

GANPAT UNIVERSITY

FACULTY OF DIPLOMA ENGINEERING

Programme	Diploma in Automobile Engineering				
Semester	II			Version	1.0.0.0
Effective from Academic Year	2025-26			Effective for the batch Admitted in	JULY 2025
Course code	1AU2101	Course Name	Fuel and Lubricants		

I.TEACHING-LEARNING AND ASSESSMENT SCHEME

Course Type	Course Code	Learning Scheme						Assessment Scheme										Total Marks
		Actual Contact Hrs./Week			SLH	NLH	Credits	Theory				Practical				Based on SL		
								FA-TH	SA-TH	TOTAL		FA-PR	SA-PR	TOTAL		SLA		
		CL	TL	LL				MAX	MAX	MAX	MIN	MAX	MAX	MAX	MIN	MAX	MIN	
DSC	1AU2101	3	-	2	3	8	4	40	60	100	40	30	20	50	20	20	8	170

Abbreviation:	CL- Classroom Learning	TL - Tutorial Learning	LL - Laboratory Learning
	SLH - Self Learning Hours	NLH - Notional Learning Hours	SLA - Self Learning Assessment
	FA - Formative Assessment (Term work +Mid Sem Exam +Attendance)		SA - Summative Assessment

II. PRE-REQUISITES

Learners should have:

1. Understanding of different types of vehicles (cars, two-wheelers, commercial vehicles).
2. Basic skills in handling tools and equipment used in automobile maintenance and repair.
3. Knowledge of workplace safety standards in automobile workshops.

III. INDUSTRY / EMPLOYER EXPECTED OUTCOMES

On course completion, learners will be able to:

1. Understand the origin, refining, and distillation processes of fuels and lubricants.
2. Use appropriate fuels and lubricants under varying operating conditions to enhance engine Performance.
3. Evaluate and apply alternative fuels considering performance, environmental impact, and Economics.
4. Ensure preventive maintenance and improve engine reliability.

IV. COURSE LEARNING OUTCOMES

At the end of the course, students will be able to achieve the following course learning outcomes:

- CO1:** Explain the origin, classification, and distillation of crude oil along with its derived products.
- CO2:** Select and apply appropriate fuels and lubricants by analysing their properties, performance characteristics, and suitability for specific engine applications
- CO3:** Analyse combustion phenomena in SI and CI engines, including abnormal combustion, ignition lag, knocking, and fuel rating systems.
- CO4:** Explain engine frictional losses and apply appropriate lubrication methods to enhance performance and durability.
- CO5:** Evaluate alternative fuels and measure critical properties of fuels and lubricants using standard instruments to support performance analysis and sustainability.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT:

Name of Unit	Theory Learning outcomes (TLO's) aligned to CO's	Learning Content mapped with Theory Learning outcomes (TLO's) & CO's	Marks	Hours

