



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170215

Semester – VII

Subject Name: Advance Combustion Technology of I.C. Engine

Type of course: Professional Core/Elective

Prerequisite: Automobile Engines

Rationale: At the end of the course, the students will apply scientific basis of knowledge and summarized skilfully the overall findings, as reflected in all topics. The students will able to identify the problems related to combustion of existing and future IC engine and also develop scientific approach to solve these problems.

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	Gasoline direct injection engines: - Introduction, Overview of direct injection gasoline engines, Potential and technologies for high efficiency direct injection gasoline engine, High pressure fuel injection system, Exhaust emissions and after treatment devices.	08
2	Stratified charge engine: - Introduction, Thermodynamics and combustion process, Methods of charge stratification, Engines with stratified gasoline direct injection	07
3	Turbocharged direct injection spark ignition engine: - Introduction, Historical background: turbocharging for high specific output, Problems and challenges associated with turbocharging spark ignition engines, Advantages of combining direct injection and turbocharging in spark ignition engines, Challenges of applying direct injection to a turbocharged spark ignition engine	08
4	Direct injection natural gas engines: - Introduction, Building an engine, Fuel injection, Ignition, Combustion, Emission control	06
5	Multiple injection diesel combustion process: - Introduction, Double injection or pilot + main, Multiple injection technology, Factor affecting combustion in multiple injection, Multiple injections with the rate control, Multiple injections with late fuel injection	08
6	Homogenous Charge Compression Ignition (HCCI) Engines: - Introduction, HCCI combustion fundamentals, Gasoline HCCI engine, Diesel HCCI combustion engines, operational limits and emissions	08

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



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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. Advanced direct injection combustion engine technologies and development, Vol. 1 by Hua Zhao
2. Advanced direct injection combustion engine technologies and development, Vol. 2 by Hua Zhao
2. Gasoline and gas engines by Hua Zhao
3. HCCI and CAI engines for the automotive industry by Hua Zhao
4. Internal combustion engine by V Ganesan
5. Internal combustion engine by Heywood

Course Outcomes:

Students will able to,

Sr. No.	CO statement	Marks % weightage
CO-1	Compare gasoline direct injection technology with other gasoline injection technology based on technology potential, combustion process and exhaust emission.	32%
CO-2	Describe the thermodynamic aspects and combustion systems of stratified charge engine	18%
CO-3	Determine approaches to build a natural gas engine with controlled combustion.	14%
CO-4	Evaluate the effect of pilot, post- and multiple fuel injection strategies on engine combustion, performance and emissions.	18%
CO-5	Analyse homogenous charge compression ignition for gasoline and diesel engine.	18%

List of Open Source Software/learning website:

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

List of Experiments:

1. Study combustion parameters of gasoline and diesel engine.
2. Study methods to measure combustion parameters of IC engine.
3. Identify different parts of gasoline direct injection system for any two/four wheeler engine and study working of it.



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4. Study technological modification between MPFI engine and GDI (gasoline direct injection engine)
5. Study/Perform combustion characteristics of any dual fuel/multi fuel diesel/gasoline engine.
6. Study charge stratification methods for SI and CI engine.
7. Comprehend the requirement, to modify existing gasoline engine into direct injection CNG engine.
8. Prepare technology and combustion analysis report based on case study of any existing gasoline direct injection engine with and without stratification.
9. Study Gasoline HCCI engine, operational limits and emissions.
10. Study Diesel HCCI engine, operational limits and emissions.