ANNA UNIVERSITY, CHENNAI

NON- AUTONOMOUS COLLEGES

AFFILIATED TO ANNA UNIVERSITY

M.E. AUTOMOBILE ENGINEERING

REGULATIONS 2025

PROGRAMME OUTCOMES (POs):

PO	Programme Outcomes
PO1	An ability to independently carry out research /investigation and development work to solve practical problems
PO2	An ability to write and present a substantial technical report/document.
PO3	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program

PROGRAMME SPECIFIC OUTCOMES (PSOS)

PSO	Programme Specific Outcomes
PSO1	Graduates will apply advanced engineering principles, computational tools, and modern software to design, analyze, and optimize automotive systems and components. They will develop innovative and sustainable solutions that address complex challenges in the automotive sector, integrating safety, environmental impact, and ethical responsibility.
PSO2	Graduates will demonstrate strong communication, leadership, and teamwork skills, and will actively engage in lifelong learning to stay current with technological advancements. They will contribute effectively to multidisciplinary teams and uphold professional and ethical standards in their engineering practice.

ANNA UNIVERSITY, CHENNAI

POSTGRADUATE CURRICULUM (NON-AUTONOMOUS AFFILIATED INSTITUTIONS)

Programme: M.E., Automobile Engineering **Regulations:** 2025

Abbreviations:

BS –Basic Science (Mathematics, Physics, Chemistry)

ES – Engineering Science (General (**G**), Programme Core (**PC**), Programme Elective (**PE**) & Emerging Technology (**ET**))

SD – Skill Development

SL – Self Learning

OE – Open Elective

L –Laboratory Course

T – Theory

LIT –Laboratory Integrated Theory

PW – Project Work

TCP –Total Contact Period(s)

Semester – I

S. No.	Course Code	Course Title	Type	Periods per week			TCP	Credits	Category
				L	T	P			
1.	MA25C06	Applied Mathematical and Statistical Modelling	T	3	1	0	4	4	BS
2.	AM25101	Electric and Hybrid Vehicle Technology	T	3	0	0	3	3	ES (PC)
3.	AM25102	Vehicle Body Engineering and Ergonomics	T	3	0	0	3	3	ES (PC)
4.	AM25103	Automotive Engine and Pollution Control	T	4	0	0	4	4	ES (PC)
5.	AM25104	Automotive Chassis and Drivetrain Systems	LIT	3	0	2	5	4	ES (PC)
6.	AM25105	Technical Seminar	-	0	0	2	2	1	SD
Total							**21**	**19**	

Semester – II

S. No.	Course Code	Course Title	Type	Periods per week			TCP	Credits	Category
				L	T	P			
1.		Automotive Design and Simulation	T	3	0	0	3	3	ES (PC)
2.		Programme Elective I	T	3	0	0	3	3	ES (PE)
3.		Programme Elective II	T	3	0	0	3	3	ES (PE)
4.		Vehicle Dynamics and Control	LIT	3	0	2	5	4	ES (PC)
5.		Engine and Vehicle Testing Laboratory	L	0	0	4	4	2	ES (PC)
6.		Industry-Oriented Course I	-	1	0	0	1	1	SD
7.		Industrial Training	-	-	-	-	-	2	SD
8.		Self-Learning Course	-	-	-	-	-	1	-
						Total	**19**	**19**	

Semester – III

S. No.	Course Code	Course Title	Type	Periods per week			TCP	Credits	Category
				L	T	P			
1.		Programme Elective III	T	3	0	0	3	3	ES (PE)
2.		Programme Elective IV	T	3	0	0	3	3	ES (PE)
3.		Open Elective	T	3	0	0	3	3	-
4.		Industry-Oriented Course II	--	1	0	0	1	1	SD
5.		Project Work I	-	0	0	12	12	6	SD
						Total	**22**	**16**	

