Maharashtra State Board Of Technical Education, Mumbai

Learning and Assessment Scheme for Post S.S.C Diploma Courses

Programme Name	**: Diploma In Automobile Engineering.**		
Programme Code	**: AE**	**With Effect From Academic Year**	**: 2023-24**
Duration Of Programme	**: 6 Semester**	**Duration**	**: 12 Weeks (Industry) + 10 Weeks (Institute)**
Semester	**: Fifth** **NCrF Entry Level : 4.0**	**Scheme**	**: K**

Sr No	Course Title	Abbrevation	Course Type	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme											Total Marks
						Actual Contact Hrs./Week			Self Learning (Activity/ Assignment /Micro Project)	Notional Learning Hrs /Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		
																	Practical						
						CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
													Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
(All Compulsory)																							
1	EMERGING TRENDS IN MECHANICAL ENGINEERING	ETM	DSC	315363	-	3	-	-	-	3	1	1.5	30	70*#	100	40	-	-	-	-	-	-	100
2	TRANSPORT MANAGEMENT AND MOTOR VEHICLE ACT	TMM	DSC	315375	1	4	-	-	2	6	2	3	30	70	100	40	-	-	-	-	25	10	125
3	ADVANCES IN AUTOMOTIVE TECHNOLOGIES	AAT	DSC	315376	-	4	-	2	-	6	2	3	30	70	100	40	25	10	25@	10	-	-	150
4	SEMINAR AND PROJECT INITIATION COURSE	SPI	AEC	315003	-	-	-	1	2	3	1	-	-	-	-	-	25	10	25@	10	25	10	75
5	MAINTENANCE OF AUTOMOBILE SYSTEMS	MAS	SEC	315011	-	2	-	4	-	6	2	-	-	-	-	-	25	10	25#	10	-	-	50
6	INTERNSHIP(12 WEEKS)	ITR	INP	315004	-	-	-	-	-	36 - 40	10	-	-	-	-	-	100	40	100#	40	-	-	200
Elective - I (Any - One)																							
7	AUTOMOBILE BODY ENGINEERING AND SAFETY	ABS	DSE	315377	-	4	-	2	-	6	2	3	30	70	100	40	25	10	25#	10	-	-	150
	AUTOMOBILE TESTING AND VALIDATION	ATV	DSE	315378	-	4	-	2	-	6	2	3	30	70	100	40	25	10	25#	10	-	-	150
	MOTOR VEHICLE INSURANCE AND VALUATION	MIV	DSE	315379	-	4	-	2	-	6	2	3	30	70	100	40	25	10	25#	10	-	-	150
Total					**1**	**17**		**9**	**4**		**20**		**120**	**280**	**400**		**200**		**200**		**50**		**850**

Sr No	Course Title	Abbrevation	Course Type	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme										
						Actual Contact Hrs./Week			Self Learning (Activity/ Assignment /Micro Project)	Notional Learning Hrs /Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		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	

Abbreviations : CL- Classroom Learning , TL- Tutorial Learning, LL-Laboratory Learning, 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.

Note: Notional learning hours for **internship represents the student engagement hours.**

Course Category : Discipline Specific Course Core (DSC) , Discipline Specific Elective (DSE) , Value Education Course (VEC) , Intern./Apprenti./Project./Community (INP) , AbilityEnhancement Course (AEC) , Skill Enhancement Course (SEC) , GenericElective (GE)

EMERGING TRENDS IN MECHANICAL ENGINEERING **Course Code : 315363**

Programme Name/s	**: Automobile Engineering./ Mechanical Engineering/ Mechatronics/ Production Engineering/**
Programme Code	**: AE/ ME/ MK/ PG**
Semester	**: Fifth**
Course Title	**: EMERGING TRENDS IN MECHANICAL ENGINEERING**
Course Code	**: 315363**

I. RATIONALE

As new technologies rapidly transform the manufacturing industry and related sectors, this course on Emerging Trends in Mechanical Engineering is designed to equip diploma pass outs with the latest knowledge essential for their professional growth. The course covers key areas such as green fuels, autonomous and sustainable maintenance practices, data analytics in manufacturing, and the integration of autonomous vehicles. It also explores the use of drones and autonomous technologies in agriculture. By focusing on these current trends, the course aims to enhance the skills of Mechanical, Automobile, Production, and Mechatronics diploma engineers, preparing them to excel in a rapidly evolving technological environment.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Adopt recent trends in mechanical engineering across various mechanical and allied industries.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Select appropriate green fuels for various applications for considering environmental sustainability.
- CO2 - Apply the principles of Autonomous and Sustainable maintenance practices in industry to improve equipment reliability and efficiency.
- CO3 - Identify the levels of autonomy in various mobility systems.
- CO4 - Use data analytics techniques to improve manufacturing processes and systems.
- CO5 - Utilize automated equipment and technologies for various agricultural applications.

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	
315363	EMERGING TRENDS IN MECHANICAL ENGINEERING	ETM	DSC	3	-	-	-	3	1	1.5	30	70*#	100	40	-	-	-	-	-	-	100

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 Explain the concept of green fuels, including their benefits and advantages. TLO 1.2 Differentiate between the various classes of green fuels based on their sources and production methods. TLO 1.3 Describe different types of green fuels derived from plants.	**Unit - I Green Fuels** 1.1 Green Fuels: Introduction, Characteristics, Benefits and advantages. 1.2 Classes of Green Fuels: 1st Generation, 2nd Generation, 3rd Generation and 4th Generation Green Fuels 1.3 Types and Applications of Green Fuels: Biofuel, Hydrogen fuel, Synthetic fuel, Algae fuel, Bio diesel from plants, Applications of Green Fuels in Automobile, Power and Heat, Aerospace sectors.	Lecture Using Chalk-Board Presentations Video Demonstrations
2	TLO 2.1 Explain the concepts of data analytics, including its types and techniques. TLO 2.2 Describe the role of a data analyst in the manufacturing industry. TLO 2.3 Explain the characteristics of big data and its applications in manufacturing processes.	**Unit - II Recent trends in Manufacturing systems** 2.1 Big Data in Manufacturing: Introduction, Big Data Characteristics, Benefits 2.2 Data Analytics in manufacturing: Introduction, Steps in Data Analytics, Types of Data Analytics, Data Analytics techniques, Applications of Big Data analytics in Manufacturing – Preventive maintenance, Product Design, Production Management Automation, Customer Experience, Supply Chain Improvement, Benefits. 2.3 Data Analytics in Quality Control: Introduction, Applications, Benefits.	Lecture Using Chalk-Board Video Demonstrations 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.
3	TLO 3.1 Explain the levels of autonomy in mobility systems. TLO 3.2 Describe the systems used in autonomous vehicles such as Advanced Driver Assistance Systems (ADAS) and Full Self-Driving (FSD) technologies. TLO 3.3 State the application of Autonomous Vehicles for given mobility system.	**Unit - III Autonomous Vehicles** 3.1 Autonomy in Mobility Systems (Autonomous Vehicle): Levels, Components, Benefits and Challenges. 3.2 Systems used in Autonomous Vehicles: Advanced Driver Assistance Systems (ADAS) and Full Self-Driving (FSD) 3.3 Applications of Autonomy in other Mobility Systems: Autonomous Trains, Autonomous Ships, Autonomous Aircrafts (Unmanned Aircraft Systems (UAS)	Lecture Using Chalk-Board Presentations Video Demonstrations
4	TLO 4.1 Describe the concept of Autonomous and Sustainable Maintenance, including the pillars of Total Productive Maintenance (TPM). TLO 4.2 Explain the procedures of Autonomous and Sustainable Maintenance along with their benefits. TLO 4.3 Describe the role of data analytics in Predictive Maintenance. TLO 4.4 Explain the concept of Computerized Maintenance Management Systems (CMMS).	**Unit - IV Recent Trends in Maintenance** 4.1 Autonomous Maintenance: Concept, Pillars of TPM, Implementation steps, benefits. 4.2 Sustainable Maintenance: Concept, Importance, Implementation steps, benefits. 4.3 Data Analytics in Predictive Maintenance: Introduction, concept of Computerized Maintenance Management System (CMMS).	Lecture Using Chalk-Board Video Demonstrations Presentations
5	TLO 5.1 Explain the role of automation in agriculture field. TLO 5.2 Describe the benefits of automated farm equipment. TLO 5.3 Describe the features and advantages of autonomous tractors and their impact on enhancing agricultural practices. TLO 5.4 Describe the applications and advantages of using drones in agriculture sector. TLO 5.5 Explain significant features of government schemes supporting drone usage in agriculture field.	**Unit - V Recent Trends in Agriculture Engineering** 5.1 Automation in Agriculture: Introduction, Automated Farm Equipments - Agri-robots, Harvesting robots, Inspection and Monitoring Agriculture robots, Automatic Seeding and Planting Machine, AI Operated Irrigation Systems, Benefits 5.2 Autonomous Tractor: Self Driving Tractors, Features and Advantages 5.3 Agricultural Drones: Soil and Field Analysis, Crop Monitoring, Plantation, Crop Spraying, Advantages of Drones, Government Schemes for Drone Usage.	Lecture Using Chalk-Board Presentations Video Demonstrations

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES : NOT APPLICABLE.

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	Not Applicable	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	Green Fuels	CO1	5	2	4	4	10
2	II	Recent trends in Manufacturing systems	CO2	6	4	4	8	16
3	III	Autonomous Vehicles	CO3	6	4	4	6	14
4	IV	Recent Trends in Maintenance	CO4	6	2	4	8	14
5	V	Recent Trends in Agriculture Engineering	CO5	7	4	4	8	16
Grand Total				**30**	**16**	**20**	**34**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Two Class test of 30 Marks and Average of two Class test

Summative Assessment (Assessment of Learning)

- Online MCQ based examination - 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	-	3			
CO2	3	-	-	-	2	-	3			
CO3	3	-	-	-	2	-	3			
CO4	3	-	-	-	2	-	3			
CO5	3	-	-	-	3	-	3			

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	Carlos Ricardo Soccol, Satinder Kaur Brar, Craig Faulds, Luiz Pereira Ramos	Green Fuels Technology: Biofuels (Green Energy and Technology)	Springer International Publishing AG; 1st ed. 2016 edition (19 August 2016); 01149344934, ISBN-13: 978-3319302034
2	Fumio Gotoh	Autonomous Maintenance in Seven Steps: Implementing TPM on the Shop Floor	1st Edition, Productivity Press, ISBN-13: 978-0367199869
3	Samuel Theodore, Daniel Lucky	Autonomous Maintenance	Maintenance Pro, 2023, ISBN-13 ?:979-886417453
4	Matthias Hartwig	Self-driving cars	E-book, 2020, by BMW
5	George Dimitrakopoulos, Aggelos Tsakanikas, Elias Panagiotopoulos	Autonomous Vehicles Technologies, Regulations, and Societal Impacts	Elsevier,2021, ISBN-13: 978-0323901376
6	Yan Li, Hualiang Shi	Advanced Driver Assistance Systems and Autonomous Vehicles	Springer, Singapore,2022, ISBN-13: 978-9811950520
7	P Suresh, T. Poongodi, B Balamurugan, Meenakshi Sharma	Big Data Analytics in Smart Manufacturing: Principles and Practices	December 14, 2022 by Chapman & Hall, ISBN-13: 978-1032065519
8	Rania I.M. AlmoselhyRania I.M. Almoselhy, Ravindran Chandran, Abisha Juliet Mary S J	Current Trends in Agriculture & Allied Sciences (Volume-1)	S. P. Publishing, Bhubaneshwar, Odisa,2023, ISBN-13: 978-9359061382
9	Dr. Suman Lata, Mamta J. Patange, Dr. Anand K. Gore, Suchibrata Chamuah and Dr. Chandana Behera	Recent Trends in Agriculture (Volume-5)	Integrated Publications, New Delhi,2023, ISBN-13: 978-9395118644

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.engieimpact.com/insights/green-fuels	Green Fuels
2	https://www.youtube.com/watch?v=T_S7Q3Uede4	Green Fuels
3	https://www.researchgate.net/publication/359732622_Green_fuels_concepts_benefits_and_studies_in_Nigeria/link/624c10bec7ab230e99cef13a/download?_tp=eyJjb250ZXh0Ijp7ImZpcnN0UGFnZSI6InB1YmxpY2F0aW9uIiwicGFnZSI6InB1YmxpY2F0aW9uIn19	Green Fuels
4	https://nitsri.ac.in/Department/Chemical%20Engineering/BRTL12.pdf	Green Fuels
5	https://www.youtube.com/watch?v=4-R5Sh-xSiI&t=5s	Autonomous Maintenance (Total Productive Maintenance Series TPM)
6	https://www.youtube.com/watch?v=ZJ6tr1kkRDg	Sustainability in Manufacturing
7	https://www.youtube.com/watch?v=HgF7E5q9sU4&t=1s	An introduction to autonomous vehicles
8	https://www.youtube.com/watch?v=gEy91PGGLR0	Autonomous car / self-driving car
9	https://www.youtube.com/watch?v=ACxTcsxSYvE	Data Analytics in Manufacturing

