 Soil pollution: 5.2.1 Chemistry of soil. 5.2.2 Soil irrigation by effluents. 5.2.3 Agricultural pollution. 5.3 Radiation pollution: 5.3.1 Sources & effects of radiation. 5.3.2 Radiation exposure standards. 5.3.3 Radiation protection. 5.3.4 Treatment & disposal of radiation waste. 5.4 Global pollution: 5.4.1 Green house effect. 5.4.2 Acid rain. 5.4.3 Ozone depletion problem.	<b>09</b>	
<b>Total</b>		<b>48 hrs.</b>	<b>70 Marks</b>
<b>Total Classes</b>		17 weeks [51 lecture hrs]	
<b>Term work :</b>	<b>Total Marks = 25</b>		
<b>Examination Scheme:</b>	<ul style="list-style-type: none"> <li>• <b>Continuous internal Sessional assessment = 25 Marks.</b></li> </ul> <p>I. Submission of reports on assignment in time = 20 Marks.</p>		

II. End semester viva-voce / viva-voce = 05 Marks.

III. Total = 25 Marks.

**List of Assignments:**

1. Write a report on how to measure CO, HC from the S.I. engine exhausts using gas analyzer.
2. Write a report on how to measure particulate matter, from C.I. engine exhaust using smoke meter.
3. Write a report on the tolerable limit of SPM, NO<sub>x</sub>, SO<sub>x</sub> in ambient air & how it is measured.
4. Write a report on the tolerable limit of turbidity, chlorides & sulphates of usable water.
5. Write a report on the tolerable limit of solids, total suspended solids, total dissolved solids in drinking water.
6. Write a report on how acidity / alkalinity of a given water sample is measured.
7. Write a report on how actual recycling & recovery of materials is done from refuse. e.g. Plastics, Glass, Paper Agricultural waste etc.
8. Prepare a report on: probable Air pollution due to automobiles at different places in your city/town. & suggest methods & steps to reduce it.
9. Prepare a report : on noise level in your city/town at different places like Bus stand, Railway station, Air port, Hospitals, Schools, Traffic jam conditions etc.

**Learning Resources :**

**Text Books :**

Author	Title	Publisher
William H. Course & Donald L. Anglin	Automotive Mechanics	Tata McGraw Hill
M.N. Rao & H.V.N. Rao	Air pollution	Tata McGraw Hill
K.K. Ramlingam	Internal Combustion Engines	Scitech
P. Meenakshi	Elements of Environment Science & Engineering	Prentice-Hall
S.Deswal & A. Deswal	A basic course in environmental studies	Dhanpat Rai and Sons.
G.S. Bilgi	Water Supply and Sanitary Engineering	Dhanpat Rai and Sons

## Automotive Electricals & Electronics

<b>Name of the Course : Diploma in Automobile Engineering</b>			
Course Code: AE	Semester :		Fifth
Duration: 17 Weeks	Maximum Marks :		150 Marks
Teaching Scheme :		Examination Scheme : Theory	
Theory: 3 hrs / week	Internal Examination :		20 Marks
Tutorial: Nil	T.A [Attendance, Assignment & Interaction] :		10 Marks
Practical: 2 hrs / week	End Semester Exam :		70 Marks
Credit : 4			
<b>Aims :</b>			
<ul style="list-style-type: none"> <li>• To impart knowledge of construction &amp; working of electrical and electronic circuits.</li> <li>• To impart knowledge of microprocessor in modern vehicles.</li> </ul>			
<b>Objectives:</b>			
Students will be able to:			
<ol style="list-style-type: none"> <li>1. Diagnose and repair the defects in the circuits, to protect circuits &amp; understand working of electromagnetic gauges as well as electrical accessories.</li> <li>2. Understand the purpose, construction, rating, testing of battery &amp; major reasons of battery failure.</li> <li>3. Identify components, operation and testing of starting as well as charging system.</li> <li>4. Understand the basic need, components, and operations of ignition system as well as trouble shooting of the ignition system.</li> <li>5. Understand lighting system &amp; accessories.</li> <li>6. Troubleshoot various complaints in electrical &amp; electronics system.</li> </ol>			
<b>Pre-requisite:-</b> Fundamental knowledge of Electrical & Electronics theories and applications.			
<b>Content [Theory] :</b>			
Chapter	Name of the Topic	Hours	Marks
01	<b>Electrical &amp; Electronic Components :</b> 1.1 Purpose and operation of electrical components like Switches, relays, solenoids, buzzers, and resistors. 1.2 Purpose of circuit protection devices like fuses, maxi fuses, circuit breakers (Manual and automatic resetting types.) and fusible links 1.3 Testing of circuit defects like open circuit, shorts, shorts to grounds, voltage drop. 1.4 Working of Electromagnetic gauges like temp Gauges, fuel gauge, engine oil pressure gauge, Speedo-meter gauge. 1.5 Features of scan tester. 1.6 Working of electrical accessories like wind shield wiper, washer pumps, blower motor, electro chromic mirror, power window, power seat, power door lock.	<b>10</b>	--

