GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Diploma

Branch: Automobile Engineering

Course / Subject Code: DI03002011

Course / Subject Name: Pollution Control Engineering

w. e. f. Academic Year:	2024-25
Semester:	3rd
Category of the Course:	ESC

Prerequisite:	"Students should have basic knowledge of internal combustion (IC) engines, including spark ignition (SI) and compression ignition (CI) engines, and understand how fuel combustion occurs within these engines."
Rationale:	In today's world, reducing automobile pollution is very important for protecting the environment and human health. This course will help students understand where vehicle pollution comes from and how it can be controlled and measured. Students will also learn about important pollution rules like Euro norms, Bharat Stage standards, and the PUC certificate, helping them understand how to follow environmental laws. Main objective of course is to equip students with hands-on experience in measuring, analyzing, and mitigating automobile emissions through various emission control systems and testing methods.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Describe the major sources of automobile pollution and their contribution to environmental degradation.	R & U
02	List various types of air-fuel mixtures and their role in the generation of emissions	R & U
03	Explain the working principles and applications of emission control systems	R & U & A
04	Demonstrate exhaust gas analysis techniques by operating instruments	R & U & A
05	Explain the significance of emission standards in pollution control	R & U

**Revised Bloom's Taxonomy (RBT)*

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Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA(M)	PA(I)	ESE (V)	
2	0	2	3	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Fundamentals of Automobile Pollution:** 1.1 Introduction 1.2 Sources of Automobile pollution 1.3 Air Pollution and its sources 1.4 Air pollution effect on Human health and the Environment 1.5 Noise Pollution: Causes, Effects, and Reduction Techniques 1.6 Noise, Vibration and Harshness (NVH) in Automobiles: 1.6.1 Introduction 1.6.2 Sources 1.6.3 Control & Reduction technique 1.7 Pollution from Hybrid and Electric Vehicles (Battery Disposal & Energy Source Impact)	5	15%
2.	**Formation of Exhaust Gas Pollutants** 2.1 Introduction about Exhaust and Non-Exhaust emission 2.2 Types of Air-Fuel Mixtures and Their Impact on Emissions 2.3 Carbon monoxide (CO) gas 2.4 Carbon Dioxide (CO_2) 2.5 Hydro Carbon (HC) gas 2.6 Oxides of Nitrogen (NOx) 2.7 Particulate matter 2.8 Impact of Driving Conditions on Exhaust Emissions	6	20%
3.	**Emission control system for SI and CI Engines** 3.1 Layout and Components of an Emission Control System 3.2 Positive Crankcase Ventilation (PCV) system.	11	35%

	3.3 Fuel evaporative emission control (EVAP) system 3.4 Charcoal Canisters 3.5 Catalytic converters. 3.6 Oxygen (O_2) Sensor and Its Role in Emission Control. 3.7 Multi-Point Fuel Injection (MPFI) System and Gasoline direct injection (GDI) for Petrol Engines 3.8 Common Rail Direct Injection (CRDI) System 3.9 Exhaust Gas Recirculation (EGR) System and Its Impact on NOx Reduction 3.10 Selective Catalytic Reduction (SCR) for NOx Control 3.11 Diesel Particulate Filters (DPF) and Soot Reduction		
4.	**Emission Measurement:** 4.1 Non-Dispersive Infrared (NDIR) Analyzer for CO Measurement 4.2 Flame ionization detector for HC Measurement 4.3 Chemiluminescence Analyzer for NOx Measurement 4.4 Exhaust Gas analyzer 4.5 Diesel smoke meter	4	15%
5.	**Emission standard for Pollution control** 5.1 Importance of Emission standard for Pollution control 5.2 European (Euro) Standards 5.3 Bharat Stage Standards 5.4 Comparison between Bharat stage and Euro norms 5.5 Zero Emission Vehicles (ZEVs) 5.5 Pollution under Control (PUC) Certificate	4	15%
	Total	**30**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
40	**40**	**20**			

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

Sr. No.	Title of Book	Author	Publication with place, year ancl ISBN
1	Automobile Engineering (Vol-I) Engine System	Anil Chhikara	Satya Prakation, New Delhi ISBN: 81-7684-505-1
2	Intemal Combustion Engines (4™ EDITION)	V. Ganesan	Tata McGraw-Hill Co., Ltd., New Delhi. ISBN: 978-1-25-900619-7
3	Automotive Emission Control	William H.Carouse Donald L. Anglina	Tata McGraw-Hill Co., Ltd., New Delhi ISBN-10 0070148163 ISBN-13 978-0070148161
4	Automobile Engineering	R.B.Gupta	Satya Prakation, New Delhi ISBN: 978-93-5192-191-2

(b) Open source software and website:

1. https://en.wikipedia.org/wiki/Vehicle_emissions_control
2. https://en.wikipedia.org/wiki/Exhaust_gas
3. https://cpcb.nic.in/vehicular-exhaust/
4. https://www.youtube.com/watch?v=BsJEBRdjGZw
5. https://www.youtube.com/watch?v=L-tAv3gnHV8
6. https://www.howacarworks.com/
7. https://auto.howstuffworks.com/

Suggested Course Practical List:

Sr. No	Unit No.	Experiment (Only Seven)		Apprx. Hrs. Required
1	1	Study the Impact of Automobile Air & Noise Pollution on Urban Environments.		4
2	2	Study of Exhaust Gas Pollutants Formation under different Air-fuel mixtures based on varying driving conditions.		4
3	3	Detailed Study of PCV system: Operation, Construction & Servicing.	Any Two	8

4	3	Detailed Study of Catalytic Converter: Operation, Construction & Servicing.		
5	3	Detailed Study of EGR: Operation, Construction & Servicing.		
6	3	Detailed Study of SCR: Operation, Construction & Servicing.		
7	3	Study of Soot trapping and regeneration process in DPF.		
8	4	Measure CO, HC emission from petrol engines on exhaust gas analysis.		4
9	4	Measure diesel exhaust smoke of diesel engine on diesel smoke meter.		4
10	5	Case Study for Emission Standards & Pollution Control.		6
			Total	30

List of Laboratory/Learning Resources Required:

1) Diesel smoke meter
2) Exhaust gas analyzer
3) Cut section /separate system like PCV, EGR, catalytic converter, charcoal canister
4) Different types of muffler
5) OBD-II Scanner/Diagnostic Tool
6) Air Quality Monitor – To measure pollutant levels like CO, NOx, HC, and PM in urban environments.
7) NVH Analyzer – To measure and analyze noise, vibration, and harshness levels in a vehicle

Suggested Project List:

1) Pollution Awareness Campaign on Vehicle Emissions and PUC Importance
2) Measuring Emission Levels of Old vs. New Vehicles Complying with Different Emission Norms
3) Smart Vehicle Emission Monitoring System Using IoT
4) Impact of BS-VI Implementation on Indian Automobile Industry
5) Case Studies on Noise and Air Pollution in Urban Areas
6) Case study on impact **of** Alternative Fuels (Ethanol, CNG, Hydrogen) on Exhaust Emissions

Suggested Activities for Students:

"Apart from classroom and laboratory-based learning, the following co-curricular activities are recommended to enhance the attainment of various course outcomes. Students are encouraged to undertake these activities individually or in groups and prepare a comprehensive short report for each activity."

1) Group discussion on topics covered in this course
2) Visit local PUC center
3) Seminars using power point presentations
4) Prepare Chart/ Demo model covered in this course
5) Short report on topic given by concern faculty

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