



# GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma in Engineering

Level: Diploma

Branch: Automobile Engineering

Course / Subject Code : DI02002021

Course / Subject Name : Fuels and Lubricants

w. e. f. Academic Year:	2024-2025
Semester:	2 <sup>nd</sup>
Category of the Course:	PCC

<b>Prerequisite:</b>	Zeal to learn the subject.
<b>Rationale:</b>	The course "Fuels and Lubricants" is designed to provide students with a comprehensive understanding of the essential role that fuels and lubricants play in the operation and performance of internal combustion (IC) engines in vehicles. As the automotive industry evolves with advancements in engine technology and increasing environmental regulations, a thorough knowledge of fuel properties, combustion processes, and lubrication mechanisms has become essential. This course addresses these needs by exploring the molecular structure and properties of various fuels, the chemistry of combustion, the role of additives, and the selection of lubricants. Course also covers preliminary idea of various alternative fuels. By doing so, it prepares students to tackle real-world challenges, such as improving fuel efficiency, reducing environmental impact, searching alternate fuels and enhancing the durability of vehicle engines.

## Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Interpret the effect of various properties and additives of fuel on the function of the engine.	R,U
02	Interpret the effect of various types of lubricants used in a vehicle based on their properties and additives.	R,U
03	Determine the role of conventional fuel in combustion and causes as well as preventive measures for abnormal combustion.	R,U
04	Compare alternative fuels on the basis of their composition, properties, merits and demerits.	R,U,A

*\*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
L	T	PR	C	Theory		Tutorial / Practical		
				ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150

## Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	<b><u>Introduction to IC Engine Conventional Fuels:</u></b> 1.1 Introduction to fuel and classification of fuels with their merits and demerits. 1.2 Requirement of IC- engine fuel 1.3 Petroleum (crude oil and atmospheric fractional distillation process with products of process) 1.4 Classification and Structures of Hydrocarbon and its effect 1.5 Comparison of Petrol and Diesel. 1.6 Various desirable properties of SI engine fuels and their effect on engine performance 1.7 Additives of gasoline (which and for what purpose) 1.8 Various desirable properties of CI engine fuels and their effect on engine performance 1.9 Additives of diesel (which and for what purpose) 1.10 Rating of fuel: (1)Octane number (2) Cetane number	14	30%
2.	<b><u>Lubricants</u></b> 2.1 Role of lubricating oil in a vehicle. 2.2 Classification of lubricating oil on the basis of their use in a		



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	vehicle. 2.3 Properties of lubricating oil and their effect. 2.4 Grading of lubricating oil. 2.5 Additives of lubricating oil (which and why basis) 2.6 Causes of Oil degradation. 2.7 Synthetic lubricants. Advantages and disadvantages of synthetic lubricants compare to conventional lubricants. 2.8 Role of grease in a vehicle. 2.9 Properties of grease used in a vehicle. 2.10 Classification of grease on the basis of constituents. 2.11 Additives of grease ( on which and why basis) 2.12 Causes of grease degradation 2.13 Factors to be considered while selecting grease.	14	30%
3.	<b><u>Combustion Process in SI and CI Engines:</u></b> 3.1 Introduction to IC- Engine. 3.2 Basic Working process in S.I. and C.I. Engines 3.3 Combustion in IC engine 3.4 Effect of hydrocarbon structure and its composition on combustion. 3.5 Normal and abnormal combustion in SI and CI engine. 3.6 Factors responsible for abnormal combustion in SI and CI engine. 3.7 Ignition Lag and factors affecting it in SI and CI engine. 3.8 Pre-ignition and its effects. 3.9 Detonation in SI engine, its effects, factors affecting it and prevention. 3.10 Diesel knock, its effects, factors affecting it and prevention.	10	20%



