

# SHRI VENKATESHWARA UNIVERSITY



## Syllabus

### Diploma

Mechanical Engineering(Automobile)

### V semester

( THREE Years Programme)

(w.e.f. 2019-20)

**SCHOOL OF ENGINEERING &  
TECHNOLOGY**

**Mechanical Engineering(Automobile )SEMESTER-V**

Sl No.	Subject Codes	Subject	Periods			Evaluation Scheme				End Semester		Tot al	Credit
			L	T	P	C T	T A	Tot al	P S	TE	P E		
1	PAE – 501	Automobile Component Design	3	0	0	20	10	30		70		100	3
2	PAE -502	Automotive Chassis-II	3	0	0	20	10	30		70		100	3
3	PAE -503	Hydraulics & Pneumatics	3	0	0	20	10	30		70		100	3
4	PAE - 504	Earth Moving Equipments & Farm Machinery	3	0	0	20	10	30		70		100	3
5	PAE-505	Mechatronics	3	1	0	20	10	30		70		100	3
6	PAE-511	Automobile Component Design Lab	0	0	2				10		15	25	1
7	PAE-512	Automotive Chassis-II Lab	0	0	2				10		15	25	1
8	PAE-513	Strength of Material And Hydraulic & Pneumatic Lab	0	0	2				10		15	25	1
9	PAE-514	Summer Internship- II	0	0	6				50			50	3
10	PAE-515	Project Phase -I		0	4				50		50	100	2
												725	23
Summer Internship-II (6 weeks) after IVth Sem													

### Automobile Component Design (PAE 501)

<b>Name of the Course : Diploma in Automobile Engineering</b>			
<b>Course Code:</b>	AE	<b>Semester :</b>	Fifth
<b>Duration:</b>	17 Weeks	<b>Maximum Marks :</b>	100 Marks
<b>Teaching Scheme :</b>		<b>Examination Scheme :</b>	Theory
<b>Theory:</b>	02hrs / week	<b>Internal Examination :</b>	30 Marks
<b>Tutorial:</b>	Nil	<b>TA [Attendance, Assignment, Interaction etc.]:</b>	10 Marks
<b>Practical:</b>	02hrs / week	<b>End Semester Exam :</b>	70 Marks
<b>Credit :</b>	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.             <ul style="list-style-type: none"> <li>• To impart knowledge concerned to Automobile Component Design.</li> </ul> </li> </ul>			
<b>Objectives:</b>			
<i>Students will be able to:</i>			
<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>			
<i>Knowledge of Mechanisms, Strength of materials, Material sciences- Manufacturing processes &amp; Mechanical engineering drawing.</i>			
<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>
01	<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,		10