Semester – IV

S. No.	Course Code	Course Title	Type	Periods per week			TCP	Credits	Category
				L	T	P			
1.		Project Work II	-	0	0	24	24	12	SD
						Total	**24**	**12**	

PROGRAMME ELECTIVE COURSES (PE)

S. No.	Course Code	Course Title	Periods per week			Total Contact Periods	Credits
			L	T	P		
1.		Alternative Fuels and Propulsion Systems	3	0	0	3	3
2.		Autonomous and Connected Vehicles	3	0	0	3	3
3.		Automotive regulations	3	0	0	3	3
4.		Engine Combustion Thermodynamics and Engine Heat Transfer	3	0	0	3	3
5.		Green Vehicle Technology	3	0	0	3	3
6.		IC Engine Process Modelling	3	0	0	3	3
7.		Advanced Automotive Electronics	3	0	0	3	3
8.		Automotive Embedded Systems	3	0	0	3	3
9.		Automotive Instrumentation and Testing	3	0	0	3	3
10.		Automotive Mechatronics	3	0	0	3	3
11.		Automotive Safety Systems	3	0	0	3	3
12.		Vehicle Electrical and Electronics System	3	0	0	3	3
13.		Application of AI & DS in Automotive Systems	3	0	0	3	3
14.		Automotive Materials and Manufacturing	3	0	0	3	3
15.		Motorsport Technology	3	0	0	3	3
16.		Noise, Vibration, and Harshness (NVH)	3	0	0	3	3
17.		Reverse Engineering in Automobile Engineering	3	0	0	3	3
18.		Special Vehicles	3	0	0	3	3
19.		Sustainable Automotive Technologies	3	0	0	3	3
20.		Vehicle Internet of Things	3	0	0	3	3

Semester I

MA25C06	**Applied Mathematical and Statistical Modelling**	L	T	P	C
		3	1	0	4

Course Objectives:

- To equip students with advanced mathematical techniques, specifically Fourier Transforms, for formulating and solving partial differential equations that model fundamental mechanical engineering phenomena such as heat transfer, vibrations, and fluid flow.
- To provide a strong foundation in statistical inference, enabling students to estimate population parameters (like material properties and process capabilities) from experimental data and assess the quality and reliability of these estimators.
- To enable students to design efficient, structured experiments and apply appropriate statistical tests to make valid, data-driven decisions for comparing processes, optimizing designs, and solving complex engineering problems.

Fourier Transform: Definitions, Properties, Transform of elementary functions, Dirac delta function, Convolution theorem, Parseval's identity, Solutions to partial differential equations: Heat equation, Wave equation, Laplace and Poison's equations.

Estimation Theory: Unbiasedness, Consistency, Efficiency and sufficiency, Maximum likelihood estimation, Method of moments.

Testing of Hypothesis: Sampling distributions, Small and large samples, Tests based on Normal, t, Chi square, and F distributions for testing of means, variance and proportions, Analysis of r x c tables, Goodness of fit, independent of attributes.

Design of Experiments: Analysis of variance, One way and two-way classifications, Completely randomized design, Randomized block design, Latin square design, 2^2 Factorial design.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

References:

1. Andrews, L. C., & Shivamoggi, B. K. (2003). Integral transforms for engineers. Prentice Hall of India.
2. Devore, J. L. (2014). Probability and statistics for engineering and the sciences, Cengage Learning.
3. Johnson, R. A., Miller, I., & Freund, J. (2015). Miller and Freund's probability and statistics for engineers, Pearson Education Asia.

E-resources:

1. https://www.edx.org/learn/probability-and-statistics/massachusetts-institute-of-technology-probability-the-science-of-uncertainty-and-data
2. https://www.itl.nist.gov/div898/handbook/
3. https://ocw.mit.edu/courses/2-830j-control-of-manufacturing-processes-sma-6303-spring-2008

AM25101	Electric and Hybrid Vehicle Technology	L	T	P	C
		3	0	0	3

Course Objectives:

To equip students with advanced knowledge of electric and hybrid vehicle systems, including propulsion design, control strategies, modelling, simulation, and integration of power electronics, energy storage, and emerging technologies in mobility.