EMERGING TRENDS IN MECHANICAL ENGINEERING **Course Code : 315363**

Sr.No	Link / Portal	Description
10	https://www.youtube.com/watch?v=31W0EzcfE74	Big data analytics for manufacturing
11	https://www.youtube.com/watch?v=P2YPG8PO9JU	Agricultural Wonder Drone
12	https://www.youtube.com/watch?v=8-uPCmHX3U0	Agricultural Drones
13	https://www.youtube.com/watch?v=JeU_EYFH1Jk	Artificial intelligence comes to farming in India
14	https://www.youtube.com/watch?v=tSdIgGin_rk	Fully autonomous tractor
15	https://www.skillindiadigital.gov.in/courses/detail/32d86c56-efc6-4c33-9c65-17901e296f8e	Kisan Drone Operator
16	https://www.youtube.com/watch?v=q7tFDw5SAAU	Farming with robots
17	https://www.youtube.com/watch?v=_Dmb1GN52no	Spraying robots

Note :

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

TRANSPORT MANAGEMENT AND MOTOR VEHICLE ACT **Course Code : 315375**

Programme Name/s : **Automobile Engineering.**
Programme Code : **AE**
Semester : **Fifth**
Course Title : **TRANSPORT MANAGEMENT AND MOTOR VEHICLE ACT**
Course Code : **315375**

I. RATIONALE

This course enables students to understand the transportation system as a whole, including the various modes of transportation, their advantages and disadvantages, and how they work together. Transport Management provides knowledge of government rules, regulations and standards, essential for those entering the transportation industry. The transport industry offers excellent employment opportunities for Automobile Diploma Engineers, such as service engineers, fleet managers, depot managers, and insurance surveyors etc. To excel in these roles, they require in-depth knowledge of the Motor Vehicle Act, taxation, insurance, record-keeping, vehicle estimation and valuation, standard operating procedures, and effective driving skills. This knowledge is crucial for developing transport-related policies, ensuring safety regulations, and meeting environmental and legal standards while providing quality services.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Apply legal aspects related to motor vehicle act in effective transport management.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Interpret the Motor Vehicle Act and Traffic Rules
- CO2 - Implement concept of Taxation and Insurance in vehicle registration
- CO3 - Manage the business processes involved in buying and selling vehicles
- CO4 - Select suitable mode of transportation and vehicle according to specific requirements
- CO5 - Distinguish the role of various research organizations in technological advancements and innovations in the motor industry

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	
315375	TRANSPORT MANAGEMENT AND MOTOR VEHICLE ACT	TMM	DSC	4	-	-	2	6	2	3	30	70	100	40	-	-	-	-	25	10	125

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.

TRANSPORT MANAGEMENT AND MOTOR VEHICLE ACT **Course Code : 315375**

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 Interpret the given terms used in Motor Vehicle Act. TLO 1.2 Describe procedure for obtaining the given type of licence according to Motor Vehicle Act. TLO 1.3 Describe procedure for registration of the given type of motor vehicle according to Motor Vehicle Act. TLO 1.4 Apply knowledge of Offenses, Penalties, and Procedures to Address Violations of Traffic Rules. TLO 1.5 Describe the given advanced traffic control system with its features. TLO 1.6 Interpret various traffic signs, explaining their significance and applications. TLO 1.7 Describe the duties and responsibilities of drivers and conductors in various operational contexts. TLO 1.8 Describe the roles and functions of the State and Regional Transport Authority in transport regulation and management.	**Unit - I Introduction to Motor Vehicle Act** 1.1 Transport systems in ancient India: Trade logistics (IKS) 1.2 Motor Vehicle Act: Brief description, Short titles and Definitions of terms used. 1.3 Licensing of Drivers and conductors of Motor Vehicle: a) Driver's Licence - Necessity, Eligibility criteria, Documents required,or's Licence, Power to disqualify conductor's licence, Renewal of conductor's licence. c) Duties and responsibilities of driver and co Procedure to obtain Learner's Licence and Permanent Driving Licence, Driving Test, Validity and Renewal of driving licence, Restriction on use of learner's licence as a driving licence, Addition of class to the driving licence, Suspension or cancellation of driving licence. b) Conductor's License – Necessity, Eligibility criteria, Application for grant of conductor's licence, Revocation of Conductor's Licence, Power to disqualify conductor's licence, Renewal of conductor's licence. c) Duties and responsibilities of driver and conductor. 1.4 Registration of Vehicles: Necessity of registration, Exemption from registration, Procedure of registration of motor vehicles, Display of Registration mark, Validity of certificate of registration, Renewal of registration, Temporary registration, Transfer of Ownership of Motor Vehicle, Suspension and cancellation of registration. 1.5 Offences, Penalties and Procedures: - Regarding driving of vehicle and violation of laws. 1.6 Transport Authorities and Control of Transport: a) Transport authorities and their functions, motor vehicle department Maharashtra, b) Necessity of Permits, Types of Permit -Stage Carriage Permit, Contract Carriage Permit, Private Service Vehicle Permit, Goods Carriage Permit, Tourist permit, National Permit, Temporary Permit, Exemption from Permit 1.7 Control of Traffic: Traffic Signs and Signals, Vehicle navigation system, vehicle tracking system, Advance traffic control devices, intelligent transport system, Smart card.	Case Study Lecture Using Chalk-Board Cooperative Learning 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.
2	TLO 2.1 Describe general provisions regarding construction and maintenance of the given class of motor vehicle. TLO 2.2 Describe method of levying tax for the given class of motor vehicle. TLO 2.3 Describe significance of the given type of motor vehicle insurance. TLO 2.4 Describe the procedure for claiming compensation in the given situation.	**Unit - II Construction of Motor Vehicle, Taxation and Insurance** 2.1 Construction of Motor Vehicle: Overall dimensions, General provision regarding construction and maintenance of motor vehicle, Power of state and central government to make rules. 2.2 Taxation: Objectives, Basis of taxation, Methods of levying tax to motor vehicle, Tax structure for motor vehicles in Maharashtra, Modes of payment of the tax, Tax exemption, Refund of tax. 2.3 Insurance: Types of Motor Vehicle insurance – Comprehensive and Third-Party insurance, Procedure to claim compensation, Motor Accident Claim Tribunal, Liability without fault in certain cases, Provision of compensation in Hit and Run case.	Presentations Lecture Using Chalk-Board Cooperative Learning Case Study
3	TLO 3.1 Describe the duties and responsibilities of a surveyor in the given condition. TLO 3.2 Describe the procedure used for accident survey and valuation of vehicle. TLO 3.3 Describe the significance of warranty for the given vehicle. TLO 3.4 Identify the factors to be considered when buying a new vehicle. TLO 3.5 Categorise the factors to be considered when buying a specific type of vehicle in a given condition. TLO 3.6 Describe procedure for selling the given type of vehicle.	**Unit - III Estimation and Valuation of Vehicle** 3.1 Role of surveyor: Eligibility for surveyor, Procedure to obtain surveyor’s licence, Duties and responsibilities of Surveyor. 3.2 Procedure of accident survey and valuation of vehicle, Claim investigation and Accident Survey Report. 3.3 Importance of warranty system and protection of law. 3.4 Buying a new vehicle: Factors to be considered - Ex-showroom price and on road price, use of vehicle, when and where to buy. 3.5 Buying used vehicles: When and where to buy - Dealers, used car firms, Private sellers, Garages, Auctions. 3.6 Sale of used vehicles: Procedures - Before, During and after sale of vehicle, Auctions, Garages, Private sale, preparing the vehicle documents, selling price.	Presentations Lecture Using Chalk-Board Cooperative Learning Case Study

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 Interpret the given terms used in transport operation. TLO 4.2 Compare different modes of transportation for the given conditions. TLO 4.3 Describe the criteria used for vehicle selection for the given transport operation. TLO 4.4 Describe services provided by transport organization to the given stakeholders. TLO 4.5 Identify the factors to be considered in Bus scheduling for the given requirement. TLO 4.6 Draw a layout of bus depot for the given facilities. TLO 4.7 Calculate the fare/ freight charges of vehicle as per given data. TLO 4.8 Explain the significance of records kept in the given transport organization.	**Unit - IV Passenger and Goods transport operation.** 4.1 Terms used in transportation: Transport vehicle, Public service vehicle, Goods vehicle, Public place, Depot, Route, Trip, Crew, Time table, Vehicle schedule, Fare, Freight charges. 4.2 Modes of transportation and comparison of urban and rural transport. 4.3 Basic elements in Transport Management – Market Potential, Selection of vehicle, Organization setup, Legal compliance, Policies of transport organization towards Passenger and employee service. 4.4 Bus and Crew scheduling: Basic factors in bus, crew (staff) scheduling. 4.5 Bus depot layout: Site selection for depot, Layout, Passenger amenities and infrastructural facilities required. 4.6 Fare and Freight charge calculation in transport organization. 4.7 Record Keeping: Log book, Trip operational sheet, Vehicle ledger, Truck history card, Monthly operational sheet, Goods consignment note, Types of bookings.	Presentations Case Study Cooperative Learning Lecture Using Chalk-Board
5	TLO 5.1 Draw organizational structure of the given transport organization. TLO 5.2 Explain the working of the given transport organization with schematic diagram. TLO 5.3 Describe role of the given research organization in relation to road transport.	**Unit - V Motor Transport and Research organizations** 5.1 Structure and working of Transport Organizations - MSRTC, BEST 5.2 Functions and Role of Research Organizations: Central Institute of Road Transport (CIRT), Automotive Research Association of India (ARAI), Vehicle Research Development and Establishment (VRDE), Central Road Research Institute (CRRI), Petroleum Conservation and Research Association (PCRA).	Lecture Using Chalk-Board Presentations Case Study Site/Industry Visit

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES : NOT APPLICABLE.

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

Assignment

- Prepare a report on registration Process of Motor Vehicle – Steps involved in registration process of given class of motor vehicle.
- Modern traffic management: Case study of implemented modern traffic management system.
- Prepare a report on transfer of ownership: Formalities involved in the given case of transfer of ownership (Examples- Within state/region, Interstate, Class of vehicle, change of owner)
- Transport Organization Management: Prepare a case study report on passenger transport organizations
- Visit Saarathi website to prepare a report on faceless services available on motor vehicle department Maharashtra containing relevant application forms and required documents
- Prepare a visit report on Central Institute of Road Transport/ Automotive Research Association of India/Vehicle Research Development and Establishment/Central Road Research Institute/ Petroleum Conservation and Research Association.
- Prepare a record of forms required for the different activities carried out in transport industries
- Prepare an accidental survey report for accidental vehicle.
- Prepare a report on various e-platforms used in motor vehicle department.
- Prepare a case study on goods transport organizations like VRL logistics Ltd., GATI, TCI, CONCOR etc.
- Prepare a case study on app-based taxi/ rikshaw services.

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 : NOT APPLICABLE

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 Motor Vehicle Act	CO1	16	2	8	10	20
2	II	Construction of Motor Vehicle, Taxation and Insurance	CO2	6	2	4	6	12

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
3	III	Estimation and Valuation of Vehicle	CO3	6	2	4	6	12
4	IV	Passenger and Goods transport operation.	CO4	8	2	8	6	16
5	V	Motor Transport and Research organizations	CO5	4	2	4	4	10
Grand Total				**40**	**10**	**28**	**32**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- tests and assignments

Summative Assessment (Assessment of Learning)

- End semester examination

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	-	-	3	3	3			
CO2	3	3	2	2	3	3	3			
CO3	3	3	3	2	3	3	3			
CO4	3	3	2	2	2	3	3			
CO5	-	-	2	-	3	2	3			

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	Ministry of Transport, Government of India	Central Motor Vehicle Rules 1989	Government of India
2	KLR Publications	The Motor Vehicles Act, 1988 (Bare Act) With Notes	Karnataka Law Reporter Publications
3	Dr.L.P.GUPTA	Insurance Claims Solutions	2016th edition (1 January 2013) ISBN-13 978-9383303038

Sr.No	Author	Title	Publisher with ISBN Number
4	Government of India	Annual Report:Motor Vehicle Accident Fund & Compensation to Victims of Hit and Run Motor Accidents Scheme, 2022	Motor Vehicle Accident Fund Trust General Insurance Council
5	IRDA	Insurance Act,1938 - incorporating all amendments till 2021	Insurance Regulatory and Development Authority of India(IRDAI)
6	Sudarsanam Padam	Bus Transport in India: The Structure, Management and Performance of Road Transport	South Asia Books, ISBN-13 978-8120202221
7	G. John Gunaseelan	Public Sector Road Transport Corporation A Comparative Study with Private Sector	Deep & Deep Publications ISBN-13 978-8176290814

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://morth.nic.in/	Ministry of road transport and highways
2	https://parivahan.gov.in/parivahan/	Intelligent Transport Systems
3	https://parivahan.gov.in/parivahan//node/2702	motor vehicle related services by transport department of government of India
4	https://parivahan.gov.in/parivahan//node/2697	Tourist Permit
5	https://parivahan.gov.in/parivahan//node/2699	Intelligent Transport Systems
6	https://transport.maharashtra.gov.in/1035/Home	Motor vehicle related services in Maharashtra state
7	https://parivahan.gov.in/parivahan//node/2702	Next generation mParivahan
8	https://parivahan.gov.in/parivahan//node/2700	Vehicle location tracking system
9	https://parivahan.gov.in/parivahan//node/2696	BH series
10	https://irdai.gov.in/	motor vehicle insurance related services

Note :

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

ADVANCES IN AUTOMOTIVE TECHNOLOGIES **Course Code : 315376**

Programme Name/s : **Automobile Engineering.**
Programme Code : **AE**
Semester : **Fifth**
Course Title : **ADVANCES IN AUTOMOTIVE TECHNOLOGIES**
Course Code : **315376**

I. RATIONALE

This course equips students with a solid foundation in understanding the transformative impact of technology on the automotive sector. By exploring recent trends, technological innovations, and emission regulations, students gain a holistic perspective essential for pursuing careers in automotive engineering and related fields. This course not only prepares students for current industry demands but also fosters a forward-thinking mindset necessary for adapting to future advancements in automotive technologies. Key technologies covered include Electric Vehicles (EVs), Hybrid Electric Vehicles (HEVs), Dual Clutch Transmission (DCT), Active Cylinder Management (ACM), and Electronic Stability Control (ESC).