02	<p><b>Battery:</b></p> <p>2.1 Lead acid battery – construction &amp; operation.</p> <p>2.2 Concept of Low maintenance, maintenance free &amp; Hybrid Battery.</p> <p>2.3 Battery – voltage, battery ratings and battery specifications.</p> <p>2.4 Battery testing – Battery terminal test, Leakage test, Specific Gravity Test, Open circuit voltage test, High discharge test &amp; Capacity test.</p> <p>2.5 Battery charging – Initial charging procedure, dry charged battery- precautions. Slow and fast rate charging and trickle charging.</p> <p>2.6 Battery maintenance and safety precautions.</p> <p>2.7 Concept of Jump starting, it's procedure &amp; precaution.</p> <p>2.8 Alkaline Batteries- construction, working principle of Nickel-Iron Battery, Nickel-cadmium battery and Silver-Zinc battery.</p> <p>2.9 Comparison between Alkaline &amp; Lead-Acid battery.</p> <p>2.10 Factors affecting battery life.</p> <p>2.11 Battery failures–cycle failure ,internal short circuit, overcharging, local action and sulphation.</p>	08		
03	<p><b>Part I</b></p> <p>3.1</p>	<p><b>Starting System:</b></p> <p>3.1.1 Purpose, construction and working of starting system.</p> <p>3.1.2 Starting motor torque and power requirement.</p> <p>3.1.3 Types of starting motor drive (Bendix and overrunning clutch types only) - construction and working.</p> <p>3.1.4 Testing of starting system – Cranking voltage test, Voltage drop test, Current draw test, starting motor bench test, &amp; no-load test.</p> <p>3.1.5 Starting Motor troubleshooting.</p>	05	
	<p><b>Part II</b></p> <p>3.2</p>	<p><b>Charging System:</b></p> <p>3.2.1 Purpose of charging system.</p> <p>3.2.2 Operation of charge indicator light circuit.</p> <p>3.2.2 General construction &amp; operation of Automotive alternator.</p> <p>3.2.3 Initial excitation and self excitation.</p> <p>3.2.4 Alternator testing – Current out put test, Field current draw test. Regulator output test</p> <p>3.2.5 Cut out Relay.</p> <p>3.2.6 Regulation- Voltage and current regulation. Regulator for Alternators.</p> <p>3.2.7 Advantage and disadvantages of dynamo and Alternator drives</p> <p>3.2.8 Charging system troubleshooting.</p>	06	
04	<p><b>Ignition Systems:</b></p> <p>4.1 Purpose of ignition system.</p> <p>4.2 Classification of ignition systems - Contact point Ignition System &amp; Electronic ignition system.</p> <p>4.3 Contact point Ignition system (Battery Ignition and Magneto ignition).</p> <p>4.3 Magneto ignition system- construction and working of CDI system.</p> <p>4.4 Elements and construction of battery oil ignition system:-</p>	08		



	<p>Ignition coil types, Distributor, spark plug, cords, and Condenser, Cam angle &amp; Ignition timing.</p> <p>4.5 Ignition advance &amp; retard timing mechanism-construction and working.</p> <p>4.6 Comparison between Battery and Magneto Ignition System.</p> <p>4.7 Electronic (or solid state) ignition system with distributor circuit diagram and working.</p> <p>4.8 Electronic Spark Control, Electronic Spark advance. Comparison with conventional system.</p> <p>4.9 Distributor less/ computer controlled coil ignition system operation.</p> <p>4.10 Sensors and Ignition Control Module for triggering and timing of spark.</p> <p>4.11 Ignition System Troubleshooting.</p>		
05	<p><b>Lighting system &amp; Advanced lighting accessories – fundamentals:</b></p> <p>5.1 Various lighting circuits.</p> <p>5.2 Vertical and Slide control of lights.</p> <p>5.3 Fog light, Slide light, Brake light, indicator lights, and instrument light, reverse light, parking light, Trailer lighting, Florescent lighting, Interior lighting.</p> <p>5.1 Operation of automatic headlight dimming.</p> <p>5.2 Operation of automatic on/off headlight with time delay.</p> <p>5.3 Wiring diagram of vehicle.</p> <p>5.4 Faults and rectification of wiring system.</p> <p>5.5 Use and working of fiber optics.</p> <p>5.6 Operation of keyless entry.</p> <p>5.7 Operation of common anti-theft system.</p> <p>5.8 Purpose &amp; operation of automatic door lock system</p>	06	
06	<p><b>Diagnosis of electronic components &amp; Systems:</b></p> <p>6.1 Sensor testing:- Oxygen sensor, Engine coolant sensor, Intake air temp. Sensor, Throttle position sensor, Manifold absolute pressure sensor.</p> <p>6.2 Function of Electronic Control Module.</p> <p>6.3 Electronic fuel Injector testing:- only sound test, Ohmmeter test.</p> <p>6.4 Onboard diagnosis (OBD):-</p> <p>6.4.1 Purpose of (onboard diagnostic second generation) OBD II, flash codes of Malfunction indicator light.</p> <p>6.4.2 OBD II terminology:- Drive cycle, Trip, Warm up cycle (Definitions only).</p> <p>6.3.3 SAE J2012 standards Diagnostic Trouble Code (DTC):- 5 (five) digits only.</p> <p>6.4 Troubles of electronic gauges like.</p> <p>6.4.1 Gauge reads low constantly.</p> <p>6.4.2 Gauge reads high constantly.</p> <p>6.4.3 Inaccurate Gauge reading.</p>	05	
<b>Total</b>		<b>48 hrs</b>	<b>70 Marks</b>