Architectures of Electric and Hybrid Vehicles: classification of EV, HEV, PHEV, FCEV architectures, System-level design considerations, Multimode hybrid configurations: power split, series-parallel with torque coupling, Vehicle dynamics and system integration, Case studies: Tesla, Toyota Prius, BMW i-Series.

Activity: Case Study on EV/HEV Architectures / Flipped Classroom on Multimode Hybrid Configurations

Battery and Energy Storage System Design: Electrochemical modelling of Lithium-ion batteries, Battery pack design, BMS algorithms (SoC, SoH estimation), Cell balancing methods: passive vs. active. Thermal analysis and thermal management systems, Fuel cell technologies: PEMFC, DMFC; integration in FCEVs, Hybrid energy storage systems (HESS)

Activity: Software Analysis of Battery Pack Design / Assignment on BMS Algorithms and Cell Balancing

Motor and Motor Drive Control: Types of Motors, Characteristic of DC motors, AC single phase and 3-phase motor, PM motors, Switched Reluctance motors, BLDC. High-efficiency converter topologies for traction applications, Control of bidirectional converters, inverter modulation (SPWM, SVPWM), Advanced motor drives: PMSM, SRM, Induction Machines – vector and direct torque control, Torque-speed control with regenerative braking, EMI/EMC considerations in EV powertrains.

Activity: Virtual Demonstration of Motor Control Techniques / Problem Set on Torque-Speed Characteristics

Vehicle Control Strategies and Modelling: Control architecture of EV/HEV: supervisory control, ECU integration, Energy and power management algorithms: Rule-based, Optimisation-based Modelling of EV systems using system engineering software, State machine and control logics, Hardware-in-the-loop (HIL) for validation.

Activity: Simulation Project on Supervisory Control / Quiz on ECU Integration and Control Architectures

Testing, Standards, and Future Technologies: Vehicle-level testing: performance, range, NVH, thermal Testing standards: AIS, ISO, SAE (J2954, J1772, J2344), Charging standards (IEC 61851, CHAdeMO, CCS, GB/T),Smart charging, V2G, battery swapping systems - Emerging areas: AI in EV control, solid-state batteries, autonomous EVs, L5 electrification.

Activity: Group Assignment on EV Testing Standards / Presentation on Emerging EV Technologies
Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%
Assessment Methodology: Quiz (5%), Project (10%), Assignment (10%), Practical (25%), Review of Question papers (IES, SSC, GATE) (20%), Internal Examinations (30%)
References: 1. Ehsani, M., Gao, Y., Longo, S., &Ebrahimi, K. (2018). Modern electric, hybrid electric, and fuel cell vehicles: Fundamentals, theory, and design (3rd ed.). CRC Press. 2. Husain, I. (2011). Electric and hybrid vehicles: Design fundamentals (2nd ed.). CRC Press. 3. Mi, C., Masrur, M. A., & Gao, D. W. (2011). Hybrid electric vehicles: Principles and applications with practical perspectives. Wiley-IEEE Press. 4. Hayes, J. G., &Goodarzi, G. A. (2018). Electric powertrain: Energy systems, power electronics, and drives for hybrid, electric, and fuel cell vehicles. Wiley. 5. Khaligh, A., & Li, Z. (2010). Battery, ultracapacitor, fuel cell, and hybrid energy storage systems for electric, hybrid electric, and plug-in hybrid electric vehicles. IEEE Transactions on Industrial Electronics, 57(11), 3873–3884. https://doi.org/10.1109/TIE.2010.2044653
E-Resources: https://www.classcentral.com/course/swayam-electric-vehicles-458436 https://www.classcentral.com/course/swayam-introduction-to-electric-and-hybrid-electric-vehicle-292692 https://www.mathworks.com/matlabcentral/fileexchange/72865-design-and-test-lithium-ion-battery-management-algorithms https://in.mathworks.com/videos/designing-battery-systems-with-modeling-and-simulation-1593688433886.html https://www.comsol.com/support/learning-center/article/39341 https://in.mathworks.com/discovery/battery-models.html https://wizape.com/English/Electric-and-Hybrid-Vehicles-Overview https://www.udemy.com/course/hybrid-and-electric-vehicle-for-beginners-full-course-2021/