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Apply advanced automotive technologies to meet the changing needs of the industry.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Identify advancements in Hybrid Electric Vehicle (HEV) and Fuel Cell Vehicle technologies influenced by emission standards.
- CO2 - Select suitable Electric Vehicle (EV) systems based on battery technologies and charging infrastructure.
- CO3 - Compare EV propulsion systems and advanced transmission technologies based on performance.
- CO4 - Assess the benefits of Active Cylinder Management (ACM), Start-Stop system and engine downsizing.
- CO5 - Analyze vehicle dynamics, safety systems, and factors affecting ride comfort.

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	
315376	ADVANCES IN AUTOMOTIVE TECHNOLOGIES	AAT	DSC	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 Explain the concept of HEV and its architecture. TLO 1.2 Explain regenerative braking with the help of a block diagram. TLO 1.3 Compare EV and FCV based on vehicle range, battery capacity, performance, and efficiency. TLO 1.4 Justify the use of CNG in two-wheeler vehicles. TLO 1.5 Compare BS IV and BS VI emission standards.	**Unit - I Hybrid Electric Vehicles** 1.1 Environmental and Regulatory Considerations: Bharat stage (BS) Emission Standards influencing automotive technology development, hydrogen fuel, Use of CNG in two-wheeler vehicles. 1.2 Hybrid Electric Vehicles (HEV): Introduction to HEV, classification of HEV on the basis of Hybridization Level, Powertrain, Plug-in Capability, Vehicle Segment, Driving Mode 1.3 Common features of hybrid vehicles 1.4 Levels of Hybrid Vehicles: Mild, Medium and Full Hybrid vehicles. 1.5 Efficiencies of Electric motors and I.C. Engines. 1.6 Plug-in Hybrid Electric Vehicles (PHEVs): Differences from HEVs- ability to charge from external power sources, extended electric-only range, and operation modes (electric mode, hybrid mode) 1.7 Fuel Cell Vehicles (FCVs): Proton exchange membrane (PEM) fuel cells and solid oxide fuel cells (SOFCs).	Lecture Using Chalk-Board Presentations Video Demonstrations Site/Industry Visit Model Demonstration

ADVANCES IN AUTOMOTIVE TECHNOLOGIES **Course Code : 315376**

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 Describe an electric propulsion system with a block diagram. TLO 2.2 Select an appropriate electric motor for a given two-wheeler EV. TLO 2.3 Choose an appropriate electric motor for a given four-wheeler EV. TLO 2.4 Compare different types of batteries used in EVs based on capacity, power, and weight. TLO 2.5 Explain the need for a Battery Management System (BMS) in EVs. TLO 2.6 Classify EV charging systems. TLO 2.7 Specify the requirements for high-speed charging of a two/four-wheeler.	**Unit - II Electric Vehicles** 2.1 Electric Vehicles (EVs): Introduction to electric vehicles system- propulsion systems, battery technologies, and charging infrastructure. 2.2 Layout of EV - Two, Three & Four Wheeler vehicles. 2.3 Battery: Types of battery (Lithium ion battery, nickel metal hydride, lead acid), capacity, size, weight and power, Battery Characteristics 2.4 Battery Management System (BSM)- operation 2.5 Electric Motor: Types, components, functions and applications 2.6 Charging Infrastructure: Overview of charging technologies (AC Vs. DC charging), charging stations, connectors, and smart charging solutions.	Lecture Using Chalk-Board Video Demonstrations Presentations Site/Industry Visit
3	TLO 3.1 Differentiate powertrain technologies based on torque, efficiency, and performance. TLO 3.2 Compare propulsion systems using single, dual motors, and all-wheel drive. TLO 3.3 Explain the dual clutch transmission system with a sketch. TLO 3.4 Describe the working of the Automated Manual Transmission (AMT) system. TLO 3.5 Explain the Intelligent Manual Transmission (IMT) system with a sketch.	**Unit - III Powertrain Technologies** 3.1 EV Propulsion Systems: Types of EV propulsion systems (single motor, dual motor, all-wheel drive) and their impact on vehicle performance 3.2 HEV Powertrains: Series Hybrid vehicle, Parallel Hybrid Vehicle, Series parallel Hybrid Vehicle, Comparison of different Powertrain Technologies 3.3 Advanced Transmission Technology: Dual-Clutch Transmission, Automated Manual Transmissions (AMTs), Intelligent Manual Transmission System	Lecture Using Chalk-Board Presentations Model Demonstration Video Demonstrations
4	TLO 4.1 Explain the working principle of Active Cylinder Management and list its benefits. TLO 4.2 Describe the working of the start-stop system at a crossroad signal. TLO 4.3 Explain the concept of a downsized engine and state the benefits of downsizing.	**Unit - IV Advanced Engine Technologies** 4.1 Active Cylinder Management (ACT): Principle and benefits 4.2 Start-Stop Systems: Belt Alternator Starter system- Operation & Benefits. 4.3 Downsizing: Concept of downsizing engines while maintaining or improving performance through turbocharging / Supercharging and direct injection.	Lecture Using Chalk-Board Presentations Video Demonstrations

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.
5	TLO 5.1 Justify the need for a traction control system under certain road conditions. TLO 5.2 Explain the benefits of Electronic Stability Control (ESC). TLO 5.3 Illustrate the working of ESC with sketches. TLO 5.4 identify the factors affecting ride comfort. TLO 5.5 Explain the working of the collision avoidance system with a sketch.	**Unit - V Vehicle Dynamics and Control Systems** 5.1 Handling Characteristics: Study of vehicle dynamics principles, including steering response, cornering behavior, and traction management: Traction Control System (TCS). 5.2 Stability Control System: Principles and operation of electronic stability control (ESC) systems to enhance vehicle stability during cornering and slippery conditions. 5.3 Ride Comfort: Factors affecting ride quality such as suspension design, damping characteristics, and vehicle weight distribution. 5.4 Active Safety Systems: Collision Avoidance System.	Lecture Using Chalk-Board Presentations Video Demonstrations

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 Use emission tester for emission measurement. LLO 1.2 Compare pollutants emitted from Petrol and CNG engines.	1	* Assessment of Engine Emissions and Fuel Impacts Using an Emissions Analyzer	2	CO1
LLO 2.1 Use OBD II scanner LLO 2.2 Test the Start Stop feature of given vehicle. LLO 2.3 Write a report to assess above technology's impact on fuel consumption and emissions.	2	* Impact of Start-Stop Technology on Fuel Consumption and Emissions Using an OBD-II Scanner	2	CO1
LLO 3.1 Demonstrate the operation of Fuel cell using kit. LLO 3.2 Operate Fuel cell kit under different conditions	3	Hydrogen Production and PEM Fuel Cell Efficiency Demonstration Using FCV Kit	2	CO1
LLO 4.1 Identify the aggregates of EV. LLO 4.2 draw layout of EV chassis LLO 4.3 Record benefits of EV chassis as compared to chassis with I.C. engine.	4	* EV Chassis Component Identification and Layout Analysis	2	CO2
LLO 5.1 Use battery analyzer for EV. LLO 5.2 Analyze EV battery pack parameters for performance.	5	* Analysis of EV Battery Voltage and Current Using Multimeter and Analyzer	2	CO2
LLO 6.1 Identify different charging methods and innovative solutions. LLO 6.2 Compare the working of different EV charging methods. LLO 6.3 Record relevant Standard Operating Procedures, precautions, charging times while adopting different charging technologies.	6	Comparative Study of EV Charging Technologies: Home, Public Stations, and Innovative Solutions.	2	CO2

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 7.1 Collect information on three vehicles from the same category. LLO 7.2 Compare their features, specifications and performance. LLO 7.3 Write report containing technology features and performance benefits of the above vehicles.	7	* Performance and Feature Assessment of Contemporary Vehicles: A Three-Brand Comparison.	2	CO1 CO2 CO3 CO4 CO5
LLO 8.1 Visit vehicle manufacturer's website for data collection relevant to the downsizing. LLO 8.2 Report benefits of downsizing of engine on vehicle performance and efficiency	8	Performance and Fuel Efficiency Comparison of Downsized Engines Versus Larger Engines	2	CO3
LLO 9.1 Demonstrate Antilock braking system features using relevant video link. LLO 9.2 Demonstrate Electronic stability control system features using relevant video link. LLO 9.3 Report benefits of ABS and ESC on vehicle stability and drivability	9	Demonstration of ABS and ESC Functions Through Braking in Various Condition	2	CO4
LLO 10.1 Demonstrate Automatic emergency braking system features using relevant video link. LLO 10.2 Report benefits of AEB, Lane-Keeping assist and Adaptive cruise control functions on vehicle safety and driver comfort	10	Demonstration of AEB, Lane-Keeping Assist, and Adaptive Cruise Control Functions	2	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)

Assignment

- Not applicable

Micro project

- 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	Exhaust Gas analyzer: ARAI Approved Device with relevant accessories; Measurement Range: CO- 0 to 10 %, HC- 0 to 10000 ppm, CO2- 0 to 20 %, O2- 0 to 25 %, A/F ratio- 7.35 to 29.40, Lambda- 0.500% to 2.000 % .	1
2	Scan tool: Make: BOSCH and alike; On Board Diagnostics (OBD) IInd Generation Scan Tool, Controller area network enabled, Colour Display, Operating Temperature: 0 to 50ºC, Internal Storage: 4 AAA batteries, External Power: 7 to 18 volts; Generic tool; Accessories: Extender cable, OBD II Cable; Relevant optional accessories;	2
3	Fuel Cell kit: Demonstration kit for fuel cell electric car principle	3
4	Digital Multimeter: LCD Display, 0 to 50ºC Operating Temperature, DC voltage- 200mV to 1000 V DC, 2 to 1000 V Alternating Current, Current: 2mA to 20 A DC, Diode Test, Continuity Test- Audible buzzer, Resistance: 200 Ohm to 200 Mega Ohm; Accessories: Test leads, Current Clamp 300 A, Current Clamp Adapter.	3,4,5,6
5	Electric Vehicle chassis or operational cut section of EV. Any make and model	4,5,6
6	EV Integrated Detection Tool: - Specifications/ Capabilities: electric vehicle battery detection and vehicle system detection functions and integrates oscilloscope, multimeter, insulation tester and current clamp. compatible with the latest EV architecture.	5

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	Hybrid Electric Vehicles	CO1	12	4	8	8	20
2	II	Electric Vehicles	CO2	10	4	4	8	16
3	III	Powertrain Technologies	CO3	6	2	4	6	12
4	IV	Advanced Engine Technologies	CO4	4	0	4	4	8
5	V	Vehicle Dynamics and Control Systems	CO5	8	2	4	8	14
Grand Total				**40**	**12**	**24**	**34**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- For laboratory learning 25 Marks
- Two-unit tests of 30 marks and average of two-unit tests.

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	-	2			
CO2	3	2	1	2	-	2	2			
CO3	3	1	-	1	-	1	2			
CO4	3	2	-	2	-	1	1			
CO5	3	-	-	-	-	-	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	Approx. 280 authors from industry and the university and college sector	Automotive Handbook	11th Edition April 2022, Robert Bosch GmbH ISBN13: 9781119911906
2	Jack Erjavec	Automotive Technology A Systems Approach	7th Edition Year: 2010, Delmar ISBN13:9781337794213 ISBN10: 133779421X
3	James D. Halderman	Automotive Technology: Principles, Diagnosis, and Service	4th Edition Year: 2012, PEARSON ISBN10: 0132542617 ISBN13: 9780132542616
4	G. K. Awari, V. S. Kumbhar, R.B. Tirpude	Automotive Systems, Principles and practices	1st edition 2021, CRC Press, ISBN13: 9780367498429
5	Rajesh Rajamani	Vehicle Dynamics and Control	Second Edition 2012, ISBN13: 9781461414322

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description

ADVANCES IN AUTOMOTIVE TECHNOLOGIES **Course Code : 315376**

Sr.No	Link / Portal	Description
1	https://www.youtube.com/watch?v=nrxmQhbZUTc	The Battery Basics: Understanding Lithium-Ion, Lead-Acid and More
2	https://www.youtube.com/watch?v=pnw1_ClC5Uw	Making of Electric vehicle Battery in India.
3	https://nap.nationalacademies.org/read/25542/chapter/9#203	Hybrid EV Powertrain
4	https://www.youtube.com/watch?v=h8yXOdS7Cb0	Smart hybrid cars dual battery engine support SHVS
5	https://www.youtube.com/watch?v=w-s3BqLlJ4A	Hybrid Electric Vehicle E-Learning Module
6	https://www.youtube.com/watch?v=mNOYS-duUJY	EV Electrical Systems basics
7	https://www.youtube.com/watch?v=HfN5dEeUyuE	Electric Vehicle Powertrain Components - Basics
8	https://www.youtube.com/watch?v=q7D1SaQF1T8	The Future of Automotive Innovation
9	https://www.youtube.com/watch?v=yoohR8sar5g	ACT - Active cylinder management

Note :

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

Programme Name/s	**: Automobile Engineering./ Artificial Intelligence/ Artificial Intelligence and Machine Learning/ Automation and Robotics/ Cloud Computing and Big Data/ Civil Engineering/ Chemical Engineering/ Computer Technology/ Computer Engineering/ Civil & Rural Engineering/ Construction Technology/ Computer Science & Engineering/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele-communication Engg./ Electrical and Electronics Engineering/ Electrical Power System/ Electronics & Communication Engg. Electronics Engineering/ Computer Hardware & Maintenance/ Industrial Electronics/ Information Technology/ Computer Scie & Information Technology/ Civil & Environmental Engineering/ Mechanical Engineering/ Mechatronics/ Production Engineering Computer Science/ Electronics & Computer Engg.**
Programme Code	**: AE/ AI/ AN/ AO/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CW/ DE/ DS/ EE/ EJ/ EK/ EP/ ET/ EX/ HA/ IE/ IF/ IH/ LE/ ME/ MK/ PG/ SE/ TE**
Semester	**: Fifth**
Course Title	**: SEMINAR AND PROJECT INITIATION COURSE**
Course Code	**: 315003**

I. RATIONALE

Most of the diploma graduates lack the confidence and fluency while presenting papers or interacting verbally and expressing themselv with a large gathering. Seminar presentation boosts the confidence of the students and prepares them precisely for facing the audienc interviews and group discussions. The course on seminar is to enhance student's ability in the art of academic writing and to present it. also helps broaden the minds of the participants. Through this course on Seminar, students will develop new ideas and perspectives of t subject /themes of emerging technologies and services of their area of studies. Project initiation enhances project planning skill whi establishes measurable objectives and interaction skills.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences: Present a seminar on the selected theme/area of study effectively and confidently to the specific audience and stakeholders. Plan innovative solutions independently or collaboratively to the identified problem statement.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Identify topics of seminar presenting to the large gathering at the institute/conference.
- CO2 - Collect relevant and updated research-based data and information to prepare a paper of seminar presentation.
- CO3 - Apply presentation skills.
- CO4 - Create conducive environment for learning and discussion through seminar presentation.
- CO5 - Identify a problem statement and establish the action plan for the successful completion of the project.

