Programme Name/s : **Mechanical Engineering**
Programme Code : **ME**
Semester : **Fifth**
Course Title : **AUTOMOBILE ENGINEERING**
Course Code : **315372**

I. RATIONALE

Diploma holders in Mechanical Engineering are expected to identify the components in automobile systems, select the different layouts as per the applications and demonstrate the working of various automobile systems. This course will be helpful to student in correlating various automobile systems with each other and provides the opportunity to work in various automobile manufacturing units , sales and service of automobiles products.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Carry out activities / tasks related to vehicle maintenance efficiently by following safe practices.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Use appropriate tools for vehicle service operation.
- CO2 - Carryout repairing activities by following laid down procedures.
- CO3 - Diagnose faults in given automobile control systems.
- CO4 - Locate faults in suspension system of given automobile.
- CO5 - Carryout appropriate test for given auto electrical and electronic components.

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	
315372	AUTOMOBILE ENGINEERING	AEN	DSC	4	-	2	-	6	2	3	30	70	100	40	25	10	25#	10	-	-	150

Total IKS Hrs for Sem. : 1 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 Identify various components of vehicle. TLO 1.2 Classify automobiles on the basis of various criteria. TLO 1.3 Draw layout of various vehicles. TLO 1.4 State the advantages and disadvantages of layout of various vehicle. TLO 1.5 State the function of chassis, frame and body. TLO 1.6 Compare conventional frame and Unitized frame. TLO 1.7 Explain with sketch the functions of various components of Electric & Hybrid vehicles.	**Unit - I Introduction to Automobile** 1.1 Automobile: Definition, Major Components of Automobiles with their functions. 1.2 Classification of Automobiles on the basis of Purpose, Load capacity, Fuels used, based on drive, no. of wheels and axles, transmission, Suspension. 1.3 Vehicle Layout: Significance of vehicle Layout, Different types of vehicle layout, Front Engine Front Wheel Drive, Front Engine Rear Wheel Drive, Rare Engine Rear Wheel Drive, Four Wheel Drive.(FEFWD, FERWD, RERWD, 4WD), Advantages and Disadvantages. 1.4 Function of Chassis, Frame and Body: Chassis components, Functions of frame, Loads acting on the frame, Advantages, disadvantages and types of frames (Conventional frame, sub-frames, unitized frame or frameless construction), Requirements of Body, different types of body styles. 1.5 Electric & Hybrid Vehicle: Needs, components and their Functions. 1.6 Development of Automobiles from Ancient time. (IKS) (No Theory question)	Video Demonstrations Presentations Model Demonstration Lecture Using Chalk-Board

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 Draw layout of transmission system TLO 2.2 State the necessity of clutch. TLO 2.3 Compare Single plate clutch & Multiplate clutch. TLO 2.4 Explain Single Plate clutch and Multiplate clutch with neat sketch. TLO 2.5 Explain working of various types of Gear box with sketch. TLO 2.6 State the function of propeller shaft, Universal joint and slip joint. TLO 2.7 Explain the working principle of Differential with sketch. TLO 2.8 Identify various types of axle and its components TLO 2.9 Explain with sketch Torque converter.	**Unit - II Automobile Transmission system** 2.1 Transmission System Layout, components and its application: Layout of two wheel drive transmission system (2WD) and four wheel drive transmission system (4WD) and application. 2.2 Clutch: Function and Necessity, Requirement, classification, working principle, construction and working of Single plate (Coil Spring and Diaphragm) clutch, Multiplate Clutch. 2.3 Gear Box: Manual Transmission, Classification, Construction and working of Constant Mesh Gear Box and Synchromesh Gear Box. Automatic transmission, Torque converter , Epicyclic Gearbox (Gear Train). 2.4 Propeller Shaft: Functions and Necessity, Construction of propeller shaft, Functions of universal joint and slip joint 2.5 Differential: Function and Necessity, construction and working principle. 2.6 Axle: Front axle Construction and requirements, Types of (Front) Stub axle, construction and functions of Semi floating, Fully floating type of rear axle.	Model Demonstration Video Demonstrations Lecture Using Chalk-Board Presentations
3	TLO 3.1 State the function of braking system. TLO 3.2 Explain various types of brake system with neat sketch. TLO 3.3 Explain with sketch major components of hydraulic brake systems. TLO 3.4 Compare Disc and Drum Brakes. TLO 3.5 Explain the concept of ABS. TLO 3.6 Explain Working of Steering linkages. TLO 3.7 Explain with sketch various types of steering gear boxes. TLO 3.8 Describe the terms related to steering geometry with neat sketch	**Unit - III Automobile Control Systems** 3.1 Braking System: Function and Braking Requirements, Classification of brakes. Construction and working of Drum and Disc Brakes. Working of Mechanical, Hydraulic and Air brake system. 3.2 Major Components of Hydraulic braking System: Master Cylinder, Wheel cylinder. 3.3 Antilock brake system (ABS):Introduction 3.4 Steering System: Function and Requirements, Construction of steering linkages for rigid axle and Independent suspension systems. 3.5 Steering Gear box: Types, Construction and working of Rack and pinion, Recirculating ball type steering gear box, Necessity and principle of power steering. 3.6 Steering Geometry: Castor, camber, Toe-in, Toe-out, King pin inclination, understeer and over steer.	Model Demonstration Video Demonstrations Lecture Using Chalk-Board Presentations