	Description of CO	Mapped POs	PSO1	PSO2
CO1	Classify and analyze various electric and hybrid vehicle architectures (EV, HEV, PHEV, FCEV) and evaluate system-level design through case studies.	PO1 (2), PO3 (3)	3	2
CO2	Design and simulate battery and energy storage systems, including lithium-ion models, BMS algorithms, and fuel cell integration, and assess thermal management strategies.	PO1 (3), PO2 (2), PO3 (3)	3	1
CO3	Select and implement appropriate motor types and drive control techniques, and demonstrate converter efficiency, modulation methods, and regenerative braking control.	PO1 (3), PO2 (1), PO3 (3)	3	2
CO4	Develop and validate vehicle control strategies using modeling tools and HIL testing, and apply relevant standards and emerging technologies in EV systems.	PO1 (3), PO2 (2), PO3 (3)	3	2

AM25102	Vehicle Body Engineering and Ergonomics	L	T	P	C
		3	0	0	3

Course Objectives:
To enable students to critically analyse and design vehicle body structures by integrating advanced concepts of aerodynamics, structural optimization, ergonomic modelling, and regulatory compliance. Emphasis is placed on research-driven innovation and simulation tools for passenger and commercial vehicle body development.

Advanced Car Body Design and Safety Engineering: Classification and evolution of car body types (sedans, coupes, limousines, sports cars, etc.), Body-in-white (BIW) development: load paths and crashworthiness. Structural layout and modularity in body panels, Safety design strategies: crash energy management, crumple zones, intrusion resistance, Driver visibility standards, simulations, and regulatory frameworks, Digital human modelling for seat design, Lightweighting: advanced body materials and joining techniques

Activity: Case Study on Crashworthiness / Software Analysis of Driver Visibility

Bus Body and Chassis Integration: Design considerations based on passenger capacity and operational requirements, Layout planning for low-floor/high-floor buses: accessibility, NVH, and structural integrity Integral vs. conventional construction: implications on ride and durability, Material selection for long-term fatigue and corrosion resistance, Simulation of load distribution and torsional stiffness, Case studies: optimization of engine placement, structural layout for electric buses

Activity: Problem-Based Assignment on Low-Floor Bus Layout Planning / Simulation Activity on Torsional Stiffness and Load Distribution

Commercial Vehicle Body Systems and Ergonomics: Design and analysis of commercial body types: tippers, tankers, platforms, refrigerated vehicles, Finite element analysis of frame-mounted structures. Ergonomic principles in cab design: driver posture, reach, visibility, comfort Integration of HVAC, display interfaces, and vibration isolation. Advanced materials for load-carrying efficiency and lifecycle cost reduction, Regulations for over-dimensional and hazardous material transport

Activity: Software Analysis of Frame-Mounted Structures / Assignment on Ergonomic Cab Design and Interface Integration

Vehicle Aerodynamics and Computational Fluid Dynamics: Drag components: form, skin friction, interference, induced drag, Influence of body shape on lift, side force, and yaw moment. Flow separation and vortex management techniques, Design optimization for fuel economy and high-speed stability, Wind tunnel correlation and virtual testing: 1D/3D CFD validation. Use of simulation tools.