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		Tota Mark
															Practical							
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA			
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min		
315003	SEMINAR AND PROJECT INITIATION COURSE	SPI	AEC	-	-	1	2	3	1	-	-	-	-	-	25	10	25@	10	25	10	75	

V. General guidelines for SEMINAR and Project Initiation

- The seminar must be related to emerging trends in engineering / technology programme or may be inter/ multi-disciplinary, based on industry expected outcomes of the programme.
- The individual students have different aptitudes and strengths. Therefore, SEMINAR should match the strengths of students. For this purpose, students shall be asked to select the TITLE (Theme)of SEMINAR they would like to prepare and present.
- Seminar titles are to be finalized in consultation with the faculty mentor.

- Seminar must involve logic development of applications of various technologies/ processes applicable in industry.
- Seminar must be assigned to the single student. However, support of other students may be sorted while presenting the seminar
- Students are required to prepare using relevant software tools, write ups for presentation
- Students shall submit One Hard copy and one Soft copy each of the presentation and may be encouraged to keep a recorded copy of t presentation made during the seminar.
- Batch of 3-4 students shall be formed for project initiation.
- Projects give a platform for the students to showcase an attitude of inquiry to identify the problem statement related to the programm Students shall Identify the information suggesting the cause of the problem and possible solutions
- Students shall study and assess the feasibility of different solutions and the financial implications.
- Students should collect relevant data from different sources (books/internet/market/suppliers/experts through surveys/interviews).
- Students shall prepare required drawings/ designs and detailed plan for the successful execution of the work.
- Students may visit the organisation pertaining to the problem statement as part of initial study.

VI.Guidelines for Seminar preparation and presentation :

Once the title/topic of a seminar has been finalized and allotted to the student, the teacher's role is important as guide, mentor and motivator, to promote learning and sustain the interest of the students.

Following should be kept in mind while preparing and presenting the seminar:

- **Seminar Orientation cum -briefing**: the seminar topics/themes should be innovative, novel and relevant to the curriculum of the programme, and also aligned to the expectations of industry.
- **Seminar Literature surve**y: Information search and data collection: the information and data should be authentic, realistic and relev to the curriculum of the programme.
- **Seminar Preparation, and presentation**: The seminar shall be present with suitable software tools and supporting handout/notes. T presentation of seminar should not be more than 20 minutes including Q-A session.

The following guidelines may be followed for Project Initiation

- **Establishing project scope:** Determine the boundaries of the project.
- **Defining project objectives:** Set clear and measurable objectives that align with the project's purpose.
- **Stakeholder identification and analysis:** Perform an exercise in identifying all stakeholders involved in the project and analyzing th needs and expectations.
- **Team Formation:** Carefully build a team with the necessary skills and expertise to execute the project successfully.
- **Documentation.** Create a project planner showcasing the action plan, define the project's scope, outline the project definition, and design of the project. The document has to be made available to all stakeholders

VII. Criteria of Assessment /Evaluation of Seminar

A. Formative Assessment (FA) criteria

The assessment of the students in the fifth semester Progressive Assessment (PA) for 50 marks is to be done based on following crite

A. Suggestive RUBRICS for assessment

Sr. No.	Criteria	Marks
1	Selection Topic/Theme of seminar	05
2	Literature review and data presentation	05
3	Quality of Preparation and innovativeness	05
4	Q-A handling	05
5	Time Management	05
6	Seminar Presentation report	10

Rubrics for assessment of Project Initiation

Sr. No.	Criteria	Marks
1	Selection of Theme of Problem Statement and its innovativeness	05
2	Stages of development of Action plan	05
3	Prototyping	05

The total marks as per above out of 50, shall be converted in proportion of 25 marks.

B. Summative Assessment criteria/

The summative assessment of the students in the fifth semester End-Semester-Examination (ESE) for 50 marks is to be done based on following criteria.
This assessment shall be done by the Faculty.

Suggestive **RUBRICS** may be developed by the faculty

Sr. No.	Criteria	Marks
1	Quality of information/Knowledge presented in SEMINAR	10
2	Creativity, Innovation in SEMINAR presentation	10
3	Response to the question during seminar presentation	10
4	Establishment of Innovative Problem Statement and its presentation	10
5	Objectives of the project and action plan	10

The total obtained marks shall be converted in proportion of 25 marks.

VIII. Suggestive CO-PO Mapping

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**
CO-1	3	1	0	-	2	2	3		
CO-2	2		2	-	2	1	3		
CO-3	3	1	1	2	1	2	3		
CO-4	2	0	0	2	1	2	3		
CO-5	3	3	3	2	2	3	3		

VIII.Typographical instructions/guidelines for seminar preparation & presentation

- The seminar PPT shall be computer typed (English- British)
- Text Font -Times New Roman (TNR), Size-12 point
- Subsection heading TNR- 12 point bold normal
- Section heading TNR- 12 capital bold
- Chapter Name/ Topic Name – TNR- 14 Capital
- All text should be justified. (Settings in the Paragraph)
- Different colors text/diagrams /tables may used
- The name of the candidate, diploma (department), year of submission,name of the institute shall be printed on the first slide of PPT.

IX.Seminar and Project Initiation Report
On completion and presentation of Seminar, every student will submit a brief report which should contain the following:

- Cover Page (as per annexure 1)
- Title page (as per annexure 2)
- Certificate by the Guide (as per annexure 3)
- Acknowledgment (The candidate may thank all those who helped in the execution of the project).
- Abstract of Paper presented in the seminar (It should be in one page and include the purpose of the seminar & methodology if a .)
- Index

- List of Figures
- Introduction
- Literature Review
- Information/Chapters related to Seminar topic
- Advantages and Disadvantages
- Conclusion
- Project Initiation : a) Description of problem statement. b) Scope and objectives. c) State holder d) Platform/ Equipment/ Resou identification.
- Bibliography
- References

NOTE: Seminar report must contain only relevant – technology or platform or OS or tools used and shall not exceed 25-30 pages.

Details of Softcopy to be submitted:
The soft copy of seminar presentation is required to be provided on the back cover of the seminar report in clear packet, which shoul include the following folders and contents:

1.Presentation (should include a PPT about project in not more than 15 slides)
2.Documentation (should include a word file of the project report)

NOTE: Soft copy must be checked for any harmful viruses before submission.

X. Sample Formats

1) Cover Page - Annexure-I

2) Index - Annexure-II

3) Assessment - Annexure-III

Annexure - I

MSBTE LOGO

SEMINAR Report

Institute Logo

"SEMINAR Title_ _ _ _ _ _ _ _ _ _ _ _ _"

as a partial fulfilment of requirement of the

THIRD YEAR DIPLOMA IN

Submitted by

Name of Student **Enrollment Number**

FOR THE ACADEMIC YEAR 20___20___

(H.O.D) **(Principal)**

(Internal Guide) **(External Examiner)**

Annexure - II

Institute Name

(An Affiliated Institute of Maharashtra State Board of Technical Education)

Table of Contents

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***Students can add/remove/edit chapter names as per the discussion with their guide**

Annexure - III

Format for SEMINAR and PROJECT INITIATION Assessment /Evaluation

Formative Assessment

CRITERIA AND WEIGHTAGE

Enrollment No	**1** Selection Topic/Theme of seminar (5)	**2** Literature review and data presentation (5)	**3**. Quality of Preparation and innovativeness (5)	**4** Q-A handling (5)	**5** Time Management (5)	6. Seminar Presentation report (10)	**7** Selection of Theme of Problem Statement and its innovativeness (5)	**8** Stages of development of Action plan (5)	**9.** Prototyping (5)	**10.** Total (50)	Sc to (

SummativeAssessment

CRITERIA AND WEIGHTAGE

Enrollment No	**1.** Quality of information/Knowledge presented in SEMINAR **10**	**2** Creativity, Innovation in SEMINAR presentation 10	**3**. Response to the question during seminar presentation 10	**4** Establishment of Innovative Problem Statement and its presentation 10	**5** Objectives of the project and action plan 10	Total **(50)**	Scaled to **(25)**

Sign: **Name: ----------** **(Course Expert/s)**	**Sign:** **Name: ----------** **(Program Head)** **(Information Technology)**

MAINTENANCE OF AUTOMOBILE SYSTEMS **Course Code : 315011**

Programme Name/s : **Automobile Engineering.**
Programme Code : **AE**
Semester : **Fifth**
Course Title : **MAINTENANCE OF AUTOMOBILE SYSTEMS**
Course Code : **315011**

I. RATIONALE

This course enables the students to acquire hands on skill related to maintenance of motor vehicle which will be helpful to get employment in automotive service sector and entrepreneurship development. It includes various automobile workshop practices like inspection, checking, troubleshooting, servicing and repair related to engine, transmission, brake, steering and suspension system etc. for keeping the vehicle in good running condition and reduce emissions.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Maintain automobile engine, transmission, control and comfort systems of the vehicles.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Select relevant tools and equipment required for maintenance of vehicle.
- CO2 - Service different types of engine systems.
- CO3 - Troubleshoot major assemblies of transmission system.
- CO4 - Maintain automobile Control and Comfort systems (HVAC) 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	
315011	MAINTENANCE OF AUTOMOBILE SYSTEMS	MAS	SEC	2	-	4	-	6	2	-	-	-	-	-	25	10	25#	10	-	-	50

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 Explain the safety precautions to be taken while using the given tool / equipment with justification. TLO 1.2 Select relevant tools and equipment required for the given application. TLO 1.3 Explain the use of the given tool/equipment with justification. TLO 1.4 Select relevant maintenance procedure for the given automobile component. TLO 1.5 Explain the given type of workshop record with its significance.	**Unit - I Automobile Workshop tools, Equipment and Maintenance Management** 1.1 General safety precautions and procedures in automobile workshop. 1.2 Functions of major automobile workshop tools and equipment with safety precautions - Wheel aligner, Wheel balancer, Engine analyzer, Hydraulic lift, Compressor, Injector tester, Compression tester, Cylinder bore gauge, Battery tester, Pneumatic gun, Timing gun. 1.3 Safety procedure for using power tools and equipment (electrically, hydraulically and pneumatically operated). 1.4 Necessity and Types of maintenance – Preventive maintenance, Scheduled maintenance, Breakdown maintenance. 1.5 Record keeping: Necessity and types of workshop records – History sheet, Work orders /Job cards, Activity file, Service manual, Spare part register, Spares procurement register.	Lecture Using Chalk-Board Hands-on Video Demonstrations Presentations