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 Explain with neat sketch working of various type of suspension system. TLO 4.2 Compare Rigid axle and Independent Suspension. TLO 4.3 Describe working of hydraulic Shock absorber and Air Suspension system. TLO 4.4 State the types of wheel rims and it's Nomenclature. TLO 4.5 Compare Radial Ply, Cross Ply tyres. TLO 4.6 Select suitable tyres on the basis of designation. TLO 4.7 State the necessity of wheel alignment and balancing TLO 4.8 State the procedure of wheel alignment and balancing.	**Unit - IV Automobile Suspension ,wheels and tyres** 4.1 Suspension Systems: Function and Requirements , Rigid axle suspension system (Leaf Spring) construction. 4.2 Independent suspension system Introduction, Types of Independent suspension system. Construction and working of Mac-pherson strut type, wishbone type of suspension system. 4.3 Shock Absorber and Air Suspension: construction and working of Telescopic shock absorber, construction and working of Air suspension system. 4.4 Wheels, Rims and Tyres: Function and requirement of wheels. Types of wheels 4.5 Tyre cross section: Cross Ply, Radial ply and belted bias, Tyre designation, Factors affecting tyre life. 4.6 Wheel Alignment and Wheel balancing: Purpose of wheel alignment, Procedure of wheel alignment .Purpose of wheel balancing and procedure of wheel balancing.	Model Demonstration Video Demonstrations Presentations Lecture Using Chalk-Board
5	TLO 5.1 Explain battery components and working. TLO 5.2 State Battery rating and its capacity. TLO 5.3 State the function of starter and alternator. TLO 5.4 Explain the working of different types of ignition system with sketch. TLO 5.5 State various types of sensor with applications.	**Unit - V Introduction to Auto Electrical Systems** 5.1 Introduction to Battery and its components: Function and Requirements of battery, Types of battery, Battery components and working, Battery Rating and Battery Capacity. 5.2 Starting System and charging system: Functions and Requirement of starting and charging system, starting system components and their functions, Alternator components and their functions. Working Principle of alternator. 5.3 Ignition System: Introduction to various types of Ignition Systems. (Battery Ignition, Magneto Ignition and Electronic Ignition System) 5.4 Miscellaneous: Types of sensors used in Automobile .	Model Demonstration Video Demonstrations Presentations Lecture Using Chalk-Board

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

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Identify automobile systems like (Transmission ,Control ,Suspension ,Electrical and Electronics) LLO 1.2 Draw layout of various types of vehicles. Front Engine Front Wheel Drive, Front Engine Rear Wheel Drive, Rare Engine Rear Wheel Drive, Four Wheel Drive.(FEFWD, FERWD, RERWD, and 4WD) LLO 1.3 Compare various layouts.	1	Preparation of Layout of given Vehicle	2	CO1
LLO 2.1 Select various tools available in laboratory. LLO 2.2 Categorize tools available in laboratory.	2	*Use appropriate tools for service applications.	2	CO1
LLO 3.1 Dismantle given clutch. LLO 3.2 Identify components of clutch. LLO 3.3 Draw any components of the clutch. LLO 3.4 Identify fault in clutch. LLO 3.5 Assemble clutch.	3	*Dismantling and Assembling of Clutch.	2	CO2
LLO 4.1 Dismantle gear box LLO 4.2 Identify various components of Constant Mesh/Synchro Mesh Gear Box. LLO 4.3 Inspect components of gear box. LLO 4.4 Identify fault in gear box LLO 4.5 Assemble gear box.	4	Dismantling and Assembling Gear Box	2	CO2
LLO 5.1 Dismantle differential. LLO 5.2 Identify the components of Differential . LLO 5.3 Check components of diffrential. LLO 5.4 Identify Fault in differential. LLO 5.5 Assemble differential.	5	Dismantling and Assembling Differential unit.	2	CO2
LLO 6.1 Repair Drum and Disc Brake. LLO 6.2 Compare Drum and Disc Brake LLO 6.3 Carry out brake bleeding procedure.	6	* Repair Drum/Disc Brake.	2	CO3
LLO 7.1 Identify components of steering Systems. LLO 7.2 Draw steering linkages LLO 7.3 Identify possible causes of failure in steering system LLO 7.4 Suggest remedial action	7	Steering system	2	CO3
LLO 8.1 Identify components of Suspension systems LLO 8.2 Compare rigid axle and Independent suspension systems. LLO 8.3 Identify possible faults. LLO 8.4 Suggest remedial action	8	*Suspension system.	2	CO4
LLO 9.1 Perform battery test. LLO 9.2 Analyze the result of Open Voltage and Specific Gravity test for battery.	9	* Carry out battery test	2	CO5