Activity: CFD Simulation of Drag Components and Flow Separation / Virtual Demonstration of Wind Tunnel Correlation

Human Factors, Styling, and Digital Ergonomics: Ergonomic modelling using software, Anthropometric databases and their application in occupant packaging, Cognitive ergonomics: HMI, visibility cone, control accessibility, Styling workflow: clay modelling to digital sculpting. Case study: ergonomic audit of existing vehicle models, Sustainable design: impact of ergonomics on mobility inclusion.

Activity: Software-Based Ergonomic Modelling and Occupant Packaging / Case Study on Ergonomic Audit of Existing Vehicle Models

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology and weightage:

Assessment Methodology: Quiz (5%), Project (10%), Assignment (10%), Practical (25%), Review of Question papers (IES, SSC, GATE) (20%), Internal Examinations (30%)

References:

1. Fenton, J. (1992). Vehicle body layout and analysis. Mechanical Engineering Publications Ltd.
2. Anselm, D. (2000). The passenger car body. SAE International.
3. Birch, J. (2011). Motor vehicle body design. Butterworth-Heinemann.
4. Allen, B. (n.d.). Vehicle aerodynamics. SAE Technical Papers and Journals.
5. Happian-Smith, J. (2002). An introduction to modern vehicle design. Butterworth-Heinemann.
6. Bhise, V. D. (2016). Ergonomics in the automotive design process. CRC Press.

E-Resources:

https://archive.org/details/vehiclebodylayou0000fent
https://www.routledge.com/Ergonomics-in-the-Automotive-Design-Process/Bhise/p/book/9781482224145
https://www.researchgate.net/publication/327185994_Ergonomics_in_the_Automotive_Design_Process
https://designstudiopress.com/product/h-point/
https://www.nasa.gov/sites/default/files/atoms/files/human_integration_design_handbook.pdf
https://www.nhtsa.gov/crash-simulation-vehicle-models
https://www.iitk.ac.in/erl/ais/ais-052.pdf
https://www.routledge.com/Heavy-Vehicle-Ergonomics/Hemphill/p/book/9780415279224
https://www.fmcsa.dot.gov/research-and-analysis/research/human-factors-considerations-truck-cab-design
https://morth.nic.in/transportation-of-hazardous-goods
https://www.openfoam.com/documentation/user-guide
https://onlinecourses.nptel.ac.in/noc19_de01/preview
https://www.plm.automation.siemens.com/global/en/products/tecnomatix/jack.html
https://dined.io.tudelft.nl/en
https://help.autodesk.com/view/ALIAS/2024/EN

	Description of CO	Mapped POs	PSO1	PSO2
CO1	Classify car and bus body types and evaluate structural layouts for crashworthiness and modularity using case studies and simulations.	PO1 (2), PO3 (3)	3	2
CO2	Design commercial vehicle body systems and analyse ergonomic features using digital modelling tools and anthropometric data.	PO1 (3), PO2 (2), PO3 (3)	3	2
CO3	Apply CFD tools to simulate and optimize vehicle aerodynamics for drag reduction, fuel efficiency, and high-speed stability.	PO1 (3), PO2 (2), PO3 (3)	3	2
CO4	Assess safety and regulatory standards in vehicle design and demonstrate integration of lightweight materials and joining techniques.	PO1 (3), PO2 (2), PO3 (3)	3	2

AM25103	Automotive Engine and Pollution Control	L	T	P	C
		4	0	0	4

Course Objectives:

This course aims to provide comprehensive knowledge on sources and effects of automotive pollution and emission standards It equips students with an understanding on the formation of major pollutants in spark ignition engines and Compression ignition engines. The course also emphasizes working principle of emission measuring instruments and test procedures.

EMISSION FROM AUTOMOBILES

Basic engine theory - Engine design and operating parameters – Typical Performance Curves and Emission Curves, Sources of Pollution, Automobile Fleet Stats - Various emissions from Automobiles — Regulated and Non-regulated Emissions — Effects of pollutants on environment and human health – Evaluation of emission standards. Lubricants handling and harmful discharges. Introduction to Global Warming, Carbon Balancing and Cycles, CO2 emission, carbon capturing, Introduction to Electro Magnetic Emissions, and Functional Safety of emission control devices. Student review presentation on an energy report.

