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AUTOMOBILE COMPONENT DESIGN **Course Code : 316346**

Programme Name/s : **Automobile Engineering.**

Programme Code : **AE**

Semester : **Sixth**

Course Title : **AUTOMOBILE COMPONENT DESIGN**

Course Code : **316346**

I. RATIONALE

The automotive industry is a dynamic and rapidly evolving sector, driven by technological advancements, increasing performance demands, and stringent safety and environmental regulations. Consequently, the design and development of automotive components require a sophisticated and multidisciplinary approach. This course addresses the critical need for engineers who possess a strong foundation in component design principles, coupled with the ability to apply modern design methodologies and analysis techniques.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of the course is to help the students to attain the following industry identified outcome through various teaching learning experiences:
Students will be able to design automotive components using relevant design principles and methodologies.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Apply fundamental design principles and methodologies to design automotive components.
- CO2 - Determine stresses in automobile components under various loading conditions
- CO3 - Design automotive chassis components.
- CO4 - Design automotive engine components.
- CO5 - Design simple axles using available data.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./ Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
316346	AUTOMOBILE COMPONENT DESIGN	ACD	DSC	4	-	2	-	6	3	3	30	70	100	40	25	10	-	-	-	-	125

Total IKS Hrs for Sem. : 6 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 List the principles of modern design concepts for designing Auto component. TLO 1.2 Describe the modes of failure with relevant examples. TLO 1.3 Explain component design procedure. TLO 1.4 Describe the standards used in the design of the given automobile component. TLO 1.5 Explain effects of aesthetics and ergonomics on shape and size of an automobile component. TLO 1.6 List environmental consideration in design of automobile components.	**Unit - I Design Principles and Practices** 1.1 Component design – Concept and modern design considerations (Concurrent engineering, Design for manufacturing, Design for assembly). 1.2 Modes of failure of different automotive components. 1.3 Basic requirements of automobile components, Basic automobile component design procedure. 1.4 Use of IS codes (For material designation, Testing of materials, standard for shapes and dimensions, standards for fits, Tolerances and surface finish) and Standards in automobile component design (Introduction only), Preferred numbers series. 1.5 Ergonomic and aesthetic considerations in automobile component design (shape, size and color). 1.6 Environmental consideration in component design.	Lecture Using Chalk-Board Case Study Video Demonstrations Presentations
2	TLO 2.1 State different types of loads acting on automobile components. TLO 2.2 Describe stresses induced in the given components. TLO 2.3 State torsional equation for solid and hollow shafts. TLO 2.4 Describe SN curve. TLO 2.5 Illustrate suitable remedies to reduce stress concentration for the given component with justification. TLO 2.6 List criteria affecting selection of factor of safety.	**Unit - II Fundamentals of Design** 2.1 Types of loads-Static, Dynamic, Impact, Shock . 2.2 Types of stresses-Normal and Shear stresses, Crushing stress, Bearing pressure, Bending stresses (Simple numerical only). 2.3 Torsion of shafts, Modulus of rigidity, Torsional equation, (Simple numerical on solid, hollow shafts only). 2.4 Fatigue, Endurance limit, SN Curve. 2.5 Stress concentration, causes and remedies. 2.6 Working stress, factor of safety, selection of factor of safety.	Lecture Using Chalk-Board Presentations Video Demonstrations