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 10.1 Identify necessity of wheel balancing and wheel alignment. LLO 10.2 List stepwise procedure for wheel balancing and wheel alignment.	10	Wheel balancing and wheel alignment.	2	CO4

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) : NOT APPLICABLE

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Model of any TWO/FOUR wheel drive (2W/4W Drive) Vehicle.	1
2	Automobile Service tool kit with Axle Stand/Scissor/Hydraulic Screw Jack	2
3	Single plate Clutch components (Coil Spring and Diaphragm).	3
4	Working model of transmission system	3,4,5
5	Bike with Multiplate clutch and brakes	3,6
6	Constant Mesh / Synchro Mesh Gear Box used in four wheeler.	4
7	Working Models of Differential Assembly	5
8	Working Model of Disc Brake and Drum Brake	6
9	Working model of steering gear box Rack and Pinion , Recirculating Ball type and Power steering.	7
10	Model of Semi Elliptical Leaf Spring	8
11	Model of Mac-Pherson suspension.	8
12	12 Volt Lead Acid Battery in working condition ,7-50 AH.	9
13	Multi meter with voltage measuring range 0-100 V.DC ,	9
14	Hydrometer for specific gravity test (Sp.gr. Range of 1.100-1.300)	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	Introduction to Automobile	CO1	8	4	4	8	16
2	II	Automobile Transmission system	CO2	10	4	6	10	20
3	III	Automobile Control Systems	CO3	8	2	4	8	14
4	IV	Automobile Suspension ,wheels and tyres	CO4	8	2	4	6	12
5	V	Introduction to Auto Electrical Systems	CO5	6	2	2	4	8

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
Grand Total				40	14	20	36	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	2			
CO2	3	2	-	2	-	2	2			
CO3	3	2	-	2	-	2	2			
CO4	3	2	-	2	-	2	2			
CO5	3	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	Dr. Kirpal Singh	Automobile Engineering Vol. I and II	Standard Publications,7 December 2020 ISBN-13: 978-818 0142420.
2	C.P. Nakra	Basic Automobile Engineering	Dhanpat Rai Publishing Co. 1 January 2023 ISBN-13.978-9352168828
3	K.K.Jain, R.B.Asthana	Automobile Engineering	McGraw Hill 1JAN 2012 ISBN-13: 978-0070445291
4	Shrinivasan	Automotive Mechanics	McGraw Hill, 23 May-2018, ISBN-13 978-1760421502
5	Crouse W.H. and Anglin D.W.	Automotive Mechanics	McGraw-Hill (31 January 1993,ISBN-13 978-0028009438

Sr.No	Author	Title	Publisher with ISBN Number
6	Rajput R.K	A Text Book of Automobile Engineering	Laxmi Publications Pvt.ltd.,New Delhi, (2007) ISBN:97881170089919.
7	TOM Denton	Automobile Electrical and Electronics Systems	Routledge; 5th edition (12 September 2017) SBN-13 978-1138310490
8	Kamaraju Ramakrishna	Automobile Engineering	PHI Learning Pvt. Ltd., New Delhi, (20 ISBN: 9788120346109.
9	Prof. Dr. Ravi Prakash Arya	Engineering and Technology in Ancient India	INDIAN FOUNDATION FOR VEDIC SCIENCE ,ISBN: 9788194759300 (2020)

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	http://nptel.ac.in/courses. (NPTEL)	Automobile Courses
2	https://www.araiindia.com/Draft AIS Standards.asp.	Certification and Testing Agency (ARAI, Pune)
3	https://www.saeindia.org/.	For Membership of students in (SAE India)
4	https://www.youtube.com/watch?v=wCu9W9xNwtI.	Working of Manual transmission
5	https://www.youtube.com/watch?v=vOo3TLgL0kM.	Working of Synchromesh Gear Box
6	https://www.youtube.com/watch?v=aNGA5Ejq8A4.	Differential working Principle
7	https://www.youtube.com/watch?v=VFu-6tckyc8.	Axle Repair and Maintenance
8	https://www.youtube.com/watch?v=LCMs-7K8nLk.	Alloy wheels manufacturing
9	https://www.youtube.com/watch?v=W1vOzcBbgfg	Working of constant mesh gear box
10	https://www.youtube.com/watch?v=uTeMz6d7hwA	Operation of Synchromesh gear box
11	https://www.youtube.com/watch?v=M5H7UY55rrw	Battery open voltage test
12	https://www.youtube.com/watch?v=devo3kdSPQY&t=3s	Transmission system components.
13	https://www.youtube.com/watch?v=X6JejXjGQiQ	Mac-Pherson strut suspension
14	https://www.youtube.com/watch?v=rbYRif0Iy0w	Vehicle layout

Note :

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