Activity: Case Study on Emission Standards and Fleet Statistics / Student Review Presentation on Global Energy or Emission Report

SI ENGINE, COMBUSTION, EMISSIONS FORMATION

SI engines - Stages of combustion - Abnormal Combustion, Theories of Detonation, Effect of operating variables on Combustion and Emission Formation in SI Engines - Carbon Monoxide - Unburned hydrocarbon, NOx, Smoke, Aldehyde emissions - Effects of design and operating variables on emission formation, Advances in SI engines, GDI – TGDI - LTC – HCCI, a literature-based comparative study on combustion and emission formation.

Activity: Literature-Based Comparative Study on Advanced SI Combustion Techniques / Quiz on Emission Formation Mechanisms in SI Engines

CI ENGINE, COMBUSTION, EMISSION FORMATION

CI engines - Stages of combustion - Diesel Knock, Droplet and Spray Characteristics, Effect of operating variables on Combustion and Formation of White, Blue, and Black Smokes, NOx, soot, Sulphur particulate and intermediate Compounds – Physical and Chemical delay — Significance Effect of operating variables on Emission Formation - Cetane number Effect. Advances in CI engines – CRDI – VVT – LTC in Diesel – RCCI – Dual Fuel – Early injection strategies. A literature-based comparative study on combustion and emission formation.

Activity: Assignment on Diesel Combustion and Emission Formation / Literature-Based Comparative Study on Advanced CI Engine Technologies

POLLUTION CONTROL TECHNOLOGIES

Controlling of pollutants - Catalytic converters, types of substrates and catalysts, Low temperature catalyst and activation — Charcoal Canister — Positive Crank case ventilation system, Secondary air injection, Thermal reactor, Laser Assisted Combustion. CO2 control techniques, Pre, Post and Oxy fuel combustion, Absorption, Adsorption and membrane separation. Fumigation, EGR, HCCI, Turbo charger, Particulate Traps, Re-generation methods, SCR, LNT, ASC.

Activity: Virtual Demonstration of Emission Control Devices / Assignment on CO_2 Control Techniques and Carbon Capture

TEST PROCEDURES AND EMISSION MEASUREMENTS

Constant Volume Sampling I and 3 (CVSI &CVS3) Systems- Sampling Procedures — Chassis dyno – Transient dyno, seven mode and thirteen mode cycles for Emission Sampling — Sampling problems — Emission analysers —NDIR, FID, Chemiluminescent, Smoke meters, Dilution Tunnel for PM measurement and Laser scattering method for PN measurement, SHED Test, Sound level meters. Homologation, EMC/EMI testing of electric electronic devices. On-board pollution measurement equipment (PEMS). Emission regulations for off-road vehicles, TREM norms.

Activity: Software Analysis of Emission Sampling and Measurement Techniques / Case Study on On-Board Emission Measurement (PEMS) and Homologation

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Quiz (5%), Project (10%), Assignment (10%), Practical (25%), Review of Question papers (IES, SSC, GATE) (20%), Internal Examinations (30%)

References:

1. Springer, G. P., & Patterson, D. J. (1986). Engine emissions: Pollutant formation. Plenum Press.
2. Patterson, D. J., &Henin, N. A. (1985). Emission from combustion engine and their control. Ann Arbor Science Publication.
3. Pundir, B. P. (2017). Engine emissions (2nd ed.). Narosa Publications.
4. Ganesan, V. (2005). Internal combustion engines (8th reprint). Tata McGraw Hill Book Co.
5. Crouse, R. H., & Anglin, D. L. (1993). Automotive emission control. McGraw Hill.
6. Leberanek, L. (1993). Noise reduction. McGraw Hill.
7. Duerson, C. (1990). Noise abatement. Butterworths Ltd.
8. Alexander, A., Barde, J. P., Lomure, C., & Langdan, F. J. (1987). Road traffic noise. Applied Science Publishers Ltd.