<b>Total Classes</b>	17 weeks [51 lecture hrs]
<b>Practical :</b>	
<b>Skills to be developed</b>	
<b>Intellectual Skills:</b>	
<ul style="list-style-type: none"> <li>• Understand various test procedures for battery as specified by manufacturer.</li> <li>• Understand the precautions while handling a battery.</li> <li>• Identify the alternator components, starter motor components and understand test procedure of some of the components.</li> <li>• Understand principle of stroboscope operation and concept of ignition timing adjustment.</li> <li>• Understand the test and service procedure for spark plug, distributor and spark plug cords.</li> <li>• Identify and locate sensors and to understand diagnostic procedures (on-board and stand alone diagnosis).</li> </ul>	
<b>Motor Skills:</b>	
Students will be able to:	
<ul style="list-style-type: none"> <li>✓ Take specific gravity reading using hydrometer, to correct it using temperature correction factor.</li> <li>✓ Perform alternator tests as specified by manufacturer.</li> <li>✓ Perform alternator component tests as specified by manufacturer.</li> <li>✓ Measure parameters such as current, voltage drop using multimeter.</li> </ul>	
<b>Examination Scheme : Practical</b>	<b>Maximum Marks : 50</b>
<ul style="list-style-type: none"> <li>• <b>Continuous Internal Assessment:</b> - 25 marks.</li> </ul> <p>I) Attending classes, doing practicals &amp; submitting respective note book in time = 20 marks.  II) End sem. viva-voce = 05 marks  III) Total (I + II) = 25 Marks.</p> <ul style="list-style-type: none"> <li>• <b>External Assessment:</b> - 25 marks.</li> </ul> <p><b>Examination : External Lecturer.</b></p>	
<b>List of Practicals:</b>	<b>Total Periods: 32 hrs.</b>
<b>Contents:</b>	
<ol style="list-style-type: none"> <li>1. Study, testing (Specific gravity of electrolyte, High rate discharge test of battery &amp; Load test of battery) and sketching of constructional details and working principle of battery.</li> <li>2. Study, testing and sketching of various components and the functions of coil ignition systems.</li> <li>3. Inspection of spark plug cords, Servicing of spark plugs and distributor.</li> <li>4. Study, testing and sketching of starting system and the constructional details of self starter.</li> <li>5. Starter Motor –component identification, starter current draw test and voltage drop test.</li> <li>6. Alternator-component identification and output test, Regulated Voltage Output Test, charging circuit resistance test. Electrical testing of rotor and stator of alternator.</li> <li>7. Study, testing and sketching of charging system and the constructional of dynamo.</li> <li>8. Adjustment of ignition timing of a multi cylinder engine with strobe (neon light).</li> <li>9. Testing dipper switch, flasher unit and indicator circuits and fault tracing.</li> <li>10. Study, testing and sketching of different types of horn and relay.</li> <li>11. Study, testing &amp; sketching of various components and their function of Electronic Ignition system.</li> <li>12. Location and identification of sensors. Stand alone diagnosis.</li> <li>13. Practice / testing of head light beam setting by Head light meter.</li> </ol>	

14. Study, testing and sketching of complete wiring circuit of four-wheeler vehicle & two wheeler.

**Assignment** - On Board Diagnosis.

**Demonstration:** Trainer kits as well as charts of electronic circuits may be used for demonstration.

**Notes:**

- ✓ Each testing, study etc. will be done by a small group of batch.
- ✓ Nos. of simultaneous testing, study etc. will be done at a time.