	<p><i>Maximum shear stress theory, Distortion energy theory.</i></p> <p><i>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.</i></p> <p><i>1.4 Selection of material and justifications for Automobile components. Advanced Materials for automotive components.</i></p> <p><i>1.5 Bearings-Classification, location in Automobiles systems &amp; selection of bearings.</i></p> <p><i>1.6 Post design aspects - Ergonomic aspect, Aesthetic consideration(Shape, color, surface finish) for Automobile.</i></p>				
02	<p><b>Design of shaft, keys &amp; levers:</b></p> <p><i>2.1 Conceptual understanding of shaft, axles &amp; spindles.</i></p> <p><i>2.2 Design of shaft for torsion, rigidity, bending, combined torsion &amp; bending.</i></p> <p><i>2.3 Design of propeller shaft, whirling &amp; critical speed.</i></p> <p><i>2.4 Design of rear axle.</i></p> <p><i>2.5 Types of keys, design of Sunk Rectangular Key, Effect of keyways on strength of shaft.</i></p> <p><i>2.6 Types of levers.</i></p> <p><i>2.7 Design of following levers for rectangular cross-section &amp; fulcrum pin only:-a) Rocker arm &amp; b) Bell crank lever.</i></p>	08			
03	<p><b>Design of Chassis &amp; engine components:</b></p> <p><i>3.1 Design of clutch- Single plate &amp; Multi plate.</i></p> <p><i>3.2 Data of engine specifications and calculations of cylinder dimensions for given power.</i></p> <p><i>3.3 Design of cylinder head thickness and bolts.</i></p> <p><i>3.4 Design of piston crown by bending strength and thermal considerations.</i></p> <p><i>3.5 Design of piston rings and skirt length.</i></p> <p><i>3.6 Design of piston pin for bearing, bending &amp; shear considerations.</i></p> <p><i>3.7 Design of connecting rod cross -section (I section).</i></p> <p><i>3.8 Design of big end, cap and bolts.</i></p>	14			
<b>Total</b>		32 hrs.			
<b>Total Classes</b>		17 weeks [34 lecture hrs.]			
<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>		
1) Analyze the loads, resisting areas, types of induced stresses on automobile components. 2) Analyze the modes of failure of different automobile components & identify the methods, strength equations to overcome the failures. 3) Calculate the dimensions of automobile components. 4) Identify different engine & chassis components.		
<b>Motor Skills:</b>		
1) Draw various automobile components as per the designed dimensions. 2) Use advanced materials for automobile components. 3) Use design data book to standardize component dimensions. 4) Prepare bill of materials. 5) Use CAD software to draw automobile components.		
<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.               <ul style="list-style-type: none"> <li>I) Attending classes, doing practicals &amp; submitting respective note book in time = 20 marks.</li> <li>II) Viva-Voce = 05 marks</li> <li>III) Total (I + II) = 25 Marks.</li> </ul> </li> <li>• <b>External Sessional Assessment:</b> - 25 marks.                Examiner : External Teacher [Lect.]</li> </ul>		
Sl. No.	<b>List of Design Practical [for Continuous Internal Assessment]</b>	Hours
01	Identify the different engine & chassis components which may fail due to stress concentration, observe & state remedy to reduce stress concentration.	02
02	Use of advanced materials with justifications for components like gears, piston, piston rings, leaf springs, cylinder head & block etc.	02
03	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.	08
04	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.	08
05	DESIGN PROJECT: (any one) 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.	12
<b>Total Periods</b>		<b>32 hrs.</b>
Note :- ➤ Design project activity should be completed in a small group of 5-6 students. ➤ Use of design data book is compulsory. Scheme for continuous Internal Assessment: 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>
<i>P C Sharma &amp; D K Aggarwal</i>	<i>Machine Design</i>	<i>S K KATARIA &amp; sons</i>
<i>R.S.Khurmi &amp; J.K.Gupta</i>	<i>Machine Design</i>	<i>Eurasia Publication House</i>
<i>R.K.Jain</i>	<i>Machine Design</i>	<i>Khanna publication</i>
<i>Pandya &amp; shah</i>	<i>Machine Design</i>	<i>Dhanpat rai &amp; sons</i>
<i>U.C. Jindal</i>	<i>Machine Design</i>	<i>Pearson</i>
<i>R B Gupta</i>	<i>Auto design</i>	<i>Satya prakashan</i>
<i>V.B.Bhandari</i>	<i>Design of Machine Elements</i>	<i>Mc. Graw Hill</i>
<i>N.K.Giri.</i>	<i>Problems in Automobile Engineering</i>	<i>Khanna publication</i>
<i>K M Aggarwal</i>	<i>Auto design problems</i>	<i>Satya prakashan</i>
<i>Griles</i>	<i>Automobile Design Vol,2,3</i>	<i>----</i>
<i>J.E. Shigley</i>	<i>Machine Design</i>	<i>McGraw Hill</i>
	<i>Design data Book</i>	<i>P S G Coimbatore</i>

### **Automobile Chassis-II (PAE-502)**

<b>Name of the Course : Diploma in Automobile Engineering</b>			
<b>Course Code:</b>	<b>AE</b>	<b>Semester :</b>	<b>Fifth</b>
<b>Duration:</b>	<b>17 Weeks</b>	<b>Maximum Marks :</b>	<b>100 Marks</b>
<b>Teaching Scheme :</b>		<b>Examination Scheme :</b>	
<b>Theory:</b>	<b>3 hrs / week</b>	<b>Internal Examination :</b>	<b>20 Marks</b>
<b>Tutorial:</b>	<b>Nil</b>	<b>T.A [Attendance, Assignment &amp; Interaction]:</b>	
			<b>10 Marks</b>
<b>Practical:</b>	<b>2 hrs / week</b>	<b>End Semester Exam :</b>	<b>70 Marks</b>
<b>Credit :</b>	<b>3</b>		
<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>			
<b>Pre-requisite :-</b>			
<b>Content [Theory] :</b>			
<b>Chapter</b>	<b>Name of the Topic</b>	<b>Hours</b>	<b>Marks</b>