MAINTENANCE OF AUTOMOBILE SYSTEMS **Course Code : 315011**

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 Identify possible causes for the given fault in the engine systems and their remedies. TLO 2.2 Explain with sketch the procedure of engine compression test. TLO 2.3 Describe servicing of the given engine system with relevant tools/equipment. TLO 2.4 Describe the procedure for Phasing and calibration of fuel injection pump. TLO 2.5 Describe with schematic diagram engine tune up procedure for the given engine.	**Unit - II Engine Maintenance** 2.1 Engine troubleshooting : a) Engine smoke, Engine Knocking, Engine misfire, b) Compression test, vacuum test, cylinder leakage test. 2.2 Lubrication system service: Change oil filter, check oil pump, diagnose causes for excessive oil consumption, external oil leakage and low oil pressure in an engine. 2.3 Fuel feed system service: Injector cleaning and testing of MPFI and CRDI system, FIP Phasing and calibration. 2.4 Cooling system servicing: Refilling of radiator, pressure testing, thermostat checking, leakage testing, radiator fan testing. 2.5 Engine servicing: Checking and servicing of engine components – Cylinder head, Cylinder block, Cylinder liners, Piston, Piston rings, Crank shaft, Connecting rod, Valves, Tuning of engine.	Lecture Using Chalk-Board Presentations Video Demonstrations Hands-on
3	TLO 3.1 State the causes and relevant remedies for the given fault in the transmission system components. TLO 3.2 Explain the servicing procedure for the given transmission system components. TLO 3.3 Explain with sketch backlash adjustment in the given pair of final drive and differential assembly. TLO 3.4 Describe with sketch lubrication of transmission system.	**Unit - III Transmission System Maintenance** 3.1 Maintenance of Clutch: a) Checking clutch plate (for thickness, run out, rivet depth, torsion spring weakness, hub splines), b) Pressure plate (for wear, scratches, scoring and warpage, free and seated height of pressure springs), c) Clutch shaft (for bent and distorted splines), d) Clutch adjustments - types and procedure, e) Troubleshooting for clutch slip, clutch noise, clutch grab and chatter. 3.2 Maintenance of Gearbox: a) Checking gearbox for run out of main shaft and lay shaft, oil seals, bearings, worn out gears and synchromesh unit. b) Gearbox troubleshooting – Causes and remedies for Gear box noise, Hard gear shifting. 3.3 Maintenance of propeller shaft and universal joint assembly: Checking for Straightness of shaft, wear of slip joint, wear and lubrication of universal joint. 3.4 Maintenance of rear axle: Checking and adjusting final drive for ring gear run-out, backlash in ring gear and bevel pinion, tooth contact between ring gear and pinion, backlash in differential gears, bearing preload –necessity and procedure. 3.5 Troubles, causes and remedies of propeller shaft, differential and rear axle. 3.6 Lubrication of transmission system.	Lecture Using Chalk-Board Presentations Video Demonstrations Hands-on

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 Identify possible causes for the given fault in vehicle control system and their remedies. TLO 4.2 Explain servicing procedure for braking system of the given vehicle with relevant tools/equipment. TLO 4.3 Describe the routine maintenance procedure of the given automotive system. TLO 4.4 Identify causes for the given fault in car air conditioning system and their remedies. TLO 4.5 Describe with sketch procedure for refrigerant leakage testing in HVAC system.	**Unit - IV Maintenance of vehicle control and HVAC system** 4.1 Maintenance of brakes: a) Inspection of master cylinder, wheel cylinder, brake drum, brake lining, brake disc and brake pads, b) Adjustment of hydraulic brakes – shoe clearance, brake pedal free travel, pedal to floor clearance, parking brake adjustment, c) Types of brake bleeding, procedure for bleeding of hydraulic brakes, d) Troubles, causes and remedies of hydraulic and Air brake system. 4.2 Troubleshooting of suspension and steering system 4.3 Maintenance of wheels and tyres: Care of wheels and tyres, procedure of wheel balancing and wheel alignment by wheel alignment gauges. 4.4 Maintenance of HVAC system: a) Troubleshooting of the air conditioning compressor, blower, evaporator, condenser, receiver and dryer, expansion valve, b) Refrigerant leakage testing procedure.	Lecture Using Chalk-Board Video Demonstrations Hands-on Presentations

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 the special tools and equipment with specifications available in the laboratory. LLO 1.2 Select appropriate tools and equipment in given situation. LLO 1.3 Follow relevant safety procedures for various tools and equipment.	1	* Automobile workshop tools and Equipment.	2	CO1
LLO 2.1 Identify different record keeping formats used in automobile workshop. LLO 2.2 Interpretation of different record keeping formats. LLO 2.3 Fill and maintain different record keeping formats used in automobile workshop.	2	Automobile workshop records for two/four-wheeler.	2	CO1
LLO 3.1 Diagnose common faults in fuel feed system in petrol / diesel engine. LLO 3.2 Replace faulty/worn out parts of the fuel feed system. LLO 3.3 Check fuel flow rate and DTC on OBD II after replacement of faulty/worn out parts.	3	Servicing the engine fuel feed system.	2	CO2

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 4.1 Check and replace faulty/ worn out components of the engine lubrication system. LLO 4.2 Check oil level, external leakages on the given engine.	4	Servicing of the engine lubrication system.	2	CO2
LLO 5.1 Identify possible causes for the given fault in engine cooling system and their remedies. LLO 5.2 Check and replace of various components of the engine cooling system. LLO 5.3 Perform coolant flushing for the given vehicle. LLO 5.4 Perform leak detection in cooling system with relevant tools/equipment.	5	* Servicing of engine cooling system.	2	CO2
LLO 6.1 Choose the relevant equipment and tools required for the compression test. LLO 6.2 Perform compression testing on the Petrol/Diesel engines. LLO 6.3 State the causes of low/high compression pressure during test.	6	* Compression test on petrol/diesel engine.	2	CO2
LLO 7.1 Dismantle cylinder head of the engine using appropriate tools. LLO 7.2 Inspect conditions of components of cylinder head. LLO 7.3 Replace worn out components of cylinder head.	7	* Servicing cylinder head of multicylinder petrol /diesel engine.	2	CO2
LLO 8.1 Dismantle cylinder block of the given engine. LLO 8.2 Check wear of cylinder block with appropriate tools. LLO 8.3 Suggest possible causes for excessive bore wear.	8	Servicing of cylinder block of multicylinder petrol /diesel engine.	2	CO2
LLO 9.1 Identify tools and equipment required for servicing of pistons and connecting rod. LLO 9.2 Service piston and connecting rod assembly. LLO 9.3 Measure various parameter as per manufacturer manual.	9	Servicing of piston and connecting rod assembly of multicylinder Petrol/Diesel engine.	2	CO2
LLO 10.1 Identify tools/equipment essential to perform engine tune up procedure. LLO 10.2 Perform tune up procedure on petrol/diesel engine.	10	* Petrol/diesel engine tune-up.	2	CO2

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 11.1 Dismantle the given Single plate dry clutch assembly. LLO 11.2 Measure various parameters of given single plate clutch assembly. LLO 11.3 Assemble the dismantled Single plate dry clutch. LLO 11.4 Suggest probable causes and their remedies for common clutch troubles.	11	* Servicing of single plate dry coil spring/diaphragm type clutch assembly.	2	CO3
LLO 12.1 Dismantle the given synchromesh gearbox. LLO 12.2 Check and replace worn out components of gearbox if required. LLO 12.3 Assemble the dismantled synchromesh gearbox. LLO 12.4 Check for smooth operation of gearbox after assembly.	12	Servicing of synchromesh gearbox.	2	CO3
LLO 13.1 Service differential assembly of the given vehicle. LLO 13.2 Observe conditions of differential components. LLO 13.3 Adjust backlash in differential assembly.	13	* Servicing of final drive and differential assembly.	2	CO3
LLO 14.1 Service propeller shaft and universal joint of the given vehicle. LLO 14.2 Check and replace various parts as per requirement.	14	Servicing of propeller shaft and universal joint assembly.	2	CO3
LLO 15.1 Check and replace components of hydraulic brake system for efficient working. LLO 15.2 Adjust of brake pedal free play and check for brake fluid leakage.	15	* Servicing of hydraulic brake system.	2	CO4
LLO 16.1 Identify the need of brake bleeding in hydraulic braking system. LLO 16.2 Perform brake bleeding of hydraulic braking system. LLO 16.3 Check for the proper working of hydraulic braking system.	16	Bleeding of hydraulic braking system.	2	CO4
LLO 17.1 Identify faults in suspension system of the given vehicle. LLO 17.2 Replace damage parts of the suspension system as per requirement. LLO 17.3 Check performance of suspension by taking test drive.	17	Troubleshooting of car/LMV suspension system.	2	CO4
LLO 18.1 Identify the faults in steering system of the given vehicle. LLO 18.2 Check and replace the worn out components if required. LLO 18.3 Adjust the clearance in steering gearbox as per requirement.	18	Troubleshooting of car/LMV steering system.	2	CO4

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 19.1 Perform wheel balancing and wheel alignment on vehicle. LLO 19.2 Explain parameters measured in this process.	19	* Wheel balancing and wheel alignment of vehicle.	2	CO4
LLO 20.1 Identify fault in HVAC system of vehicle. LLO 20.2 Perform Leak test on the HVAC system. LLO 20.3 Replace worn out components of HVAC system. LLO 20.4 Check proper working of HVAC system.	20	* Troubleshooting of HVAC system.	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	Single plate dry coil spring/ diaphragm type clutch assembly of LMV/HMV.	11
2	Sliding mesh/Constant mesh/ Synchromesh gearbox of LMV/HMV in good running condition.	12
3	Final drive and differential assembly of LMV/HMV in good running condition.	13
4	Propeller shaft and universal joint assembly of LMV/HMV in good running condition.	14
5	Actual steering gear boxes of LMV/HMV in good working condition. (Rack pinion type, Recirculating ball and Nut type, Worm and roller type).	18
6	a) Wheel Balancer- max power consumption: 1.1 KW, Balancing Speed <100 rpm, Balancing Accuracy: 10 gm for truck, Cycle time for wheel: 20sec, Diameter Setting range: 10”-30”, Max Wheel Diameter 1300mm, Max Wheel weight: 250Kg. b) Wheel Aligner- Equipped with variable height camera support, Vehicle orientation directional indicator, located on camera beam, advanced customer database, Advanced alignment measurement, custom vehicle specification, front/rear/ all/zoom reading, Individual Camber, Caster and Toe, Initial/Final printout in graphical and text. Parameter, Range, Accuracy: Camber ±10°, ±2’, Caster ±20°, ±6’; Kingpin Inclination: ±20°, ±6’, Toe-in and Toe-out ±20°, ±2’.	19
7	a) Refrigerant Recovery Machine- 0.75Hp, 230V 50Hz, Recovery tank capacity-1L. b) Refrigerant Leak detector kit (UV dye kit)	20
8	Injector tester- pressure range: 0-60 MPa, fuel tank of 1L	3
9	a) Pressure tester for cooling system- 0-4 bar, b) Antifreeze refractometer, 3-in-1 antifreeze coolant tester for checking freezing point.	5
10	Compression tester for petrol and diesel engine.	6
11	Cylinder bore gauge- resolution 0.01mm, range- 50-160 mm, depth 250mm.	8

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
12	a) Hydraulic lift- capacity 3 Ton. b) Air compressor- 1.5 HP, 23Lit, 1300W c) Battery charger- Input 220-240V AC 50Hz, Output-12V, 8A, starting current 70A. d) Pneumatic nut runner- 10-60 Nm e) Engine analyzer- Generic OM123 OBD II.	All
13	Actual working engine (Multicylinder 4 stroke SI and CI engine above 1000CC) setup with all accessories.	All
14	Light Motor Vehicle: A modern car /jeep of any make and model along with all relevant accessories and systems.	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	Automobile Workshop tools, Equipment and Maintenance Management	CO1	3	0	0	0	0
2	II	Engine Maintenance	CO2	6	0	0	0	0
3	III	Transmission System Maintenance	CO3	5	0	0	0	0
4	IV	Maintenance of vehicle control and HVAC system	CO4	6	0	0	0	0
Grand Total				**20**	**0**	**0**	**0**	**0**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- For laboratory learning 25 Marks.

Summative Assessment (Assessment of Learning)

- End semester assessment of 25 marks for laboratory learning.

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	3			
CO2	3	3	2	2	2	2	3			
CO3	3	3	2	2	2	2	3			

CO4	3	3	2	2	2	2	3			

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	R. B. Gupta	Automobile Engineering	Satya Prakashan, New Delhi, 2016 ISBN-13. 978-9351921912
2	Jigar Doshi, Dhruv Panchal, Jayesh Maniar	Vehicle Maintenance and Garage Practice	PHI Learning Pvt. Ltd. Delhi, 2014 ISBN-9788120349827
3	Schwaller, Anthony	Motor Automotive Technology	Delmar Publishers 1998 ISBN-13-978-08227351004
4	Jack Erjavec	Automotive Technology	Delmar Cengage Learning, 2020 ISBN-13-978-1337794213
5	Crouse, Anglin	Automotive Mechanics	Tata McGraw-Hill Education, New Delhi, 2017 ISBN-13-978-0070634350

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.youtube.com/watch?v=luoLh0WBtTw	Engine diagnosis.
2	https://www.youtube.com/watch?v=sn2XkEEDLKg	Cylinder head crack.
3	https://www.youtube.com/watch?v=8KAszximKhw	Engine overheating.
4	https://www.youtube.com/watch?v=k0ovUHEOtyE	Engine cooling system servicing.
5	https://www.youtube.com/watch?v=1vejKSxzGC8	Cylinder bore inspection
6	https://www.youtube.com/watch?v=_tN4G8e3Qao	Inspection of piston and connecting rod.
7	https://www.youtube.com/watch?v=QfW1E3Dvt1U	Inspection of clutch
8	https://www.youtube.com/watch?v=HzfNatzyz68&t=15s	Clutch pedal adjustment
9	https://www.youtube.com/watch?v=PWtpfvUZoYA	Differential Service - Bevel Gear Runout Inspection
10	https://www.youtube.com/watch?v=qmnnEw5_n7c	Inspection of differential

Note :

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

Programme Name/s	**: Automobile Engineering./ Artificial Intelligence/ Artificial Intelligence and Machine Learning/ Automation and Robotics/ Cloud Computing and Big Data/ Civil Engineering/ Chemical Engineering/ Computer Technology/ Computer Engineering/ Civil & Rural Engineering/ Construction Technology/ Computer Science & Engineering/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele-communication Engg./ Electrical and Electronics Engineering/ Electrical Power System/ Electronics & Communication Engg./ Electronics Engineering/ Computer Hardware & Maintenance/ Industrial Electronics/ Information Technology/ Computer Science & Information Technology/ Civil & Environmental Engineering/ Mechanical Engineering/ Mechatronics/ Production Engineering/ Computer Science/ Electronics & Computer Engg.**
Programme Code	**: AE/ AI/ AN/ AO/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CW/ DE/ DS/ EE/ EJ/ EK/ EP/ ET/ EX/ HA/ IE/ IF/ IH/ LE/ ME/ MK/ PG/ SE/ TE**
Semester	**: Fifth**
Course Title	**: INTERNSHIP(12 WEEKS)**
Course Code	**: 315004**

I. RATIONALE

Globalization has prompted organizations to encourage skilled and innovative workforce. Internships are educational and career development opportunities, providing practical/ hands-on experience in a field or discipline. Summer internship is an opportunity for students to get accustomed to modern industry practices, apply the knowledge and skills they've acquired in the classroom to real-world situations and become familiar with industry environments before they enter the professional world. Keeping this in mind, industrial training is incorporated to all diploma programmes as it enables the student to get equipped with practical skills, soft skills and life skills

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences: Apply skills and practices to industrial processes.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Observe time/resource management and industrial safety aspects.
- CO2 - Acquire professional experience of industry environment .
- CO3 - Establish effective communication in working environment.
- CO4 - Prepare report of assigned activities and accomplishments.

