AUTOMOBILE BODY ENGINEERING AND SAFETY **Course Code : 315377**

Programme Name/s : **Automobile Engineering.**
Programme Code : **AE**
Semester : **Fifth**
Course Title : **AUTOMOBILE BODY ENGINEERING AND SAFETY**
Course Code : **315377**

I. RATIONALE

This course equips students with essential knowledge and skills in Vehicle Body Technology, preparing them for significant employment opportunities in auto service stations and body building workshops. As supervisors or self-employed technicians, diploma holders are expected to fabricate and repair various vehicle bodies. Mastery in vehicle body technology and safety is crucial for managing these tasks. With the rapid growth in auto body field, including advancements in materials, repair systems, and enhanced safety features, there is a high demand for well-trained technicians.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Apply the latest trends in production and maintenance practices for automobile bodies

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Select an appropriate auto body for a given application.
- CO2 - Choose relevant materials for different parts of the auto body and for body refinishing work.
- CO3 - Use appropriate tools and equipment for auto body repair work.
- CO4 - Repair damaged auto body parts using relevant tools, instruments, and machine tools.
- CO5 - Follow safety practices and standards in auto body repair work.

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	
315377	AUTOMOBILE BODY ENGINEERING AND SAFETY	ABS	DSE	4	-	2	-	6	2	3	30	70	100	40	25	10	25#	10	-	-	150

Total IKS Hrs for Sem. : 0 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.* 10 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 Select an auto body for a given application with justification. TLO 1.2 List various auto body sections and parts of a given type of vehicle. TLO 1.3 Describe the purpose of major auto body parts. TLO 1.4 Illustrate the loads acting on an auto body in given conditions. TLO 1.5 Explain, with a sketch, the effect of aerodynamic drag on the performance of a given type of vehicle.	**Unit - I Auto Body Construction and Aerodynamics** 1.1 Purpose and requirements of automobile bodies 1.2 Classification of auto body (shape, construction and application) 1.3 Body Terminology 1.4 Purpose and location of body parts - a) Front section (bumper, grille, frame rails, floor pan and fender panel) b) Center section (roof panel, cowl, doors, door pillars and glass) c) Rear section (rear quarter panel, rear floor pan, rear frame rails, trunk or deckled and rear bumper) 1.5 Loads on vehicle body – Static load, acceleration and braking load, moments and torque due to driving conditions (torsion and bending moments) 1.6 Body Aerodynamics – Concept, effect of aerodynamic drag on vehicle performance, methods to reduce aerodynamic drag	Chalk Board/ White Board PPT Presentation Video Demonstration Model Demonstration

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.
2	TLO 2.1 Explain the use of sheet metal for a given auto body panel/part with justification. TLO 2.2 Justify the use of plastic parts in a vehicle for given applications. TLO 2.3 Compare conventional and composite materials based on mechanical properties, ease of manufacturing and maintenance, repairability, durability, cost, and applications. TLO 2.4 List the properties and specifications of body refinishing materials. TLO 2.5 Compare various types of body paints.	**Unit - II Auto Body Materials** 2.1 Types, properties and applications of body materials - Sheet Metal, Glass (tempered and laminated glass), Resins, Plastic, Composite Materials (Glass Reinforced Plastic and Fiber Reinforced Plastic) 2.2 Body Paint - a) Basic composition of paints (pigments, binder, thinner and additives), b) Types of paints (cellulose synthetic, oil paints, synthetic paints, stoving paints, two pack paints) 2.3 Body Refinishing Materials - Fillers, Primers, Sealers (standard, isolating and bleed inhibiting sealers), Additives and Other compounds common to body shop	Chalk Board/ White Board PPT Presentation Video Demonstration Hands-on practice Auto Body Shop visit
3	TLO 3.1 Explain the use of given body shop tools and equipment with relevant justification. TLO 3.2 State the legal and technical requirements for building a new body workshop. TLO 3.3 Design the body shop layout for auto body service. TLO 3.4 State safety precautions and procedures to be followed in a body shop.	**Unit - III Auto Body Shop Planning** 3.1 Basic Hand Tools - a) General Purpose Tools (Wrenches, Screwdrivers, Pliers, Miscellaneous Hand Tools), b) Body Working Tools (Hammers, Mallets, Dollies, Spoons, Picks, Dent Pullers, Pull Rods, Suction Cups, Punches, Chisels, Panel Cutters and Rivet Gun), c) Body Surfacing Tools (Metal Files, Sanding Board, Spreaders and Squeegees) 3.2 Power Tools - a) Air Powered Tools (Air Compressor, Air Wrenches, Air Drills, Air Chisels, Grinders, Polishers/Buffers, Spray Gun and Air Sanders), b) Electric Power Tools (Power Screwdrivers, Drill Press, Bench Grinders, Vacuum Cleaners, Power Washers, Heat Gun and Welding Machine), c) Hydraulic Power Tools (Power Jacks, Vehicle Lift, Hydraulic Hoist for Engine and Transmission) 3.3 Body Shop Planning - Pre planning, Choosing a site, Legal requirements of planning stage, Planning areas of workshop layout, Basic principles and dimension for body shop. 3.4 General safety rules and measures in body shop	Chalk Board/ White Board PPT Presentation Video Demonstration Model Demonstration Hands-on practice Auto Body Shop visit