**Examination Scheme: Theory**

Group	Chapter	Objective Questions			Total Marks
		To be Set	To be Answered	Marks per Question	
A	01 & 02	06	Any twenty	01	20 x 1 = 20
B	03 & 04	09			
C	05 & 06	05			

Group	Chapter	Subjective Questions			Total Marks
		To be Set	To be Answered	Marks per Question	
A	01 & 02	03	Any five	10	10 x 5 = 50
B	03 & 04	04			
C	05 & 06	02			

**Learning Resources :**

**Text Books :**

Author	Title	Publisher
P.L. Kohli	Automotive Electrical	(Tata-McGraw-Hill)
Crouse & Anglin	Automotive Mechanics	(Tata-McGraw-Hill)
Kirpal Singh	Automobile Engineering Vol-1&2	
Barry Hollenbeck	Automotive Electricity, Electronics & Computer Controls	Delmar Publishers
Jack Erjavec, Robert Scharff	Automotive Technology: A System Approach	Delmar Publisher Inc
Trevor Mellard	Automotive electronic systems	ELBS
Ken Pickerill	Today's Technician: Automotive Engine Performance Classroom and Shop Manuals	ASE (NATEF)

## Strength of Material and Hydraulic & Pneumatic Laboratory

<b>Name of the Course: Diploma in Automobile Engineering</b>	
Course Code: AE	Semester: Fifth
Duration: 17weeks	Maximum Marks: 75 [Practical]
Teaching Scheme :	Examination Scheme : [Practical]
Theory: hrs./week	Internal Practical Examination : 45 Marks
Tutorial: hrs./week	End Semester External Exam.: 30 Marks
Practical: 4 hrs./week	End Semester Exam. [Theory]: Nil
Credit: 2	
<b>Practical :</b>	
<b>Skills to be developed :</b>	
<b>Intellectual Skills:</b>	
<ul style="list-style-type: none"> <li>• Identify different stresses in machine parts.</li> <li>• Calculate the shear force &amp; bending moment.</li> <li>• Understand the basic principles of Hydraulics and their applications.</li> <li>• Measure discharge, pressure head and velocity of flow.</li> <li>• Understand the working of hydraulic &amp; pneumatic system.</li> <li>• Co-relate the performance hydraulic &amp; pneumatic system.</li> </ul>	
<b>Motor Skills:</b>	
<ul style="list-style-type: none"> <li>➤ Use of instruments and equipments.</li> <li>➤ Observe &amp; compare behaviour of different materials during test.</li> <li>➤ Draw shear force &amp; bending moment diagram for different types of loading on beams.</li> <li>➤ Assemble &amp; dismantle centrifugal &amp; gear pump.</li> <li>➤ Use &amp; operate pressure gauge, venturi- meter, stopwatch &amp; orifice meter.</li> </ul>	
<b>Examination Scheme : Practical</b>	
<b>Total Periods : 68 Hrs.</b>	
<ul style="list-style-type: none"> <li>• <b>Continuous Internal Sessional Assessment:- 45 marks</b> [Gr. A : Gr.B = 1 : 2]</li> </ul> <p>I) Attending classes, doing practical &amp; submitting respective practical report in time = 35 marks.            II) Viva-Voce = 10 marks            III) Total (I + II) = 45 Marks.</p> <ul style="list-style-type: none"> <li>• <b>External Sessional Assessment:- 30 marks.</b> [Gr. A : Gr.B = 1 : 2]</li> </ul> <p style="text-align: center;"><b>Examination : External Lecturer</b></p> <p><b>Total Marks : 75</b> [Gr. A = 25 marks &amp; Gr.B = 50 marks]</p>	
<b>Practical : Group A [ Strength of Material]</b>	
<b>Total Marks : 25</b>	
<b>List of Laboratory Experiments:</b>	
<b>Sl. No.</b>	<b>Name of the Experiments</b>
01	Tensile test on mild steel and aluminum specimen by using Universal Testing Machine (UTM) to calculate yield stress, ultimate stress, breaking stress, percentage elongation and Modulus of Elasticity.
02	Understand different components, their purpose and operations of Extensometer by conducting a trial on sample test specimen.
03	Compression test on cast iron specimen by using "Universal Testing Machine".
04	Determination of hardness of metal by Brinell and Rockwell Testing Machines.
05	Izod or Charpy test on M.S. and aluminum specimen to calculate energy absorbed.
06	Conduct torsion test on mild steel bar and find breaking torsional shear strength and stiffness.
07	Determination of Strength and Stiffness of Springs.

