



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170212

Semester –VII

Subject Name: Automotive Pollution and Control

Type of course: Professional Core/Elective

Prerequisite: Fluid Mechanics

Rationale: The main objective of this course is to impart knowledge in automotive pollution control. The detailed concept of formation and control techniques of pollutants like UBHC, CO, NO_x, particulate matter and smoke for both SI and CI engine will be taught to the students. The instruments for measurement of pollutants and emission standards will also be introduced to the students. At the end of the course the students will have command over automotive pollution and control.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs.
1	EMISSION FROM AUTOMOBILES - Pollutants – sources – formation – effects of pollution on environment - human – transient operational , effects on pollution – Regulated – Unregulated emissions - Emission Standards.	08
2	EMISSION FROM SPARK IGNITION ENGINE AND ITS CONTROL Emission formation in SI Engines – Carbon monoxide & Carbon di oxide – Unburned hydrocarbon, NO _x , PM – Effects of design and operating variables on emission formation – controlling of pollutants – fuel modifications - Positive Crank case ventilation system, Evaporative Emission Control, Exhaust Gas Recirculation, Secondary air injection, thermal reactor, Catalytic converters – Types – substrate, Wash coat and Catalyst, Cold start emission control – Close coupled catalytic converter, Hydrocarbon Adsorber- Leam de-NO _x Catalysts- NO _x traps – Catalyst deactivation, use of unleaded petrol	10
3	EMISSION FROM COMPRESSION IGNITION ENGINE AND ITS CONTROL Formation of White, Blue, and Black Smokes, Soot, Particulate Matter NO _x , SO _x , HC, CO and Intermediate Compounds – Significance Effect of design and Operating variables on Emission formation —Fuel modification/additives, CRDI - High Injection Pressure and Injection Rate Shaping and Multiple injection, EGR- EGR Cooling and Heating, EGR Control, Fumigation, Diesel Oxidation Catalysts, Diesel de-NO _x Catalysts, NO _x traps, SCR, Diesel Particulate Filters - DPF material, structure and regeneration- HCCI Engines	10
4	NOISE POLLUTION FROM AUTOMOBILES Sources of Noise — Engine Noise, Transmission Noise, vehicle structural Noise, aerodynamics noise, Exhaust Noise. Noise reduction in Automobiles — Encapsulation technique for noise reduction — Silencer Design	06
5	TEST PROCEDURES AND EMISSION MEASUREMENTS Test cycles for light and medium duty vehicles – US-EPA cycle, ECE and EUDC cycle,	09



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170212

	Japanese cycle, Indian driving cycles – steady state and transient cycles - SHED Test - Chassis dynamometer – Constant Volume Sampling (CVS) Procedure for driving cycles - Emission analyzers — NDIR, FID, Chemiluminescent Analyzer (CLA), Smoke meters, Gas Chromatography, Particulate Emission Measurement - Dilution Tunnel, Sound level meters	

Suggested Specification table with Marks (Theory):

Distribution of Theory % Marks					
R Level	U Level	A Level	N Level	E Level	C Level
30	20	30	20	0	0

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Bernard Challen and Rodica Baranescu, "Diesel Engine Reference Book" – Second edition – SAE International Publications– 1999.
2. D.J.Patterson and N.A.Henin, 'Emission from Combustion Engine and their control', Anna Arbor Science Publication,1985
3. B.P. Pundir, "Engine Emissions - Pollutant Formation and Advances in Control Technology" Narosa Publishing house Pvt. Ltd, 2011
4. Geoff Davies, "Materials for Automobile Bodies", Butterworth-Heinemann, 2012.
5. Paul Degobert, "Automobiles and Pollution" SAE Publications, 1991
6. Ganesan, V., "Internal Combustion Engines", Tata McGraw Hill Co., 1994.
7. Ramalingam. K.K., "Internal Combustion Engines", Scitech Publications, 2003
8. Springer and Patterson, "Engine Emission", Plenum Press, 1990

Course Outcomes: students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Understand the mechanism of formation of various emissions in IC engines	25
CO-2	Understand the effects of pollution on human health and environment	20
CO-3	Understand the emission control techniques	40
CO-4	Develop fundamentals of the emission norms and test procedures	15

List of Experiments:

1. Study of Emission Standards for Automobile.
2. Measure CO, HC emission from petrol engines on exhaust gas analysis



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170212

3. Measure diesel exhaust smoke of diesel engine on diesel smoke meter
4. Demonstrate Exhaust gas re-circulation (EGR) system
5. Service of Catalytic converter
6. To study Noise reduction techniques in Automobiles.
7. Study of various Emission Analyzers

List of Open Source Software/learning website:

1. <http://nptel.ac.in/>
2. <http://npti.in/default.aspx>

Industrial Visit: It is strongly suggested and recommended to arrange a visit to automotive workshop/garages and auto industries