E-Resources:

https://www.youtube.com/watch?v=V83pI7WbSpM

https://www.youtube.com/watch?v=ciCWXWR9SFw https://www.youtube.com/watch?v=PPJjNY9cNuI

https://www.youtube.com/watch?v=e6rglsLy1Ys

https://www.youtube.com/watch?v=xL6x3sqH9QU

https://www.youtube.com/watch?v=foYggZIQevM

https://www.youtube.com/watch?v=Y8l6AEquy94

https://www.youtube.com/watch?v=iEkcG7uzr_Y

https://www.youtube.com/watch?v=xTNnJiXXMro

https://www.youtube.com/watch?v=8Q5TRYik_jQ

https://www.youtube.com/watch?v=DW06y-H5qo0

https://www.youtube.com/watch?v=J9TfNksMIW4

https://www.youtube.com/watch?v=o8WcP97md_w

	Description of CO	**Mapped POs**	**PSO1**	**PSO2**
CO1	Analyse emission characteristics of SI and CI engines and compare the effects of combustion variables on pollutant formation.	PO1 (3), PO3 (3)	3	1
CO2	Evaluate pollution control technologies such as catalytic converters, EGR, and particulate traps for their effectiveness in reducing emissions.	PO1 (3), PO2 (2), PO3 (3)	3	2
CO3	Apply emission measurement techniques using equipment like NDIR, FID, and CVS systems, and interpret results based on regulatory standards.	PO1 (3), PO2 (3), PO3 (3)	3	2
CO4	Assess the environmental impact of automotive emissions and demonstrate understanding of global warming, carbon cycles, and functional safety.	PO1 (3), PO2 (2), PO3 (3)	3	2

AM25104	Automotive Chassis and Drivetrain Systems	L	T	P	C
		3	0	2	4

Course Objective:
This course aims to provide a comprehensive understanding of the design, function, and integration of chassis systems and drivetrain components in automobiles. It covers frames, suspension, steering, braking systems, clutches, gearboxes, and advanced transmission technologies with an emphasis on system behaviour, safety, and emerging technologies.

Chassis Fundamentals and Steering Systems: Chassis layout types based on Power plant location and drive types, Types and construction of frames, materials, and load considerations, Front axles, stub axles, and wheel geometry, True rolling condition, Ackermann and Davis steering, Steering errors, linkages, steering gears, slip angle, oversteer/understeer, EPAS.

Activity: Virtual Demonstration of Steering Geometry and Ackermann Principle / Assignment on Chassis Layout and Frame Design

Practical: Chassis layout case studies, Steering gear disassembly and study, Power-assisted steering system demonstration

Clutch and Gearbox Systems: Requirement of transmission system, Types of transmission system, Requirement of Clutches, Functions-Types of clutches, construction and operation of Single plate, multiplate and Diaphragm Spring clutches. Centrifugal clutch, DCT, Electronic clutch. Purpose of gear box. Construction and working principle of sliding, constant and synchromesh gear boxes, Automatic manual transmission. Introduction to epicycle gear trains, Numerical examples on performance of automobile such as Resistance to motion, Tractive effort, Engine speed & power and acceleration. Determination of gear ratios for different vehicle applications.

Activity: Problem Set on Gear Ratio Calculation and Vehicle Performance / Case Study on Modern Transmission Systems (DCT, AMT, Epicyclic)

Practical: Single plate clutch disassembly, Gearbox component study and reassembly.

Propeller Shaft, Axles, and Differential: Effect of Driving Thrust, torque reactions and side thrust, Hotchkiss drive, torque tube drive, radius rods and stabilizers, Propeller Shaft, Universal Joints, Constant Velocity Universal Joints. Construction and Design of Drive Axles, Types of Loads acting on drive axles, Full, Floating, Three, Quarter Floating and Semi, Floating Axles, Axle Housings and Types. Front Wheel drive, Final drive, different types, Double reduction and twin speed final drives, Differential principle and types, limited speed differential.