08	To determine principal stresses and to locate principal planes for a given loading by analytical and graphical (Mohr's circle) methods.	
<b>Practical : Group B [Hydraulic &amp; Pneumatic]</b>		
		<b>Total Marks : 50</b>
<b>List of Laboratory Experiments:</b>		
<b>Sl. No.</b>	<b>Name of the Experiments</b>	
01	Study of Bourdon tube pressure gauge.	
02	Experimental determination of Coefficient of Discharge of Venturimeter & Orificemeter.	
03	Experimental Verification of Bernoulli's Theorem.	
04	Loss of head due to friction in flow through pipes.	
05	Dismantling and assembly of centrifugal pump and gear pump used in automobile.	
06	Trial on reciprocating pump to determine efficiency.	
07	Symptoms, faults, causes and remedies in general hydraulic components and circuits.	
08	Construct any two simple pneumatic circuits using trainer kit observe the working of those circuits.	
<b>Learning Resources:</b>		
<b>Books:</b>		
<b>Author</b>	<b>Name of Book</b>	<b>Publication</b>
Pippengen & Hicks	Industrial Hydraulics	Tata McGraw Hill Int.
S. R. Mujumdar	Pneumatics Systems – Principle and Maintenance	Tata McGraw Hill Co.
	Vicker's Industrial Hydraulic Manual	Vicker's system international Ltd. Pimpri, Pune – 411018
S. Ramamrutham & R. Narayanan	Strength of Material	Dhanpat Rai & Publication

**PROJECT AND ENTREPRENEURSHIP DEVELOPMENT**

<b>Name of the Course : Diploma in Automobile Engineering</b>		
Course Code: AE	Semester :	Fifth
Duration: 17 Weeks	Maximum Marks :	50 Marks
Teaching Scheme :	Examination Scheme :	Practical
Theory: 01hr. / week	Internal Examination :	Nil
Tutorial: Nil	Attendance, Assignment & Interaction :	Nil
Practical: 02hrs / week	End Semester Exam :	Nil
Credit : 2		
<b>Aims :</b>		
<ul style="list-style-type: none"> <li>• To inculcate the entrepreneurial values during their educational tenure.</li> <li>• To impart awareness and interest in entrepreneurship and create employment for others. .</li> <li>• To change attitude and take the challenging growth oriented tasks instead of waiting for white- collar jobs.</li> <li>• To develop attitude to explore the emerging opportunities.</li> </ul>		
<b>Objectives:</b>		
Students will be able to:		
<ol style="list-style-type: none"> <li>1. Identify entrepreneurship opportunity.</li> <li>2. Acquire entrepreneurial values and attitude.</li> <li>3. Develop awareness about enterprise management.</li> <li>4. Use the information to prepare project report for business venture.</li> </ol>		
<b>Practicals :</b>		
		Total Marks = 50
I. Part – A [Entrepreneurship Development] = 25		
II. Part – B [Project & project report with feasibility study ] = 25		
<b>PART-A :</b>	<b>Entrepreneurship Development</b>	<b>Total Marks = 25</b>
<b>Content [Theory] :</b>		
<b>Chapter</b>	<b>Name of the Topics</b>	<b>Hours</b>
01	<b>Entrepreneurship, Creativity &amp; Opportunities:</b> 1.1) Concept, Classification & Characteristics of Entrepreneur. 1.2) Creativity and Risk taking. 1.2.1) Concept of Creativity & Qualities of Creative person. 1.2.2) Risk Situation, Types of risk & risk takers. 1.3) Business Reforms. 1.3.1) Process of Liberalization. 1.3.2) Reform Policies. 1.3.3) Impact of Liberalization. 1.3.4) Emerging high growth areas. 1.4) Business Idea Methods and techniques to generate business idea. 1.5) Transforming Ideas in to opportunities transformation involves Assessment of idea & Feasibility of opportunity. 1.6) SWOT Analysis	03

02	<p><b>Information and Support Systems:</b></p> <p>2.1) Information Needed and Their Sources. Information related to project, Information related to support system, Information related to procedures and formalities.</p> <p><b>2.2) Support Systems</b></p> <p>1) Small Scale Business Planning, Requirements. 2) Govt. &amp; Institutional Agencies, Formalities 3) Statutory Requirements and Agencies.</p>	
03	<p><b>Market Assessment:</b></p> <p>3.1) Marketing -Concept and Importance 3.2) Market Identification, Survey Key components 3.3) Market Assessment</p>	02
04	<p><b>Business Finance &amp; Accounts:</b></p> <p><b>Business Finance</b></p> <p>4.1) Cost of Project</p> <p>1) Sources of Finance 2) Assessment of working capital 3) Product costing 4) Profitability 5) Break Even Analysis 6) Financial Ratios and Significance</p> <p><b>Business Account</b></p> <p>4.2) Accounting Principles, Methodology</p> <p>1) Book Keeping 2) Financial Statements 3) Concept of Audit</p>	03
05	<p><b>Business Plan &amp; Project Report:</b></p> <p>5.1) Business plan steps involved from concept to commissioning, Activity Recourses, Time, Cost.</p> <p><b>5.2) Project Report</b></p> <p>1) Meaning and Importance 2) Components of project report/profile (Give list)</p> <p><b>5.3) Project Appraisal</b></p> <p>1) Meaning and definition 2) Technical, Economic feasibility 3) Cost benefits Analysis.</p>	03
06	<p><b>Enterprise Management And Modern Trends:</b></p> <p>6.1) <b>Enterprise Management:</b> -</p> <p>1) Essential roles of Entrepreneur in managing enterprise 2) Product Cycle: Concept And Importance 3) Probable Causes Of Sickness 4) Quality Assurance 5) Importance of Quality, Importance of testing</p> <p>6.2) E-Commerce Concept and process</p> <p>6.3) Global Entrepreneur</p>	02
<b>Total Periods</b>		<b>16 Hrs.</b>

