GALGOTIAS UNIVERSITY

Department of Mechanical Engineering

Vision, Mission, PEOs , PSOs& POs M.Tech Automobile Engineering:

Vision

To be recognized globally in engineering education, interdisciplinary research, innovation and application of knowledge for the benefit of society.

Mission

MD1: Create a strong foundation in fundamentals of Automobile Engineering and Applied Mathematics.

MD2: Conduct interdisciplinary research leading to the delivery of innovative technologies through Problem and Research Based Learning.

MD3: Produce socially responsible, ethical Automobile Engineering graduates with ability to use modern tools and a mind-set of enquiry.

MD4: Provide an eco-system for aspirants to collaborate with peers to gain interpersonal skills.

Program Educational Objectives:

PEO1: Graduates will be an Engineering professionals and innovators in core automotive industry, service industries or pursue research

PEO2: Graduates will be a key team player to provide sustainable solutions for complex interdisciplinary problems using modern tools and techniques.

PEO3: Graduates will be engaged in professional activities with ethical practices to enhance the knowledge and contribute to the green environment.

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Program Specific Objectives

PSO1: Ability to apply principles of automobile engineering in various practical fields to engage in research projects.

PSO2: Ability to function in software industry in the areas of design and development of software tools for Automobile engineers

Program Outcomes

1. **Engineering Knowledge :** Apply the knowledge of Mathematics, Science, and Engineering fundamentals, and an engineering specialization to solution of complex engineering problems.
2. **Problem analysis :** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3. **Design/development of solutions :** Design of solutions for complex engineering problems and design of system components or processes that meet the specified needs with appropriate considerations of public health and safety, and cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems :** Use research based methods including design of experiments, analysis and interpretation of data and synthesis of information leading to logical conclusions.
5. **Modern tool usage :** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling complex engineering activities with an understanding of limitations.
6. **The engineer and society :** Apply reasoning within the contextual knowledge to access societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability :** Understand the impact of the professional engineering solutions in the societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable developments.

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8. **Ethics :** Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.
9. **Individual and team work :** Function effectively as an individual independently and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication :** Communicate effectively on complex engineering activities with the engineering community and with society at large such give and receive clear instructions.
11. **Project management and finance :** Demonstrate knowledge and understanding of engineering management principles and apply those to one's own work as a member and leader of a team to manage projects in multidisciplinary environments.
12. **Life-long Learning :** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

M. Tech. Automobile Engineering program caters to create research-oriented sub-domain, specialized engineers. The focus of curricula is on advanced CFD, FEM, Engine Design, and Vehicle Aerodynamics courses. The courses in advanced numerical and statistical methods, communication skills, Alternative Fuels and Power Systems course supported by specialized electives like design and analysis of experiments and Simulation of Automobile Systemsensures that graduates are well equipped to analyze the complex problems and thereby propose and design complete solutions as per requirements of R&D sector of Automobile industries.

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MAUE5001	Automotive engines and emission	L	T	P	C
Version1.0		3	0	0	3
Pre-requisites/Exposure					
Co-requisites					

Course Objectives

This subject is taught to impart knowledge of working principle of engines, fuel combustion, emission and emission control.

Course Outcomes

Student will be able to

CO1	Summarize the principle and need of carburetion, lubrication and cooling in vehicles (K3)
CO2	Analyze different combustion mechanisms and flame propagation (K4)
CO3	Investigate the emission characteristics of vehicle engine and control mechanisms (K4)
CO4	Identify the need for alternative fuels, their sources and properties(K3)
CO5	Solve the heat transfer problems using FEM (K3)
CO6	Illustrate the new trends of automobile bio fuels, it's engine modification and research on new generation of biofuels (K3)

Catalog Description

Knowledge of automotive engines and emission is a primary component of any program on automobile engineering. In this course, the students learn about carburetion, lubrication and cooling of IC engines, and the combustion of fuel and combustion chambers. The course also explores the automobile emission and control mechanisms, the exhaust emission measurement, alternative fuels and dynamic analysis using finite elements.

Text BooksandReference Books

1. Richard Stone, *Introduction to Internal Combustion Engines*, McMillan, London. ISBN-978-0-333-37593-8.
2. Hein Heister, *Vehicle and Engine Technology*, Butterworth-Heinemann Ltd ISBN- 978-0-340-69186-1.
3. Hein Heister, *Advance Vehicle Technology,* Society of Automotive Engineers Inc. ISBN-978-0-768-01071-8.
4. E. F. Obert, (1973), *I. C. Engine & Air Pollution*, Harper & Row Publishers, New York. ISBN 0-352-04560-0.
5. C. Fayette Taylor & Edward S. Taylor, *I. C. Engines*, International text book com, ISBN-978-0-700-22096-0.
6. V. L. Maleev, *I.C. Engine*, McGraw Hill Book, Co. ISBN- 978-0-070-85471-0.
7. Ferguson, *Internal Combustion Engines: Applied Thermosciences*, John Wiley & Sons, ISBN- 978-0-471-35617-2.
8. Charles A. Fisher, *S.I. Engine – Fuel Injection Development*, Chapman & Hall.
9. Herbert E. Ellinger, *Automotive Engines*. ISBN- 978-0-130-55426-0.

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10. John B. Heyhood, *Internal Combustion Engines Fundamentals*, McGraw Hill. ISBN-978-0-070-28637-5.

Course Content

Unit I :Carburetion, Lubrication and cooling **6 lecture hours**

Fuel Supply, Ignition, Cooling and Lubrication Systems – Theory of carburetion and carburettors, A/F ratio, petrol injection, diesel fuel injection pumps, conventional and electronic ignition systems for SI engines, cooling systems, design aspects, lubrication systems.

Unit II: Combustion of fuel and combustion chambers **6 lecture hours**

Air Motion Combustion and Combustion Chambers: Swirl and turbulence – swirl generation, combustion in SI & CI engines, flame travel and detonation, Ignition delay, Knock in CI engines, combustion chamber design..

Unit III: Automobile emission and control **8 lecture hours**

Sources of Emission, Exhaust gas constituents & analysis, Ingredients responsible for air pollution, Smoke, odour, Smog formation. Exhaust Emission Control: Basic method of emission control, catalytic converter, After burners, reactor manifold, air injection, crank case emission control, evaporative loss control, Exhaust gas recirculation, Fuel additives. Pollution Norms : European pollution norms, Indian pollution norms as per Central Motor Vehicle Rules (C.M.V.R.).

Unit IV: Exhaust Emission Measurement and alternative fuels **8 lecture hours**

Instrumentation for Exhaust Emission Measurement: Measurement procedure, Sampling Methods, Orsat Apparatus, Infrared Gas analyzer, Flame Ionization Detector (FID), Smoke meters. Alternative Fuels : CNG, LPG, Bio-Diesel, Hydrogen, fuel cells, Eco-friendly vehicles, Electric & Solar operated vehicle.

Unit V:Dynamic Analysis using Finite Elements **9 lecture hours**

Introduction to vibration problems, Consistent and Lumped mass matrices, Form of finite element equations for vibration problems, Eigen value Problems, Transient vibration analysis and unsteady heat transfer problem. Simulation of automotive emission control systems.

Unit VI: New trends of automobile bio fuels **7 lecture hours**

Study of all available biofuels, and it's commercial status, engine modification as per biofuels characteristics, emissions analysis, modification in emission control system, exhaust heat utilisation, and research issue on new generation of biofuels and it's feasibility.

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