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.
4	TLO 4.1 Select a relevant repair method for given minor body damage with justification. TLO 4.2 Describe the damages caused by a given type of collision. TLO 4.3 Describe the procedure for panel replacement of a given vehicle body. TLO 4.4 Suggest relevant surface preparation/preventive treatment for refinishing a given body condition with justification.	**Unit - IV Auto Body Repairs** 4.1 Classification of Body Damage- Direct, Indirect and Concealed damage 4.2 Minor Damage Repair - a) Standard Procedure, b) Straightening Dents with Hammers, Hammers and Dolly, Hammers and Spoons, c) Other Metal Straightening Techniques (Washer Welder, Body Fillers and Dent Pullers) 4.3 Accident Damage Repair- a) Types of major damages, b) Factors to be considered in diagnosis of accident damage, c) Accident repair standard procedure, d) Rust damage repair procedure, e) Panel replacement procedure, f) Fiber Glass repair procedure 4.4 Body Repainting Processes- a) Preventive and Anti-corrosive Treatment (Hot Dip Galvanization, Cavity Wax Injection, Barrier Coating, Cathodic Protection and Soap and Water), b) Standard Repainting Procedure	Chalk Board/ White Board PPT Presentation Video Demonstration Hands-on practice Auto Body Shop visit
5	TLO 5.1 Describe the basic body design considerations for a given type of vehicle. TLO 5.2 Explain the safety features integrated into various parts of a vehicle's body structure. TLO 5.3 Interpret the safety ratings of vehicle bodies by observing videos available on GNACP & BNCAP official websites	**Unit - V Auto Body Safety** 5.1 Basic design considerations for auto body safety 5.2 Auto body structure, its system and parts - Safety features of Doors, Window glasses, Windshield, Bumper, Seat (back & head restraints), Ventilation and Rear view mirror. 5.3 Safety Ratings - New Car Assessment Program a) Globally (Global NCAP), b) Nationally (Bharat NCAP)	Chalk Board/ White Board PPT Presentation Video 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 Identify various safety equipment used in auto body workshop LLO 1.2 Follow various safety standards and practices while designing auto body workshop LLO 1.3 Draw a layout for a given auto body workshop	1	Layout and safety practices in auto body workshop.	2	CO1 CO3

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 2.1 Inspect the effect of aerodynamic drag on different auto body shapes LLO 2.2 Calculate the drag force for given body shape and conditions. LLO 2.3 Infer the relationship between aerodynamic drag and vehicle performance	2	*Aerodynamic shapes of auto body and its effect on vehicle performance.	2	CO1
LLO 3.1 Identify the different auto body parts LLO 3.2 Inspect the type of material used for given auto body parts. LLO 3.3 Prepare a comparative report of materials used for given auto body parts on the basis of mechanical properties, ease of manufacturing and maintenance, repairability, durability, cost and applications	3	*Identification of different materials of auto body parts	2	CO2
LLO 4.1 Prepare a table of different refinishing materials with its specifications and purpose. LLO 4.2 Choose the right refinishing material for particular repair work. LLO 4.3 Prepare the refinishing materials for given job. LLO 4.4 Use the refinishing material for given job.	4	Refinishing materials in auto body workshop.	2	CO2
LLO 5.1 Identify the different tools and equipment. LLO 5.2 Select appropriate tools and equipment for auto body rework. LLO 5.3 Perform the task using identified tools and equipment.	5	*Auto body workshop tools and equipment.	2	CO3
LLO 6.1 Detect the dent on given auto body panel. LLO 6.2 Select the appropriate dent removing tool. LLO 6.3 Carry out the repair of panel.	6	Auto body panel repair using dent removing tools	2	CO3
LLO 7.1 Inspect the damaged auto body parts LLO 7.2 Identify the type of repair work for given damaged parts. LLO 7.3 Repair the damaged auto body part by selecting appropriate tool and processes.	7	*Practices of repairing minor damaged auto body parts.	2	CO3 CO4
LLO 8.1 Inspect the extent of damaged auto body parts LLO 8.2 Identify the type of repair work for given damaged auto body part. LLO 8.3 Perform repair work on damaged auto body part by selecting appropriate tools and processes.	8	Diagnosis of major accidental damaged auto body.	2	CO3 CO4
LLO 9.1 Identify tools to remove damaged part. LLO 9.2 Replace damaged part with genuine part. LLO 9.3 Check the functionality of replaced part.	9	Replacement of damaged auto body part	2	CO3 CO4
LLO 10.1 Collect the various crash test standards. LLO 10.2 Identify appropriate safety ratings along with its specifications and evaluation parameters. LLO 10.3 Compare safety ratings of given vehicle based on GNCAP and BNCAP standards.	10	*Safety standards and ratings for vehicle.	2	CO5

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs

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)