<b>PART -B : (Practical)</b>	<b>Content</b>	<b>Total periods = 32 hrs.</b>
<b>Project :</b>		<b>Total Marks = 25</b>
Following activities related to project are required to be dealt with, during this semester :		
<ol style="list-style-type: none"> <li>1. Form project batches &amp; allot project guide to each batch. (Max. 6 students per batch)</li> <li>2. Each project batch should select topic / problem / work by consulting the guide &amp;/or industry. Topic / Problem / work should be approved by Head of department.</li> <li>3. Each project batch should prepare action plan of project activities &amp; submit the same to respective guide.</li> <li>4. At the end of semester, each project batch should submit the action plan and abstract of the project along with list of materials required if project involves fabrication or other facilities required in other kinds of project.</li> <li>5. Action Plan should be part of the project report.</li> </ol>		
<b>Note: During completion of part-A &amp;B following reports should be submitted with in this sem.</b>		
<ol style="list-style-type: none"> <li>I) Assess yourself-are you an entrepreneur? &amp;</li> <li>II) Prepare a project report and study its feasibility.</li> </ol>		
<b>The components of project report consist of the followings:</b>		
<ol style="list-style-type: none"> <li>a. Project Summary (One page summary of entire project )</li> <li>b. Introduction (Promoters, Market Scope / requirement)</li> <li>c. Project Concept &amp; Product (Details of product)</li> <li>d. Promoters (Details of all Promoters- Qualifications, Experience, Financial strength)</li> <li>e. Manufacturing Process &amp; Technology</li> <li>f. Plant &amp; Machinery Required</li> <li>g. Location &amp; Infrastructure required</li> <li>h. Manpower ( Skilled, unskilled )</li> <li>i. Raw materials, Consumables &amp; Utilities</li> <li>j. Working Capital Requirement (Assumptions, requirements)</li> <li>k. Market ( Survey, Demand &amp; Supply )</li> <li>l. Cost of Project, Source of Finance</li> <li>m. Projected Profitability &amp; Break Even Analysis</li> <li>n. Conclusion.</li> </ol>		
<b>Examination Scheme: Practical</b>		<b>Total Marks = 50</b>
<ul style="list-style-type: none"> <li>• <b>Continuous Internal Sessional Assessment:</b> - - 25 marks.</li> </ul> <ol style="list-style-type: none"> <li>I) Attending classes, entrepreneurship development work &amp; submitting respective project report in time = 20 marks.</li> <li>II) End sem. viva-voce = 05 marks</li> <li>III) Total (I + II) = 25 Marks.</li> </ol>		
<ul style="list-style-type: none"> <li>• <b>External Sessional Assessment:</b> - 25 marks.</li> </ul>		
<b>Examiner :</b> External Teacher [Lect.]		
<b>Learning Resources :</b>		
<b>Text Books :</b>		



<b>Author</b>	<b>Title</b>	<b>Publisher</b>
E. Gorden & K. Natrajan	Entrepreneurship Development	Himalaya Publishing. Mumbai
Preferred by Colombo plan staff college for Technical Education.	Entrepreneurship Development Website : <a href="http://www.ediindia.org">http://www.ediindia.org</a>	Tata Mc Graw Hill Publishing co. ltd. New Delhi.
J.B.Patel D.G.Allampally	A Manual on How to Prepare a Project Report	EDI STUDY MATERIAL Ahmadabad (Near Villaget , Via Ahmadabad Airport & Indira Bridge), P.O. Bhat 382428 , Gujrat,India P.H. (079) 3969163, 3969153.
P.C.Jain	A Handbook of New Entrepreneurs'	
Gautam Jain Debmuni Gupta	New Initiatives in Entrepreneurship Education & Training Website : <a href="http://www.ediindia.org">http://www.ediindia.org</a>	
Poornima M. Charantimath	Entrepreneurship Development of Small Business Enterprises	Pearson Education, New Delhi
J.S. Saini B.S.Rathore	Entrepreneurship Theory and Practice	Wheeler Publisher New Delhi
<b>VIDEO CASSETTES:</b> Business Opportunity Selection and Guidance		Website : <a href="http://www.ediindia.org">http://www.ediindia.org</a>