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	
315004	INTERNSHIP(12 WEEKS)	ITR	INP	-	-	-	-	36 - 40	10	-	-	-	-	-	100	40	100#	40	-	-	200

Legends: # External Assessment

Note: Credits for Industrial Training are in-line of guidelines of NCrF : The industrial training is of 12 weeks considering 36-40 hours per week engagement of students (as per Guidlines of GR of Maharashtra Govt.) under Self Learning with guidance of industry supervisor / Mentor

V General guidelines for organizing Industrial training

The Industry/organization selected for Industrial training/ internships shall be Government/Public Limited/ Private limited / Startup /Centre of Excellence/Skill Centers/Skill Parks etc.

1. Duration of Training - 12 weeks students engagement time
2. Period of Time slot - Between 4th and 5th semester (12 weeks) i.e. commencement of internships will be immediately following the 4th semester exams.
3. Industry area - Engineering Programme Allied industries of large, medium or small-scale, Organization/Govt./ Semi Govt Sectors.

VI Role(s) of Department at the Institute:

Following activities are expected to be performed by the concerned department at the Polytechnics.

Table of activities to be completed for Internship

S.No	Activity	Suggested Schedule WEEKS
1	Collection of information about industry available and ready for extending training with its offered capacity of students (**Sample Format 1**)	1st to 3rd week of 4th Semester
2	Allocations of Student and Mentor as per availability (Mentor: Student Ratio (1:15)	4th to 6th week of 4th semester
3	Communication with Industry and obtaining its confirmation Sample letter Format	6th to 8th week of 4th semester
4	Securing consent letter from parents/guardians of students (Sample Format 2)	Before 10th week of 4th semester
5	Enrollment of Students for industrial training (Format 3)	Before 12th week of 4rd semester
6	Issue of letter to industry for training along with details of students and mentor (Format 4)	Before 14th week of 4th Semester

7	Organize Internship Orientation session for students	Before end of 4th Semester
8	Progressive Assessment of industry training by Mentor	Each week during training period
9	Assessment of training by institutional mentor and Industry mentor	5th Semester ESE

Suggestions-

1. Department can take help of alumina or parents of students having contact in different industries for securing placement.
2. Students would normally be placed as per their choices, in case of more demand for a particular industry, students would be allocated considering their potentials. However preference for placement would be given to students who have arranged placement in company with the help of their parents or relatives.
3. Principal/HOD/Faculty should address students about industrial safety norms, rules and discipline to be maintained in the industry during training before relieving students for training.
4. The faculty members during the visit to industry or sometimes through online mode will check the progress of the student in the training, student attendance, discipline, and project report preparation each week.

VII Roles and Responsibilities of students:

1. Students may interact with the mentor to suggest choices for suitable industry, if any. If students have any contact in industry through their parents or relatives then the same may be utilized for securing placement for themselves and their peers.
2. Students have to fill the forms/formats duly signed by institutional authorities along with a training letter and submit it to a training officer/mentor in the industry on the first day of training.
3. Students must carry with him/her Identity card issued by the institute during the training period.
4. Students should follow industrial dressing protocols, if any. In absence of specific protocol students must wear college uniform compulsorily.
5. Students will have to get all necessary information from the training officer/mentor at industry regarding schedule of training, rules and regulation of the industry and safety norms to be followed. Students are expected to observe these rules, regulations and procedures.
6. Students must be fully aware that if they disobey any rule of industry or do not follow the discipline then non-disciplinary action will be taken .
7. Students must maintain a weekly diary (**Format 6**) by noting daily activities undertaken and get it duly signed from industry mentor or Industrial training in charge.
8. In case students face any major problems in industry such as an accident or any disciplinary issue then they should immediately report the same to the mentor at the institute.

9. Prepare a final report about the training for submitting to the department at the time of presentation and viva-voce and get it signed from a mentor as well as industry training in charge.

10. Students must submit the undertaking as provided in **Format 5**.

VIII Typographical guidelines for Industry Training report

Following is the suggestive format for preparing the training report. Actual report may differ slightly depending upon the nature of industry. The training report may contain the following

1. The training report shall be computer typed (English- British) and printed on A4 size paper.

2. Text Font -Times New Roman (TNR), Size-12 point

3. Subsection heading TNR- 12 point bold normal

4. Section heading TNR- 12 capital bold

5. Chapter Name/ Topic Name – TNR- 14 Capital

6. All text should be justified. (Settings in the Paragraph)

7. The report must be typed on one side only with double space with a margin 3.5 cm on the left, 2.5 cm on the top, and 1.25 cm on the right and at bottom.

8. The training report must be hardbound/ Spiralbound with a cover page in black color. The name of the candidate, diploma (department), year of submission, name of the institute shall be printed on the cover.

9. The training report, the title page should be given first then the Certificate followed by the acknowledgment and then contents with page numbers.

IX Suggestive format of industrial training report

Following format may be used for training report. Actual format may differ slightly depending upon the nature of Industry/ Organization.

- Title Page
- Certificate
- Abstract
- Acknowledgement
- Content Page

Chapter 1	Organization structure of Industry and general layout.
Chapter 2	Introduction to Industry / Organization (history, type of products and services, turn over and number of employees etc.)
Chapter 3	Types of Major Equipments/raw materials/ instruments/machines/ hardware/software used in industry with their specifications, approximate cost, specific use and routine maintenance done
Chapter 4	Processes/ Manufacturing Manufacturing techniques and methodologies and material handling procedures
Chapter 5	Testing of Hardware/Software/ Raw materials/ Major material handling product (lifts, cranes, slings, pulleys, jacks, conveyor belts etc.) and material handling procedures.
Chapter 6	Safety procedures followed and safety gears used by industry.

Chapter 7	Particulars of Practical Experiences in Industry/Organization if any in Production/Assembly/Testing/Maintenance
Chapter 8	Detailed report of the tasks undertaken (during the training).
Chapter 9	Special/challenging experiences encountered during training if any (may include students liking & disliking of workplaces).
Chapter 10	Conclusion
Chapter 11	References / sources of information

X Suggested learning strategies during training at Industry

- Students should visit the website of the industry where they are undergoing training to collect information about products, processes, capacity, number of employees, turnover etc.
- They should also refer to the handbook of the major machines and operations, testing, quality control and testing manuals.
- Students may also visit websites related to other industries wherein similar products are being manufactured.

XI Tentative week wise schedule of Industry Training

Industrial training is a common course to all Diploma programmes , therefore the industry selection will depend upon the nature of the programme and its related industry. The training activity may vary according to nature and size of industry.

The following table details of activities to be completed during industrial training.

Details of Activities to be completed during Industry training
Introduction of Industry and departments.
Study of Layout of Industry, Specifications of Machines , raw materials, components available in the industry
Study of setup and manufacturing processes
Execute given project or work assigned to the students, study of safety and maintenance procedures
Validation from industry mentor regarding project or work allocated
Report writing

XII CO-PO Mapping Table to be created by respective Department/faculty.

XIII. Formative Assessment of training : Suggested RUBRIC

(Note : Allot the marks in proportion of presentations and outcome observed. Marks excluding component of week 11 are to be filled by Institute mentor)

Week No	**Task to be assessed**	**Outcome Achievement - Poor**	**Outcome Achievement - Moderate**	**Outcome Achievement - High**		**Week-wise total Marks**
		Poor Marks	Average Marks	Good Marks	Excellent Marks	

1	Introduction of Industry	Minimal Knowledge of Departments, processes, products and work culture of the company **(Marks –1)**	Moderate Knowledge of Departments, processes, products and work culture of the company **(Marks –2)**	Good Knowledge of Departments, processes, products and work culture of the company **(Marks –3/4)**	Extensive Knowledge of Departments, processes, products and work culture of the company **(Marks –5)**	
2	Presentation of Layout of Industry, Specifications of Machines, raw materials, components available in the industry	Minimal w.r.t. tasks **(Marks –1)**	Moderate w.r.t. tasks **(Marks –2)**	Good w.r.t. tasks **(Marks –3/4)**	Extensive w.r.t. tasks **(Marks –5)**	
3	Participation in setup and manufacturing processes/platforms	Minimal Participation with poor understanding **(Marks –1-8)**	Moderate Participation with poor understanding **(Marks –9-12)**	Good Participation with poor understanding **(Marks –13-17)**	Extensive Participation with poor understanding **(Marks –18-20)**	
4 to 10	Execution of given project or work to the students, Follow of safety and maintenance procedures	Minimal Participation with poor understanding **(Marks –1-8)**	Moderate Participation with lower level understanding **(Marks – 9-12)**	Good Participation with Good understanding **(Marks – 13-17)**	Extensive Participation with excellent understanding **(Marks – 18-20)**	
11	Validation by industry mentor regarding project or work allocated	Minimal Participation with poor performance **(Marks –1-10)**	Moderate Participation with acceptable performance **(Marks – 11-15)**	Good Participation with Good performance **(Marks – 16-20)**	Extensive Participation with excellent performance **(Marks – 21-25)**	
12	Diary writing	• Results are not Presented properly, • Project work is summarized and concluded not acceptable • Future extensions are not specified **(Marks –1-10)**	• Results are Presented just casually • Project work is summarized and concluded casually • Future extensions are casually specified **(Marks –11-15)**	• Results are Presented well and properly, • Project work is summarized and concluded to a Good level • Future extensions are well specified **(Marks –16-20)**	• Results are Presented exhaustively • Project work is summarized and elaborated in excellent manner , concluded • Future extensions are excellently specified **(Marks –21-25)**	

Total Out of :100	

Marks for (FA) are to be awarded for each week considering the level of completeness of activity observed as per table specified in Sr.No. XIII above, from the daily diary maintained . Feedback from industry supervisor shall also be considered.

XIV Summative Assessment (SA) of training:

Academic year : 20 -20

i) Suggested RUBRIC for SA

	Observations from Orals				**Presentations**				**Total (100)**
Enrollment Number	Tasks undertaken (20)	Overall Understanding (20)	Creativity /Innovation demonstrated (10)	Knowledge acquired (10)	Speech Clarity (10)	Body Language (10)	Presentations (10)	Diary , Report writing and / Product (10)	

Name of mentor:
Signature of Mentor

XV FORMATS

Format-1: Collecting Information about Industry/Organization available for training along with capacity

1) Name of the industry/organization:
2) Address/communication details with email :
3) Contact person details:
   a) Name:
   b) Designation:
   c) Email
   d) Contact number/s:

4) Type:

   Govt / PSU / Pvt /

   Large scale / Medium scale / Small scale …..

5) Products/services offered by industry:

6) a) Whether willing to offer Industrial training facility during May/ June for Diploma in Engineering students: **Yes / No.**
   b) If yes, whether you offer 12 weeks training: **Yes/No**
   c) Possible Industrial Capacity:

Students	Programme name/ Title					Total
	Civil	Mechanical	Chemical			
Male						
Female						
Total						

7) Whether accommodation available for interns **Yes / No.**
If yes capacity:_____

8) Whether internship is charged or free:
If charged please specify amount per candidate: _____

Signature of responsible person at Industry:

Format-2: Obtaining Consent Letter from parents/guardians

(Undertaking from Parents)

To,

The Principal,
_____,

Subject: Consent for Industrial Training.
Sir/Madam,

I am fully aware that -

i) My ward studying in _____ semester at your _____ institute has to undergo 12 weeks of Industrial training for partial fulfillment towards completion of Diploma in _____ Engineering.

ii) For this fulfillment he/she has been deputed at_____ industry, located at _____ for Industrial training /internship for the period from _____ to _____ .

With respect to above I give my full consent for my ward to travel to and from the mentioned industry. Further I undertake that –

a) My ward will undergo the training at his/her own cost and risk during training and/or stay.
b) My ward will be entirely under the discipline of the organization where he/she will be placed and will abide by the rules and regulations in face of the said organization.
c) My ward is NOT entitled to any leave during the training period.
d) My ward will regularly submit a prescribed weekly diary, duly filled and countersigned by the training supervisor of the organization to the mentor faculty of the polytechnic.