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Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Describe design procedure for threaded joint in a tie rod. TLO 3.2 Calculate friction lining dimensions of a clutch plate. TLO 3.3 Describe design procedure for a propeller shaft and universal coupling. TLO 3.4 Explain design procedure of parallel and transverse fillet welded joints for axially loaded symmetrical sections.	**Unit - III Design of chassis components** 3.1 Design of threaded joint in a tie rod. 3.2 Torque transmitted by clutch considering Uniform pressure and Uniform wear theory (No derivation), Clutch plate friction lining design for single and multi-plate clutch considering uniform wear condition. (Simple numerical only). 3.3 Design of propeller shaft, Universal coupling design (Shaft diameter, pin diameter and empirical relations). 3.4 Design of welded joints in automobile manufacturing, Design of parallel and transverse fillet welds, axially loaded symmetrical Section.	Lecture Using Chalk-Board Presentations Video Demonstrations Flipped Classroom
4	TLO 4.1 Explain valve spring design procedure. TLO 4.2 Explain design procedure for IC engine piston and piston pin. TLO 4.3 Describe design procedure of connecting rod.	**Unit - IV Design of Engine components** 4.1 Materials for valve spring with justification, IC engine valve spring terminology, Design procedure of valve spring. 4.2 Materials for piston and piston pin with justification, IC engine piston design procedure (For strength) , Piston pin design procedure (Simple numerical only). 4.3 Materials for connecting rod with justification, Design procedure of connecting rod cross section (Simple numerical only).	Lecture Using Chalk-Board Video Demonstrations Presentations
5	TLO 5.1 Describe design procedure a front axle cross section for given load condition . TLO 5.2 Describe design procedure of a full floating rear axle cross section for given load condition.	**Unit - V Design of Axles** 5.1 Material for axle with justification, Design procedure for front axle beam cross section (Simple numerical only). 5.2 Material for rear axle with justification, Design procedure for full floating rear axle cross section (solid, hollow)(Simple numerical only).	Lecture Using Chalk-Board Video Demonstrations Presentations Model Demonstration

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Find a feasible solution to resolve manufacturing and assembly issues using 'Concurrent Engineering' .	1	*Concurrent Engineering for designing automobile components.	2	CO1
LLO 2.1 Select suitable material for automobile component based on environmental aspects.	2	Environmental considerations in component design	2	CO1
LLO 3.1 Select an automobile component based on ergonomic and aesthetic considerations as per requirement. LLO 3.2 List the ergonomic and aesthetic aspects identified components under LLO 3.1. LLO 3.3 Analyze shape, size and color of selected component with respect to ergonomics and aesthetics.	3	Aesthetic and Ergonomic design considerations in automobile components.	2	CO1

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 4.1 Find a feasible solution to reduce stress concentration in the engine/ chassis components such as crank, connecting rod, chassis frame, leaf spring, axles, etc.	4	*Stress concentration in the automobile components.	2	CO2
LLO 5.1 Identify material used in manufacturing of automobile components such as crank, connecting rod, chassis frame, leaf spring, axles, etc. (Any four) referring design data book. LLO 5.2 Specify material properties for components given in LLO 5.1 with relevant justification.	5	*Automobile component materials.	2	CO1 CO2
LLO 6.1 Measure dimensions of given propeller shaft and Universal coupling. LLO 6.2 Select relevant materials from design data book. LLO 6.3 Select relevant design procedure. LLO 6.4 Calculate dimensions. LLO 6.5 Modify dimensions. LLO 6.6 Prepare CAD drawing.	6	*Propeller shaft and universal coupling design	6	CO3
LLO 7.1 Measure dimensions of given piston. LLO 7.2 Select relevant materials from design data book. LLO 7.3 Select relevant design procedure. LLO 7.4 Calculate dimensions. LLO 7.5 Modify dimensions. LLO 7.6 Prepare CAD drawing.	7	*Piston design	6	CO4
LLO 8.1 Measure dimensions of given front axle beam. LLO 8.2 Select relevant materials from design data book. LLO 8.3 Select relevant design procedure. LLO 8.4 Calculate dimensions of I section. LLO 8.5 Modify dimensions for preparation of drawing.	8	Front axle design	4	CO5
LLO 9.1 Measure dimensions of given rear axle beam. LLO 9.2 Select relevant materials from design data book. LLO 9.3 Select relevant design procedure. LLO 9.4 Calculate the dimensions of the section. LLO 9.5 Modify the dimensions for preparation of drawing.	9	*Rear axle design.	4	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Other

- NOT APPLICABLE

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of

microprojects, assignments, and activities in a similar way.

- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Computer system (Core i5 or equivalent, RAM- 4GB or more, Monitor 20" or more) with internet connectivity (More than 2 mbps)	1
2	Computer system (Core i5 or equivalent, RAM- 4GB or more, Monitor 20" or more) with internet connectivity (More than 2 mbps)	2
3	Chassis model of old vehicle with major chassis components (Chassis frame, leaf spring, engine mounted on frame, propeller shaft, Axles).	3
4	Chassis model of old vehicle with major chassis components (Chassis frame, leaf spring, engine mounted on frame, propeller shaft, Axles). Crankshaft, piston, connecting rod, valves, etc.	4
5	Design data book and Chassis model of old vehicle with major chassis components (Chassis frame, leaf spring, engine mounted on frame, propeller shaft, Axles). Crankshaft, piston, connecting rod, valves, etc.	5
6	Single piece propeller shaft with hollow cross section and slip joint, universal coupling at ends for any commercially vehicle.	6
7	Petrol/Diesel engine working model, specifications of the engine, Vernier caliper, Design data book and piston connecting rod assembly model.	7
8	Dead type front axle (I cross section) with chassis component mounted on frame, Design data book.	8
9	fully floating rear axle used in light/heavy commercial motor vehicle with vehicle specifications (Engine torque, gear box ratio, differential ratio).	9

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Design Principles and Practices	CO1	12	4	8	4	16
2	II	Fundamentals of Design	CO2	10	2	8	2	12
3	III	Design of chassis components	CO3	14	4	4	8	16
4	IV	Design of Engine components	CO4	16	2	4	8	14
5	V	Design of Axles	CO5	8	2	8	2	12
Grand Total				**60**	**14**	**32**	**24**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Continuous assessment based on process and product related performance indicators

Summative Assessment (Assessment of Learning)

- End semester examination

XI. SUGGESTED COS - POS MATRIX FORM

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Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	3	2	2	2	-	2			
CO2	3	3	2	2	-	-	2			
CO3	3	3	3	2	-	-	2			
CO4	3	3	3	2	-	-	2			
CO5	3	3	2	2	-	-	2			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Bhandari, V.B.	Design of Machine Elements	McGraw Hill Education New Delhi, 3rd Edition 2012 ISBN (13 digit) 9780070681798
2	Khurmi, R.S., Gupta J.K.	A Textbook of Machine Design	S Chand Publishing New Delhi 2010, ISBN (13 Digit) 9788121925372
3	Giri, N.K.	Automobile Technology	Khanna Publisher, Delhi 110006, 2012, ISBN (13 Digit) 9788174091789
4	--	Design Data Book	PSG College of Technology Coimbatore, 2014 ISBN 13-9788192735504
5	Aggarwal K.M.	Auto Design Problems	Satya Prakashan New Delhi 2012 ISBN:8176842079

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3283358	Environment consideration in Auto component design
2	https://www.youtube.com/watch?v=9_R7M49Atz4	Aesthetics and Ergonomics in Design
3	https://www.youtube.com/watch?v=-hLwyhDRcJM	Design of fillet welds
4	https://www.youtube.com/watch?v=LhUclxBUV_E	Fatigue testing procedure
5	https://www.youtube.com/watch?v=ZwqBia_gRGo&list=PLg9TnucUbzBW3tt1AtCBxcz6Hr1YqQYwQ&index=1	Design of piston in IC engine
6	https://www.youtube.com/watch?v=Pvlm35eiI78	Use of Design data book
7	https://www.youtube.com/watch?v=-FG9AVYqF0U	Modes of failure
8	https://www.youtube.com/watch?v=yQGiwsHQab8	Methods of reducing stress concentration

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

MSBTE Approval Dt. 04/09/2025 **Semester - 6, K Scheme**