### Professional Practice –III [AE]

<b>Name of the Course : Diploma in Automobile Engineering</b>	
<b>Course code: A.E.</b>	<b>Semester :</b> Fifth
<b>Duration :</b> 17 weeks	<b>Maximum Marks :</b> 50
<b>Teaching Scheme :</b>	<b>Examination Scheme :</b> Practical
<b>Theory :</b> Nil	<b>Continuous Internal Assessment:</b> Nil
<b>Tutorial: --</b> Nil	<b>External Assessment:</b> Nil
<b>Practical :</b> 03 hrs./week	<b>End Semester Exam. [theory]:</b> N.A
<b>Credit:</b> 02	
<b>Aim:</b>	
<ul style="list-style-type: none"> <li>• To develop general confidence, ability to communicate and develop positive attitude, in addition to basic technological concepts through Industrial visits, expert lectures, seminars on technical topics and group discussion.</li> <li>• To help in broadening technology base of students beyond curriculum.</li> <li>• To develop creatively and innovatively and inculcating habit of working with their own hands.</li> </ul>	
<b>Objectives :</b>	
Student will be able to:	
<ul style="list-style-type: none"> <li>➤ Acquire information from different sources.</li> <li>➤ Work in a team and develop team spirit.</li> <li>➤ Present seminar using power projection system.</li> <li>➤ Interact with peers to share thoughts.</li> <li>➤ Prepare a report on industrial visit, expert lecture.</li> </ul>	
<b>Intellectual Skill:</b>	
Student will be able to-	
<ul style="list-style-type: none"> <li>➤ Search information from various resources.</li> <li>➤ Prepare notes on selected topics.</li> <li>➤ Participate in group discussions.</li> </ul>	
<b>Motor Skills:</b>	
<ul style="list-style-type: none"> <li>✓ Observe industrial practices during visits.</li> <li>✓ Prepare slides / charts for presentation in seminar.</li> <li>✓ Develop a model.</li> </ul>	
<b>Content:</b>	
<b>Topic &amp; Content</b>	<b>Hrs</b>
<ul style="list-style-type: none"> <li>➤ <b>Part –A [Industrial Visits]:</b></li> </ul> <p>Structured industrial visits be arranged and report of the same should be submitted by the individual student, to form a part of the term work (2visits).</p> <p>Following are the suggested type of Industries/ Fields –</p> <ol style="list-style-type: none"> <li>i) A modern garage with engine scanning facility (diagnosis of electronic fuel injection systems).</li> <li>ii) A vehicle manufacturing company (Exhaust gas analysis, vehicle testing).</li> <li>iii) Railway repairing / manufacturing Workshop.</li> <li>iv) A vehicle manufacturing company, like Hindustan Motor, TATA Motor etc.</li> <li>v) State Transport Garage.</li> </ol>	

<ul style="list-style-type: none"> <li>vi) Hydroelectric power plant / sub-station.</li> <li>vii) Vehicle body building workshop.</li> <li>viii) A refuse, recycling / reclamation site.</li> <li>ix) Auto Engine Testing unit to gather details regarding the testing procedures / parameters etc.</li> <li>x) Wheel Balancing unit for light and/or heavy motor vehicles.</li> <li>xi) Steel Plant / Heavy Engg. Workshop / Iron casting Plant.</li> <li>xii) Process Industries.</li> <li>xiii) Engg. Research Institute.</li> </ul>	
<p>The <b>Guest Lectures</b> from field / industry experts, professionals or competent Lecturers from other polytechnic to be arranged from the following or alike topics. A <b>brief report</b>, on the guest lectures, is to be submitted by each student as a part of <b>Term work</b>.</p> <ul style="list-style-type: none"> <li>a) Electronic fuel injection systems.</li> <li>b) Exhaust gas analysis.</li> <li>c) Vehicle testing.</li> <li>d) Computer aided drafting.</li> <li>e) Electric motors &amp; generators.</li> <li>f) Automotive wiring &amp; lighting.</li> <li>g) Transducer application in automobiles.</li> <li>h) Environmental pollution &amp; control.</li> <li>i) Vehicle aerodynamics &amp; design.</li> <li>k) Earth moving machines.</li> <li>l) Automobile pollution, norms of pollution control.</li> </ul>	
<p>➤ Part – B [<b>Information Search</b>] :-</p> <p>Search information on <b>Any Two</b> of the following suggested topics and write a report (group size – 3 to 5 students, report – up to 10 pages)</p> <ul style="list-style-type: none"> <li>a) Common rail direct injection system / MPFI / TBI system.</li> <li>b) LPG conversion kit.</li> <li>c) CNG conversion kit.</li> <li>d) Vehicle pollution norms &amp; pollution control methods.</li> <li>e) Alternative fuels &amp; energy options.</li> <li>f) Vehicle / Engine tuning. ( Tappet clearance values, injection timing, ignition timing, injector opening pressure, spark plug gap, trouble code of MPFI / CRDI system, Idling RPM, Clutch lining thickness, various clearances in clutches, differential backlash, brake lining thickness, various clearances in brakes, steering backlash).</li> <li>g) Vehicle aerodynamics &amp; design.</li> <li>h) Vehicle testing.</li> <li>i) Laboratory testing of vehicle subsystems As per IS/SAE norms)</li> <li>j) Bio-diesel.</li> <li>k) Hybrid Car.</li> <li>l) Electric car.</li> <li>m) Hydraulic/pneumatic circuits in a modern car.</li> <li>n) Hydraulic/pneumatic circuits in an Earth moving vehicle.</li> </ul>	
<p>➤ <b>Seminar :</b></p> <p>Seminar topic may be related to the subjects of fifth semester / topics from information search &amp; guest lectures given above. Each student shall submit a report of at least 10 pages and</p>	