I have explained the contents of the letter to my ward, who has also promised to adhere strictly to the requirements. I assure that my ward will be properly instructed to take his own care to avoid any accidents/injuries in the industry. In case of any accident neither industry nor the institute will be held responsible.

Signature :
Name : _____
Address : _____

Phone Number :

Format-3: Students Enrollment for Industrial Training

(Academic Year –)

Sr No	Enrollment Number	Name of Student	Name of Industry	Name of Mentor at Institute

Format-4: Issue Letter to the Industry/Organization for the training along with details of students and mentors

To,

The HR Manager,

_____

Subject: Placement for Industrial training of ___ weeks in your organization….

Reference: Your consent letter no: ….

Sir,

With reference to the above we are honored to place the following students from this institute for Industrial training in your esteemed organization as per the arrangement arrived at.

The purpose of this training is to equip the student with some essential skills relevant to the demands of the industry and world of work, as well as to provide exposure to the professional environment and work culture. It is hoped that this training may enhance his/her employability and livelihood opportunities. In view of the above, we kindly request your support in facilitating this Industrial Training for the student. He/she has been adequately oriented and guided on the expectations of this training, including the maintenance of a daily diary during the training period. Additionally, the institute has secured the necessary consent and undertaking from the parent/guardian regarding the guidelines for exit training. In view of all the above industry shall refrain from involving students into the mundane and housekeeping activities. Your cooperation in this regard will be highly appreciated.

Diploma programme in _____ Engg.

Sr.No	Enrollment No	Name of Student	Name and designation of Mentor

Diploma programme in _____ Engg.

Sr.No	Enrollment No	Name of Student	Name and Designation of Mentor

Kindly extend all possible cooperation to the students for above.

Thanking you

Yours sincerely,

(Principal)
Name of the Institute:
with Seal

Cc- To HoD/Mentor

Format-5: Undertaking by the students

TO

Principal

Subject: Undertaking regarding Placement for Industrial training of 12/16/18 weeks duration

I ……Reg No:…….. S/o/D/o. ……Studying in ---------- ---------- at ---------- Institute at ----------fully aware of the Industrial Training requirement and related responsibilities and participation in the ……, Industrial training between From: …… To……..

I assure you that I will be of good behavior and be obedient to the staff and mentor during the ……/Industrial training. I will also abide and will not participate in all activity. I will also discipline myself within the rules and regulations of the Institution. I am also aware that I am participating in the …….. at my own risk and I will not hold the ----------Institute responsible in any way in any eventuality namely Accident /Injury/death or whatever mishap and I myself will be solely responsible for my safety.

Place :Signature of the student

Date :Reg. No.

Format-6: Internships Daily Diary

Name of the Student: _____ Name of the mentor (Faculty) : _____

Enrollment Number: _____ Semester: _____ Academic Year _____

Week	Day & Date	Discussion Topics/Activity	Details of Work Allotted Till Next Session /Corrections Suggested/Faculty Remarks	Signature of Industry Mentor
Week 01	Mon, Date			
	Tue, Date			
	Wed, Date			
	Thu, Date			
	Fri, Date			
	Sat, Date			
.	Mon, Date			
	Tue, Date			
.	Wed, Date			
	Thu, Date			
.	Fri, Date			
.	Sat, Date			
Week n	Mon, Date			
	Tue, Date			
	Wed, Date			
	Thu, Date			
	Fri, Date			
	Sat, Date			

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

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

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

AUTOMOBILE TESTING AND VALIDATION **Course Code : 315378**

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

Programme Code : **AE**

Semester : **Fifth**

Course Title : **AUTOMOBILE TESTING AND VALIDATION**

Course Code : **315378**

I. RATIONALE

Vehicle testing and validation are fundamental in the automobile manufacturing industry to ensure vehicles meet high performance and quality standards. Through comprehensive testing and homologation, manufacturers can confirm the safety, reliability, and efficiency of their vehicles, adhering to global standards. This course provides students with in-depth knowledge of testing procedures for various vehicle subsystems and components, using industry-standard equipment and techniques. By learning these testing processes, students will be equipped to contribute to the development of high-quality, safe, and compliant vehicles, ultimately enhancing their proficiency in automotive engineering.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Apply standard testing procedures to ensure vehicle compliance with regulatory and safety standards

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Apply vehicle testing standards for validation and homologation.
- CO2 - Select appropriate vehicle-level tests for various types
- CO3 - Perform test of vehicle on test tracks.
- CO4 - Use chassis dynamometer for vehicle testing.
- CO5 - Interpret NCAP rating for comfort and safety of passengers.

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	
315378	AUTOMOBILE TESTING AND VALIDATION	ATV	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 Explain the need for vehicle testing and homologation TLO 1.2 State the requirements for a given test TLO 1.3 Identify parameters measured by the specified equipment. TLO 1.4 Identify test standards for vehicle testing and validation TLO 1.5 Describe steps for production part approval process.	**Unit - I Vehicle Testing and Homologation** 1.1 Overview of Vehicle Testing - Need and importance of vehicle testing and homologation. 1.2 Basis of tests - Driving cycles, Homologation 1.3 Requirements of test - a) Test equipments, b) Procedure, c) Quality Personnel. 1.4 Testing instruments and equipments: Use, Capabilities and Parameters measured by - Engine dynamometer, Compression tester, Stroboscope, Petrol/Diesel engine scanner, Exhaust gas analyzer, Diesel smoke meter, Vacuum tester, Chassis dynamometer. 1.5 Testing standards - a) SAE standards, b) ASMT standards, c) ARAI standards, d) CMVI regulations. 1.6 Significance of test. 1.7 Production part approval process.	Chalk-Board Flipped Classroom Video Demonstrations Presentations
2	TLO 2.1 Identify effect of different parameters on vehicle performance. TLO 2.2 Describe effects of change in steering geometry on vehicle performance. TLO 2.3 Explain test procedure for tyre testing.	**Unit - II Vehicle Performance Testing** 2.1 Identify the effect of different parameters on vehicle performance. 2.2 Describe the effects of changes in steering geometry on vehicle performance 2.3 Explain the test procedure for tire testing	Chalk-Board Video Demonstrations Presentations Case Study

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 : Explain the purpose and justification of different test tracks for vehicles TLO 3.2 Describe the importance of vehicle-level performance testing TLO 3.3 Explain the procedure for conducting different tests on specific tracks. TLO 3.4 : Explain the procedure for conducting vehicle-level performance tests.	**Unit - III Road and Track Testing** 3.1 Testing of Vehicles on road: Introduction of sampling technique. 3.2 Vehicle level performance test: a) Acceleration, b) Driveability, c) Gradeability, d) Restartability, e) Brakes testing, f) Steering effort Testing, g) Speedometer and odometer testing. 3.3 Accelerated endurance testing procedures: Torture tracks - 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. 3.4 Draw bar or winch pull test.	Lecture Using Chalk-Board Video Demonstrations Presentations Flipped Classroom
4	TLO 4.1 Describe the construction and operational principles of two-wheeler and four-wheeler dynamometers TLO 4.2 Explain procedure of different tests on chassis dynamometer. TLO 4.3 Interpret data obtained from dynamometer tests to assess vehicle performance and compliance with standards TLO 4.4 Follow standard procedures for testing vehicle components on a chassis dynamometer to ensure vehicle safety and reliability	**Unit - IV Vehicle Testing on Chassis Dynamometers** 4.1 Two wheeler and four wheeler dynamometers: Construction and working. 4.2 Vehicle testing lanes: Side slip testers, wheel alignment testing, wheel balancing, brake test, head light alignment and light intensity testing.	Lecture Using Chalk-Board Video Demonstrations Presentations Site/Industry Visit
5	TLO 5.1 Explain the crashworthiness test procedures and standards of Global NCAP, Euro NCAP, and Bharat NCAP. TLO 5.2 Identify BNCAP car testing protocols, including full frontal, frontal offset, side impact, and pedestrian protection testing. TLO 5.3 Perform rollover and inverted vehicle drop tests to evaluate vehicle safety TLO 5.4 Interpret the results from various safety tests to assess the effectiveness of active and passive safety systems in vehicles	**Unit - V Testing of Active and Passive Safety Systems** 5.1 Crashworthiness test of vehicle: Global NCAP, Euro NCAP, Bharat NCAP. 5.2 BNCAP car testing protocols: Full frontal, Frontal offset testing, Side impact testing, Pedestrian protection testing. 5.3 Roll over test without collision. Inverted vehicle drop test.	Lecture Using Chalk-Board Video Demonstrations Presentations Site/Industry Visit

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 the process of ensuring a vehicle meets regulatory standards before it is approved for sale LLO 1.2 Identify safety standards and regulatory requirements for sale of vehicle LLO 1.3 Identify vehicle emissions under different operating conditions.	1	* Vehicle testing and homologation process	2	CO1
LLO 2.1 Identify regulatory compliance and standards for Noise Level Testing and Structural Integrity Testing of vehicles. LLO 2.2 Identify specialized testing equipment for above vehicle testing. LLO 2.3 Prepare testing protocols and documentation.	2	Approval of Component/System/Vehicle from Concerned Organizations for the following Test: Noise Level Testing and Structural Integrity Testing.	2	CO1
LLO 3.1 Identify various industry standards and specifications. LLO 3.2 Compare vehicle components against AIS, IS, SAE, ECE, BIS standards. LLO 3.3 Prepare comparative analysis of materials used in vehicles for compliance with standards.	3	Standards for Vehicle Testing - AIS, IS, SAE, ECE, BIS	2	CO1
LLO 4.1 Identify measurement tool and software. LLO 4.2 Determine the aerodynamic drag and rolling resistance of the vehicle.	4	*Coast Down Test on a Vehicle by following Test 1. Aerodynamic Drag calculations 2. Rolling Resistance Assessment	2	CO2
LLO 5.1 Measure fuel consumption in real-time during various driving conditions. LLO 5.2 Measure the distance travelled to calculate fuel efficiency. LLO 5.3 Record and analyse the data.	5	On-Road Fuel Consumption Test on Two-Wheeler	2	CO2
LLO 6.1 Identify various braking measurement tools. LLO 6.2 Measure the force applied by the braking system on the basis of the online practical demonstration. LLO 6.3 Record data and analysis.	6	*Brake efficiency test on a vehicle (stopping distance test).	2	CO3

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 7.1 Identify various noise level measurement techniques and tools. LLO 7.2 Measure noise levels emitted by a vehicle passing by at different speeds. LLO 7.3 Record data and analysis.	7	Pass-by Noise Test.	2	CO3
LLO 8.1 Identify various acceleration measurement tools. LLO 8.2 Measure the acceleration of a vehicle when the throttle is fully opened from idle. LLO 8.3 Analyse emissions produced during free acceleration.	8	Free acceleration test.	2	CO4
LLO 9.1 Use websites for above practical demonstrations. LLO 9.2 Identify various vehicle performance parameters. LLO 9.3 Follow procedures for testing vehicle performance parameters such as power, torque, and emissions using a chassis dynamometer.	9	*Vehicle Performance Testing Using Chassis Dynamometer.	2	CO4
LLO 10.1 Use websites for practical demonstrations. LLO 10.2 Write procedures and outcomes of vehicle crash tests to assess safety.	10	*Crash Test	2	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) : NOT APPLICABLE

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Stroboscope: Digital ignition timing gun with LED Display, 12 V system, for 1 to 8 cylinder S.I. engine, Ignition adjustment from o to 60 degrees, engine speed range: 200 to 9999 rpm. additional crocodile clips and inductive pliers.	2
2	Brake efficiency tester: It is composed of a roller brake tester, a suspension tester and a side slip tester. Braking, suspensions & side slip, Productivity: totem with PC, touch screen and remote control, S9010 PTI testing process, Epoxy rollers.	6

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
3	Pass-by test set up: Single Mini Input Module,1 x 100 Hz GPS Data Logger, 1 x Laser Light Barrier Kit, 2 x 5 Ahr Li Ion battery pack, 1 x Vehicle Telemetry Radio, 1 x Road side Telemetry Radio, PC or Tablet, B&K 2250 SLM DC output cable to Min Input Module.	7
4	Chassis dynamometer for two/four-wheeler: Drive- 2WD, Torque-5000Lb-ft, Max power-500 HP, Dynamometer capable of supporting speeds up to 175+ MPH and 1250+ HP. The maximum axle weight is 6,500 lbs and the track width range is 36"-86". Dynamometer shall be capable for different testing scenarios – FWD/RWD Cars, Sport Compacts, Diesel Trucks, Motorcycles and ATV's. Eddy brake to perform acceleration, step, sweep and steady-state tests. • View in real-time torque/horsepower output, at steady and changing speeds, • Diagnose engine and drivetrain problems. • Troubleshoot drivability issues. • Run track ¼ mile or circle track lap simulations with reaction times that you determine in the software parameters. • Bi-Directional roller for testing of both RWD and FWD vehicles. It shall be fully upgradeable in the field, it can be coupled with any other Chassis Dynamometer (7500, 15,000, or DC POD's) for All-Wheel-Drive Testing.	9
5	Working Two-wheeler: Engine- single cylinder, air cooled,4-stroke,100-150CC, Min Power- 7ps @7500 rpm, torque-8 Nm @5000 rpm. Complying BS VI norms.	All
6	Working Four-wheeler vehicle: 3 cylinder – 4 stroke, petrol/ diesel engine, Min 800CC, Min-35ps @5000 rpm, Torque 5 Nm @2500 rpm, complying BS VI norms.	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	Vehicle Testing and Homologation	CO1	6	2	8	2	12
2	II	Vehicle Performance Testing	CO2	10	2	6	8	16
3	III	Road and Track Testing	CO3	10	2	6	8	16
4	IV	Vehicle Testing on Chassis Dynamometers	CO4	6	2	4	4	10
5	V	Testing of Active and Passive Safety Systems	CO5	8	2	6	8	16
Grand Total				**40**	**10**	**30**	**30**	**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
- For Self Larning 25 Marks.