01	<p><b>Brakes and Braking system:</b></p> <p>1.1 Introduction, Principle of braking.</p> <p>1.2 Function and necessity of brakes, Braking Effect- weight transfer.</p> <p>1.3 Classification of brakes and braking systems.</p> <p>1.4 Construction and working of - Drum brake.</p> <p>1.5 Concept of Leading Shoe &amp; Trailing Shoe.</p> <p>1.6 Friction materials used for brake shoes and pads. Characteristics of friction material- brake fade, coefficient of friction, dry friction and wet friction.</p> <p>1.7 Disc brake, types, construction and working principle, use.</p> <p>1.8 Solid and ventilated disk brakes.</p> <p>1.9 Comparison between Drum Brake and Disc Brakes</p> <p>1.10 Construction and working of - Mechanical braking system.</p> <p>1.11 Hydraulic Braking system, construction &amp; working principle.</p> <p>1.12 Master cylinder, wheel cylinder construction &amp; working principle, bleeding of Brakes.</p> <p>1.13 Properties of Brake Fluid and their specifications.</p>	11	--
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	<p>1.14 Air braking system - construction and working principle.</p> <p>1.15 Parking brake, Adjustments of Brakes, Brake Test.</p> <p>1.16 Brake System Troubleshooting.</p>		
02	<p><b>Power Brakes:</b></p> <p>2.1 Necessity of Power Brakes, Types of Power Brakes.</p> <p>2.2 Construction and working principle of power brakes (pedal assisted &amp; combined unit type).</p> <p>2.3 Hydraulic operated air braking system and vacuum assisted braking system, vacuum pump, manifold vacuum..</p> <p>2.4 Concept and working of Antilock Brake System (ABS).</p> <p>2.5 Power Brake Troubleshooting.</p>	06	
03	<p><b>Suspension Systems:</b></p> <p>3.1 Functions of suspension system. Sprung weight, unsprung weight.</p> <p>3.2 Types of suspension system - Rigid and independent Suspension.</p> <p>3.3 Types of Independent suspension system - McPherson strut and Wishbone type.</p> <p>3.4 Semi-elliptical Leaf spring, Helper springs (variable rate springs), coil spring, torsion bar arrangement,</p> <p>3.5 Construction and working of Air Suspension System.</p> <p>3.6 Construction and working of- Shock absorbers -Telescopic and Gas filled.</p> <p>3.7 Comparison between Rigid and independent Suspension.</p> <p>3.8 Anti roll bar or stabilizer bar.</p>	09	--
04	<p><b>Wheels and Tyres:</b></p> <p>4.1 Wheels: Functions, Wheel Specification, Types of wheels-wired spoke wheel, disc and alloy Wheels.</p> <p>4.2 Tyres: Necessity of tyres, Construction, working and comparison of a Tubed tyre and Tubeless tyres.</p> <p>4.3 Types of Tyres -radial, cross ply &amp; belted bias type.</p> <p>4.4 Specification of tyres, concept of Aspect ratio.</p> <p>4.5 Types of tread patterns</p> <p>4.6 Effect of inflation pressure on the life of tyre and tyre rotation.</p> <p>4.7 Factors affecting tyre performance and life.</p> <p>4.8 Balancing of wheel tyre assembling (static and dynamic).</p> <ol style="list-style-type: none"> <li>Tyre Rotation.</li> <li>Tyre Retreading.</li> <li>Tube Vulcanizing.</li> </ol>	09	

05	<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.	07	--
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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>		48 hrs	<b>70 Marks</b>
<b>Total Classes</b>		17 weeks [51 lecture hrs]	
Practical :			

SL. No.	Skills to be developed	
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>	
Examination Scheme : Practical		Maximum Marks : 50
<ul style="list-style-type: none"> <li>● Continuous Internal Assessment: - 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>● External Assessment: - 25 marks.</li> </ul> Examiner : External Lecturer.		



**List of Practicals:** Total Periods : 32 hrs.

**Skills to be developed :**

1. Know your Automobile Systems laboratory through, listing the systems, working models, and charts in laboratory with their purpose.
  - Listing the tools used in dismantling and assembly of various Automobile systems.
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.
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.
4. Observe and draw the layout of hydraulically operated air/vacuum assisted braking system.

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	<b>Any twenty</b>	<b>01</b>	<b>20 x 1 = 20</b>
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	<b>Any five</b>	<b>10</b>	<b>10 x 5 = 50</b>
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