deliver a seminar (Presentation time – 10 minutes)		
<p>➤ <b>Part – C [Group Discussion] :</b></p> <p>The students should discuss in-group of six to eight students and write a brief report on the same as a part of term work. The faculty members may select ANY TWO topics for group discussion. Some of the suggested topics are -</p> <ol style="list-style-type: none"> <li>i) CNG versus LPG as a fuel.</li> <li>ii) Petrol versus Diesel as a fuel for cars.</li> <li>iii) Trends in automobile market.</li> <li>iv) Load shading and remedial measures.</li> <li>v) Rain water harvesting.</li> <li>vi) Trends in energy.</li> <li>vii) Disaster management.</li> <li>viii) Safety in day-to-day life.</li> <li>ix) Energy Saving in Institute.</li> <li>x) Nano technology.</li> </ol>		
<p>➤ <b>Mini Project: Any other equivalent/Similar topics (any one) .</b></p> <ol style="list-style-type: none"> <li>1) Design / Drawing of engine component in a group of 4 students.</li> <li>2) Prepare Models of Fuel injection pump components using suitable material.</li> <li>3) Preparing preventive maintenance schedule for an automobile.</li> </ol> <p><b>OR</b></p> <p>Modular Courses on ANY One of the suggested or alike relevant topic be undertaken by a group of students (Min 10):</p> <p><b>a) LPG/CNG conversion of vehicles &amp; b) Advance features in CAD.</b></p> <p>Two Assignments be completed on the course work as a part of the Term Work.</p>		
<b>Total periods</b>		<b>48 Hrs.</b>
<p><b>Notes:-</b> The above reports may be written &amp; seminar presentation may be prepared in Libra Office &amp; Latex. This are Open source software &amp; freely available.</p>		
<b>Examination Scheme : Practical</b>		
<ul style="list-style-type: none"> <li>• <b>Continuous Internal Sessional Assessment:</b> - - 25 marks.</li> </ul> <ol style="list-style-type: none"> <li>I) Industrial visit &amp; submitting respective report in time &amp; Mini project report = 10 marks.</li> <li>II) Submitting reports on Information Search &amp; presenting in Seminar in time = 05 marks.</li> <li>III) Participating in Group discussion = 05 marks.</li> <li>IV) End sem. viva-voce = 05 marks</li> <li>V) Total (I + II + III + IV) = 25 Marks.</li> </ol> <ul style="list-style-type: none"> <li>• <b>External Sessional Assessment:</b> - 25 marks.</li> </ul> <p><b>Examiner :</b> External Teacher [Lect.]</p>		
<b>Learning Resources:</b>		
<b>Books:</b>		
<b>Author</b>	<b>Title</b>	<b>Publisher</b>
Robert M. Thomas	Advanced AutoCAD	Sybex BPD
<a href="#">R Cheryl</a>	Beginning AutoCAD 2011- Exercise Book (W/2 DVDs)	BPB Publication
Donnie Gladfelter	AutoCAD 2014 and AutoCAD	Wiley India Pvt. Ltd.

	LT 2014	
How things works encyclopedia	DK Publishing	DK Publishing
Trott	Innovation mgmt.& new product development	Pearson Education
<b>1. Web sites</b> <a href="http://www.engineeringforchange.org">www.engineeringforchange.org</a> <a href="http://www.wikipedia.com">www.wikipedia.com</a> <a href="http://www.slideshare.com">www.slideshare.com</a> <a href="http://www.teachertube.com">www.teachertube.com</a>		