Summative Assessment (Assessment of Learning)

- End semester assessment of 70 marks.
- 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	-	-	-	3	2	3			
CO2	3	-	-	2	3	2	3			
CO3	3	2	-	2	3	2	3			
CO4	3	2	-	2	3	2	3			
CO5	3	2	-	2	3	2	3			

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	K. V. Fadadu and B. H. Kadiya	VEHICLE TESTING AND HOMOLOGATION	Books India Publication, ASIN B07R9Y9JFK
2	Dr. N. K. Giri	Automobile Mechanics	Khanna Publications,ISBN13,978-8174092168
3	G.B.S. Narang	Automobile Engineering	Khanna publication, 1995 ISBN 13 : 978-9387394254
4	--	AIS- Automotive Industry Standards	Ministry of road transport and highways
5	---	Central Motor Vehicle regulations 1989	Ministry of road transport and highways
6	---	SAE handbook	Society of Automotive Engineers.
7	W. H. Crouse, L. Anglin	Motor vehicle inspection	McGraw-Hill, Gregg Division 1978, ISBN: 0070148139

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.youtube.com/watch?v=yIovz10bMpk	Vehicle crash test
2	https://www.youtube.com/watch?v=m9vdYeTVUrs	Vehicle crash test
3	https://www.youtube.com/watch?v=WrScvpRzavI	Chassis dynamometer test
4	https://youtu.be/M8I9X5ssEfw?feature=shared	Pass by noise test
5	https://youtu.be/ZWI80ETZ480?feature=shared	Chassis dynamometer test for two wheeler
6	https://youtu.be/jNgrem0Ll7M?feature=shared	Testing and validation of Braking system
7	https://youtu.be/_8aPLp2FqOE?feature=shared	Brake testing
8	https://youtu.be/fKCR09JH7pU?feature=shared	Brake stopping distance test

AUTOMOBILE TESTING AND VALIDATION **Course Code : 315378**

Sr.No	Link / Portal	Description

Note :

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

MOTOR VEHICLE INSURANCE AND VALUATION **Course Code : 315379**

Programme Name/s : **Automobile Engineering.**
Programme Code : **AE**
Semester : **Fifth**
Course Title : **MOTOR VEHICLE INSURANCE AND VALUATION**
Course Code : **315379**

I. RATIONALE

Nowadays, many companies are launching different models of vehicles in the Indian market, resulting in a rapidly increasing vehicle population. As the number of vehicles on the roads grows, so does the risk of motor vehicle accidents, leading to a rise in motor vehicle insurance claims. To effectively process these claims and prevent fraudulent ones, the insurance sector must be staffed with practitioners who possess comprehensive knowledge and can apply the provisions of the Motor Vehicles Act (MVA) and insurance principles. Therefore, this course helps students acquire the relevant knowledge and skills to settle insurance claims more efficiently, benefiting both individuals and the nation as a whole.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Apply motor vehicle acts and insurance policies to assess vehicle damage and theft claims.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Identify the appropriate type of motor insurance coverage for a given vehicle.
- CO2 - Prepare insurance proposals and policy forms for a given motor vehicle.
- CO3 - Evaluate insurance underwriting based on provided information.
- CO4 - Assess motor vehicle valuation based on specified parameters
- CO5 - Assess motor insurance claims and propose settlements in accordance with policy frameworks.

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	
315379	MOTOR VEHICLE INSURANCE AND VALUATION	MIV	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 Explain the basic principles of general insurance applicable for the given category of vehicle TLO 1.2 Select a relevant motor vehicle insurance policy for the given category of vehicle with justification TLO 1.3 Compare liability and comprehensive insurance policies based on risk cover, provisions, conditions, premium, and vehicle application. TLO 1.4 Describe the role, organizational structure, and jurisdiction of the Insurance Regulatory Authority of India (IRDAI). TLO 1.5 Differentiate between public and private sector motor insurance organizations in India TLO 1.6 Examine the effect of different insurance parameters on motor vehicle insurance policies and their applications.	**Unit - I Fundamental of Motor Vehicle Insurance** 1.1 Principles of insurance, introduction to motor insurance, need of motor insurance 1.2 Classification of insurance: liability (3rd party) only and comprehensive (1st party / own damage), Add on cover under comprehensive policy 1.3 Comparison of above insurance policies on following parameters : Risk cover, other provisions, conditions, premium and application of vehicle 1.4 Insurance Regulatory Authority of India (IRDAI): Role, organization structure and its Jurisdiction 1.5 Various motor vehicle insurance organizations in India. (Brief comparison between public and private sector organizations)	Lecture Using Chalk-Board Presentations Case Study

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 Describe the contents of proposal form TLO 2.2 Interpret the different clauses and condition given in policy form TLO 2.3 Describe the major features of cover notes and certificates of insurance and their significance in the insurance process. TLO 2.4 Justify the need for insurance renewal and provide suitable examples to clarify the procedures involved. TLO 2.5 Describe various hazards in motor insurance with relevant examples to indicate their impact on insurance.	**Unit - II Insurance Proposal and Renewal Procedure** 2.1 Proposal forms: Bio-data of proposer, vehicle details, cover required, insurance history, no claim discount, claims history, declaration. 2.2 Policy Form: Clauses (Recital clause, Operative clause, Avoidance of certain terms and right of recovery, emergency treatment, no claim discount schedule, signature clause,) Conditions(notification, control of claim and subrogation, cancellation, contribution, maintenance and examination, arbitration, observance of condition.) 2.3 Features of Cover notes and certificate of insurance 2.4 Insurance Renewal procedure: Need, definition and suitable examples 2.5 Hazards in Insurance: Moral Hazard (Driver age, litigiousness, moral hazard meaning and examples), Physical Hazard (physical conditions vehicle, Vehicle - power, capacity, weight, age, maintenance, design, load used)	Lecture Using Chalk-Board Presentations Case Study
3	TLO 3.1 Identify the various factors considered in underwriting for the given situation. TLO 3.2 Calculate premiums for the given type of insurance cover. TLO 3.3 Explain the provision of compulsory excess in the given category. TLO 3.4 Justify the exclusions in insurance cover for the given situation. TLO 3.5 Describe the insurance of government and state transport undertaking vehicles.	**Unit - III Underwriting Motor Insurance** 3.1 Underwriting: Need and definition, various aspects of under writing viz. acceptance of proposal, complete declinature. 3.2 Underwriting of third-party cover only, own damage cover, third party fire/theft cover 3.3 Increased premium, inclusions and exclusion of various cover 3.4 Compulsory excess and voluntary excess applicable. 3.5 Insurance of government and state transport undertaking vehicles	Lecture Using Chalk-Board Presentations Case Study
4	TLO 4.1 Identify the various factors affecting the IDV of a given vehicle TLO 4.2 Interpret the Insurance Declared Valuation (IDV) of vehicle on the basis of given parameters. TLO 4.3 Describe the key factors to consider in the valuation of used vehicles TLO 4.4 Justify the valuation of used vehicle on the basis of given parameters.	**Unit - IV Motor Vehicle Valuation** 4.1 Insurance Declared Valuation (IDV): Definition, and importance of IDV, calculation of IDV (with and without accessories), calculation of depreciation, factors affecting IDV of vehicle(Type, Make & Model, Age & Depreciation, Place of registration, Accessories.) 4.2 Valuation of used vehicle: factors consider(condition of the vehicle, kilometres driven, year of purchase, no of previous owners, service history, accident history, modifications, location)	Lecture Using Chalk-Board Presentations Case Study

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.
5	TLO 5.1 Describe the duties and responsibilities of surveyors and loss assessors in a given situation. TLO 5.2 Justify the need for investigation and loss assessment in claim settlement. TLO 5.3 Explain the documents required for a motor insurance claim. TLO 5.4 Compare cashless claims and reimbursement claims. TLO 5.5 Describe techniques for loss minimization in the context of a given claim. TLO 5.6 Explain various mechanisms for conflict redressal in motor insurance.	**Unit - V Motor Insurance Surveying and Claim Processing** 5.1 Surveyors and loss assessors: Insurance Surveyor (license, jobs functions, opportunity of career mobility, work ethics) 5.2 Investigation and loss assessment 5.3 Claim documents 5.4 Settlement: cashless claim and reimbursement claim 5.5 Loss minimization, Salvage and Recoveries 5.6 Conflict Redressal Mechanism: Integrated Grievance Management System (IGMS); Arbitration; Tribunals for third party claim settlement	Lecture Using Chalk-Board Presentations Case Study

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 covers under third-party, own damage with addons plan LLO 1.2 Identify various inclusions and exclusions third-party, own damage with addons plan	1	* Comparative analysis of top five car insurance third-party, own damage with addons plan in India.	2	CO1
LLO 2.1 Interpret the roles and responsibilities of IRDA. LLO 2.2 Prepare the report on various motor insurance regulation frame by IRDA.	2	Analysis of motor insurance regulation by IRDA.	2	CO1
LLO 3.1 Interpret the important terms and conditions of motor insurance policy. LLO 3.2 Prepare the report on key terms mention in given motor insurance policy.	3	* Summarization analysis of key terms mention in given motor insurance policy.	2	CO2
LLO 4.1 Identify the critical hazards under given insurance proposal. LLO 4.2 Select the different hazards according to the loss percentage may occur to the Insurer.	4	Summarization analysis of different hazards in motor insurance.	2	CO2
LLO 5.1 Identify the critical risk in given insurance proposal. LLO 5.2 Calculate the premium to be charged based on the risk under given insurance proposal.	5	* Underwriting of insurance proposal based on risk analysis.	2	CO3

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 6.1 Identify the components for increased premium, different inclusions & exclusions, and compulsory & Voluntary excesses of given insurance policy. LLO 6.2 Calculate the premium on the basis of choices given by the insured.	6	Summarization analysis of various increased premium, inclusions, exclusions, and excesses for motor insurance	2	CO3
LLO 7.1 Identify parameters to decide IDV of a given vehicle. LLO 7.2 Calculate the IDV based on the selected parameter weightage.	7	* Insurance Declared Valuation (IDV) of a given car	2	CO4
LLO 8.1 Identify parameters to decide valuation of a given used vehicle. LLO 8.2 Calculate valuation of a given used vehicle on the basis of selected parameters weightage.	8	Resale valuation of a given used vehicle.	2	CO4
LLO 9.1 Identify the stages of claim settlement process. LLO 9.2 select cashless claim and reimbursement claim settlement based on their pros and cons.	9	* Comparative analysis of cashless claim and reimbursement claim settlement.	2	CO5
LLO 10.1 Identify the conflicts resolution method of motor insurance. LLO 10.2 Select the particular mechanism to resolve the motor insurance conflicts.	10	Summarizing analysis for conflicts resolution mechanisms under motor insurance.	2	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) : NOT APPLICABLE

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Not Required	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	Fundamental of Motor Vehicle Insurance	CO1	8	4	4	6	14
2	II	Insurance Proposal and Renewal Procedure	CO2	10	2	8	6	16
3	III	Underwriting Motor Insurance	CO3	8	2	6	6	14

MOTOR VEHICLE INSURANCE AND VALUATION **Course Code : 315379**

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
4	IV	Motor Vehicle Valuation	CO4	6	2	6	4	12
5	V	Motor Insurance Surveying and Claim Processing	CO5	8	0	4	10	14
Grand Total				**40**	**10**	**28**	**32**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Progressive tests, and Term work

Summative Assessment (Assessment of Learning)

- End Semester Exam and Practical Exam

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	-	1			
CO2	3	-	-	-	2	-	1			
CO3	3	2	-	-	2	-	-			
CO4	3	2	-	-	2	-	-			
CO5	3	-	-	-	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	Agrawal, Rakesh	General Insurance Underwriting - IC 45	The insurance times education series ISBN-13: 978-9381489000
2	Sharma, K. C.	General Insurance in India: Principles and Practices	Regal Publications. ISBN 13: 9788184842241.
3	Dr. L. P. GUPTA	Insurance Claims Solutions	Dr. L P Gupta ISBN- 978-9383303038
4	V. K. Surana	Compensation in Motor Vehicles Accidents and Insurance Claims Manual	Xcess Infostore Pvt. Ltd. ISBN 978-8192791708

Sr.No	Author	Title	Publisher with ISBN Number
5	Anil Jauhri	Motor Policy A Perspectives	Sankap Publications, ISBN-9788194717645
6	Dr. Janak Raj Jai	Motor Accident Claims: Law & Procedure	Universal Law Publishing, ISBN-9788175348967
7	Insurance Regulatory and Development Authority of India	Indian Motor tariff	IRDAI- Government of India Publication

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://irdai.gov.in/	Insurance Regulatory Authority of India (IRDA)
2	https://www.iiisla.co.in	Indian Institute of Insurance Surveyors and Loss Assessors
3	https://morth.nic.in	Ministry of Road Transport and Highways
4	https://transport.maharashtra.gov.in/	RTO Maharashtra
5	https://testmvdm.mahaitgov.in/	Motor Vehicle Department Govt of Maharashtra
6	https://parivahan.gov.in/	Parivahan Sewa, Ministry of Road Transport & Highways Govt of India

Note :

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