Activity: Assignment on Axle Design and Load Analysis / Virtual Demonstration of Differential Operation and Final Drive Types

Practical: CV joint dismantling, Differential and rear axle assembly

Braking and Advanced Transmission Systems: Braking theory, stopping distance, weight transfer, Drum and disc brake mechanisms and efficiency, Hydraulic, mechanical, pneumatic, and ABS systems, Hydrodynamic drives: fluid coupling, torque converters, Hydrostatic drives and Janny drive system, CVT, AMT, electric drives, Ward Leonard control

Activity: Case Study on ABS and Brake Efficiency / Assignment on Hydrodynamic and Electric Drive Systems

Practical: Brake system demonstration (ABS/regenerative braking), Torque converter and AMT disassembly, Epicyclic gear assembly study

Suspension and Tyre Systems

Need for suspension, ride comfort and stability, Leaf, coil, torsion bar, rubber, pneumatic, hydro-elastic springs, independent suspension, telescopic shock absorbers, Air suspension system. Types and Constructional Details of Different Types of Wheels and Rims, Different Types of Tyres and their constructional details.

Activity: Virtual Demonstration of Suspension Types and Ride Comfort / Assignment on Tyre Construction and Performance

Practical: Study of conventional vs modern suspension, Case study on active suspension systems, Tyre inspection and comparison

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Assessment Methodology: Quiz (5%), Project (10%), Assignment (10%), Practical (25%), Review of Question papers (IES, SSC, GATE) (20%), Internal Examinations (30%)

References

1. Heisler, H. (2020). Advanced vehicle technology. Butterworth-Heinemann.
2. Singh, K. (2022). Automobile engineering. Standard Publishers.
3. Erjavec, J. (2020). Automotive technology: Principles, diagnosis, and service. Cengage.
4. Halderman, D., & James, K. V. (2013). Automotive chassis systems. Prentice Hall.
5. Duffy, J. E. (2011). Modern automotive technology. Goodheart-Willcox.
6. Husain, I. (n.d.). Electric and hybrid vehicles: Design fundamentals. CRC Press..

E-Resources:

https://www.classcentral.com/course/engineering-tsinghua-university-automobile-chassi-284886
https://catalogue.surrey.ac.uk/2024-5/module/ENG2119
https://www.riseupp.com/course/tsinghua-university/automotive-chassis-systems-and-design
https://www.amrita.edu/course/automotive-chassis-and-transmission-systems
https://link.springer.com/book/10.1007/978-3-319-72437-9
https://link.springer.com/book/10.1007/978-3-8348-9789-3
https://www.engbookpdf.com/2019/04/automotive-engineering-powertrain.html

https://en.wikipedia.org/wiki/Drivetrain https://en.wikipedia.org/wiki/Drive_by_wire https://en.wikipedia.org/wiki/Electronic_stability_control

	Description of CO	Mapped POs	PSO1	PSO2
CO1	Identify and compare chassis layouts, frame types, and steering geometries, and demonstrate understanding through practical disassembly and analysis.	PO1 (2), PO3 (3)	3	2
CO2	Explain and evaluate clutch and gearbox mechanisms, including manual and automatic systems, and calculate gear ratios for various vehicle applications.	PO1 (3), PO2 (2), PO3 (3)	3	2
CO3	Analyse the design and function of propeller shafts, axles, and differentials, and demonstrate assembly and inspection procedures.	PO1 (3), PO2 (2), PO3 (3)	3	2
CO4	Assess braking, suspension, and tyre systems for performance and comfort, and apply knowledge in practical demonstrations and case studies.	PO1 (3), PO2 (2), PO3 (3)	3	2