Assignment

- NA

Micro project

- NA

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	Buffing and Polishing machines: For sanding, polishing and buffing. Variable speed control. Large loop handle for operator control. Output shaft M14 male. Pad size 180 mm. No load speed 600-3,000 rpm.	4

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
2	Denting tools and equipment- Basic denting tools like I. Hammers (Weight 1/4 kg to 2 kg): General purpose pick hammer, Bumping hammer, Cross-Peen hammer, Cross-Chisel hammer, Pick Fin hammer, Cross Chisel shrinking hammer, Dinging hammer, Door Skin hammer, Trim hammer. 2. Dolly blocks: Long handle spoon dolly, Caulking Iron, General Purpose Dolly, Shrinking Dolly, Anvil Dolly, Dome Dolly, Round Forming Dolly, Oblong Dolly, Heel Shaped Dolly, Curved Dolly, Toe-shaped Dolly, Shrinking Body dolly, Wedge Shaped Dolly, Egg Shaped Dolly. 3. Dent Pullers: Pneumatic type (Vacuum based), Electrical type (Spot - weld type). 4. Spoons: Light dinging spoon, Slapping spoon, General purpose fender spoon 5. Pick bars: Medium short curved picks. 6. Chisels: Metal Chisel - Blade Width (mm): 6-7mm, Surface Treatment: Polished, Site (Inch): 4 Inch, Structure: Straight, Finish: Mat. 7. Files: Simple flat & round metal files, Special flexible Vixen files. 8. Blow Lamp: Material Used: Brass & Iron Steel, Application/Use: Heating 9. Soldering equipment: Voltage:110V, Wattage:60W, Wire Capacity:0.8 to 2mm or any other suitable specifications.	5,6,7,8
3	Body of Car: A used Car Body of any model (above 1000 cc), Type - Integrated Body	All
4	Body of Light Motor Vehicle - Body of hard top Jeep of any model (minimum 1400 cc) along with all relevant accessories, Type - Conventional Body	All

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	Auto Body Construction and Aerodynamics	CO1	6	2	4	6	12
2	II	Auto Body Materials	CO2	8	2	4	6	12
3	III	Auto Body Shop Planning	CO3	8	2	8	6	16
4	IV	Auto Body Repairs	CO4	14	2	8	10	20
5	V	Auto Body Safety	CO5	4	2	4	4	10
Grand Total				**40**	**10**	**28**	**32**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Two-unit tests of 30 marks and average of two-unit tests.

For laboratory learning 25 Marks

Summative Assessment (Assessment of Learning)

- End semester assessment of 25 marks for laboratory learning.

End semester assessment of 70 marks.

XI. SUGGESTED COS - POS MATRIX FORM

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	-	2	-	2	3	-			
CO2	3	2	2	-	2	-	2			
CO3	3	2	-	3	-	3	2			
CO4	3	3	2	2	2	3	2			
CO5	2	-	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	Pawlowski, J.; Tidbury, G.H.	Vehicle body engineering	Century Publications, Century,1970 ISBN-13: 9780220689162
2	Andre, G. Deroche	The Principles of Auto body repairing and Repainting	Prentice Hall, Inc. London,1976 ISBN-13 : 9780137056996
3	Adrew Livesey; Alan Robinson	The Repair of Vehicle Bodies	7th edition. | Boca Raton : Routledge, 2018 ISBN 13 : 9781351230643
4	Ramlingam, K.K	Automobile Engineering	Scitech Publication, Delhi, 2011 ISBN-13: 9788188429486
5	Chikara, Anil	Automobile Engineering Vol.5 Paint Techniques	Satya Prakashan, New Delhi, 2015, Editon, ISBN 13 : 9788176840774
6	Gupta, R.B	Automobile Engineering	First Edition, Satya Prakashan, New Delhi, 2016 ISBN 13: 9788176848589
7	William H, Crouser: Anglin Donald L	Automotive Mechanics	9th Edition, McGraw- Hill Publication, 2017, ISBN 13 : 9780070148604
8	Giri, N. K.	Automobile Mechanics	Khanna Publication, Delhi,2014, 8th Edition, ISBN 13: 9788174092168
9	James E., Duffy	Auto Body Repair Technology	Fifth Edition, Delmar Cengage Learning, ISBN 13: 9781418073534

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.youtube.com/watch?v=LZ82iANWBL0&list=PLbMVogVj5nJTW50jj9_gvJmdwFWHaqR5J&index=1&t=1s	Introduction to Vehicle Dynamics
2	https://youtu.be/wiyT8LBdQ5Q?si=diFkVlzzNFwkH107	Global New Car Assessment Program Testing
3	https://www.youtube.com/watch?v=VebCTdI0EYY	Bharat New Car Assessment Program Testing
4	https://www.globalncap.org/resources	Global New Car Assessment Program
5	https://www.bncap.in/notifications/	BNCAP Procedure
6	https://www.youtube.com/live/vYj1FhQwvFY?si=UMt6aCTxBa4JYNjh	Advanced Materials for Automotive Application

Note :

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