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4.	4) <b>Alternative fuels for IC-Engine.</b> 4.1 Need for Alternative Fuels. 4.2 Introduction to LPG, CNG, Alcohol, Methanol, Ethanol, Fuel cell, Vegetable oils, bio-diesel, biogas, Hydrogen. 4.3 Comparative study of Properties, advantages and disadvantage of Alternative Fuels.	7	20%
<b>Total</b>		<b>45</b>	<b>100%</b>

## Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
45%	45%	10%			

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:

1. Internal Combustion Engines by V Ganesan, 4<sup>TH</sup> EDITION, McGraw-Hill Publication, New Delhi, ISBN(13 digit): 978-1-25-900619-7, ISBN(10 digit): 1-25-900619-0
2. Internal combustion engine by V.M. Domkundwar, Dhanpat Rai Publishing Company (P) Ltd
3. Alternative fuels by S.S. Thipse, Jaico Publishing House,
4. Automobile Engineering (Vol- I) by Anil Chhikara, Satya Prakashan, New Delhi, ISBN(10 digit): 81-7684-505-1
5. Automobile Engineering by R.B.Gupta, Satya Prakashan, New Delhi, ISBN(10 digit): 978-93-5192-191-2

### (b) Open source software and website:

1. <https://nptel.ac.in>
2. <https://auto.howstuffworks.com>
3. <https://swayam.gov.in>
4. <https://www.howacarworks.com>



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## Suggested Course Practical List:

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
	<b>Any three from following.</b>		
1	Measure calorific value of given sample of fuel.	1	4
2	Measure viscosity of given sample of fuel and lubricant by viscometer.	1,2	4
3	Measure flash and fire point of given sample of fuel.	1	4
4	Measure volatility range of given sample of fuel.	1	4
5	Measure specific gravity of fuel. From that find out API gravity of sample.	1	4
	<b>Any three from following.</b>		
6	Measure cloud point and pour point of given sample of oil.	2	4
7	Measure carbon residue of given sample of oil.	2	4
8	Measure dropping point of given sample of grease.	2	4
9	Measure consistency of grease on rolling.	2	4
10	Measure penetration quality of grease.	2	4
	<b>Any one from following</b>		
11	Prepare and explain the chart of normal and abnormal combustion in SI engine and list out symptoms of abnormal combustion with preventive measure.	3	2
12	Prepare and explain the chart of normal and abnormal combustion in CI engine and list out symptoms of abnormal combustion with preventive measure.	3	2
	<b>Any one from following.</b>		



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13	Analysis of Petrol and CNG Properties with a Focus on Long-Term Engine and Environmental Impacts.	4	4
14	Analysis of Diesel and Biodiesel Properties with a Focus on Long-Term Engine and Environmental Impacts.	4	4
	<b>Total Hrs.</b>		<b>30</b>

## List of Laboratory/Learning Resources Required:

- 1) Bomb calorimeter/Junker's calorimeter/ Gas calorimeter
- 2) U tube viscometer/say bolt viscometer/red wood viscometer-1 and 2
- 3) Pen sky-martin/ Abel Flash and fire point apparatus
- 4) Fuel distillation test apparatus.
- 5) West phal balance/ specific gravity bottle/Hydrometer
- 6) Cloud point and pour point apparatus
- 7) Carbon residual tester
- 8) Dropping point apparatus for grease
- 9) Grease roll stability test apparatus
- 10) Standard penetrometer for grease

## Suggested Project List:

- 1) Prepare report on properties of actual fuel available in market.
- 2) Prepare report on properties of actual lubricant/ grease available in market.
- 3) Case Study on National and International norms for fuels and lubricants.
- 4) Prepare chart of various types of lubricants used in automobile and available in nearby market.
- 5) Prepare short report/Chart on Combustion of fuel.
- 6) Prepare short report/Chart on Comparative study of different parameters of Alternative fuels
- 7) Visit the local market and collect information about fuels and lubricants.
- 8) Demonstration model of use of alternate fuels in a vehicle.

## Suggested Activities for Students:

- 1) Download and Collect videos, animation about fuels and lubricants
- 2) Participate in group discussions on any topic of fuels and lubricants given by concern faculty

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