Unit-1 Introduction to Fuels	<p>TLO 1.1 Explain the basic requirements of a fuel and lubricant.</p> <p>TLO 1.2 Classify various types of fuels and lubricants with their uses and sources.</p> <p>TLO 1.3 Describe the theory of origin and accumulation of crude oil.</p> <p>TLO 1.4 Explain the methods used for searching crude oil.</p> <p>TLO 1.5 Describe the process of crude oil recovery.</p> <p>TLO 1.6 Classify crude oil and hydrocarbons.</p> <p>TLO 1.7 Identify the structure of various hydrocarbons.</p> <p>TLO 1.8 Explain fractional distillation and classification of refinery products.</p> <p>TLO 1.9 Describe various refining processes.</p>	<p>1.1 Basic requirements of a fuel & lubricant</p> <p>1.2 Types of fuels & lubricants, their uses & sources</p> <p>1.3 Theory of origin and accumulation of crude oil</p> <p>1.4 Methods of searching crude oil</p> <p>1.5 Recovery of crude oil</p> <p>1.6 Classification of crude oil & hydrocarbon</p> <p>1.7 Structure of various hydrocarbons</p> <p>1.8 Fractional distillation and classification of refinery products</p> <p>1.9 Various refining processes</p>	8	6
Unit-2 Properties and Additives of Fuel	<p>TLO 2.1 Explain various desirable properties of SI engine fuels.</p> <p>TLO 2.2 Analyse the effect of SI engine fuel properties on engine performance.</p> <p>TLO 2.3 Describe common additives used in gasoline.</p> <p>TLO 2.4 Explain the blending and treatment process of gasoline.</p> <p>TLO 2.5 Explain various desirable properties of CI engine fuels.</p> <p>TLO 2.6 Analyse the effect of CI engine fuel properties on engine performance.</p> <p>TLO 2.7 Describe additives used in diesel fuel.</p>	<p>2.1 Various desirable properties of SI engine fuels</p> <p>2.2 Their effect on engine performance</p> <p>2.3 Additives of gasoline</p> <p>2.4 Blending and treatment of gasoline</p> <p>2.5 Various desirable properties of CI engine fuels</p> <p>2.6 Their effect on engine performance</p> <p>2.7 Additives of diesel</p>	8	6
Unit-3 Combustion Process and Rating of Fuels	<p>TLO 3.1 Explain combustion in SI engines including normal and abnormal combustion.</p> <p>TLO 3.2 Identify factors affecting normal combustion in SI engines.</p> <p>TLO 3.3 Define ignition lag and explain its influencing factors.</p> <p>TLO 3.4 Describe pre-ignition and its effects.</p> <p>TLO 3.5 Explain detonation, its effects, and prevention techniques.</p> <p>TLO 3.6 Describe phases of combustion in CI engines.</p> <p>TLO 3.7 Analyse factors affecting combustion in CI engines.</p> <p>TLO 3.8 Define ignition lag in CI engines and identify influencing</p>	<p>3.1 Combustion in SI engine: Normal and abnormal combustion</p> <p>3.2 Factors affecting normal combustion</p> <p>3.3 Ignition lag and factors affecting it</p> <p>3.4 Pre-ignition and its effects</p> <p>3.5 Detonation, its effects and prevention</p> <p>3.6 Phases of combustion in CI engine</p> <p>3.7 Factors affecting combustion in CI engine</p> <p>3.8 Ignition lag and factors affecting it (CI engine)</p> <p>3.9 Diesel knock, its effects</p>	14	10

	<p>factors.</p> <p>TLO 3.9 Explain diesel knock, its effects, and prevention.</p> <p>TLO 3.10 Define octane number and state the merits/demerits of high and normal octane fuel.</p> <p>TLO 3.11 Define cetane number.</p>	<p>and prevention</p> <p>3.10 Octane number, merits and demerits of high/normal octane fuel</p> <p>3.11 Cetane number</p>		
Unit-4 Introduction to Engine Friction and Lubricants	<p>TLO 4.1 Explain engine frictional losses.</p> <p>TLO 4.2 Identify factors affecting engine frictional losses.</p> <p>TLO 4.3 Explain the concept of boundary lubrication.</p> <p>TLO 4.4 Classify and describe types of lubricating oils.</p> <p>TLO 4.5 State the basic requirements of lubricants.</p> <p>TLO 4.6 Explain the distillation process to extract lubricating oil from crude oil.</p> <p>TLO 4.7 Describe various treatments applied to lubricating oils.</p> <p>TLO 4.8 Classify types of grease and explain their characteristics.</p>	<p>4.1 Engine frictional losses</p> <p>4.2 Factors affecting frictional losses</p> <p>4.3 Boundary lubrication</p> <p>4.4 Classification and types of lubricating oil</p> <p>4.5 Basic requirements of lubricants</p> <p>4.6 Distillation process to get lubricating oil from crude oil</p> <p>4.7 Various treatment given to the lubricating oil</p> <p>4.8 Types of grease and its characteristics.</p>	6	4
Unit-5 Properties, Gradation and Additives of Lubricants	<p>TLO 5.1 Explain various properties of lubricating oils.</p> <p>TLO 5.2 Describe the gradation system for lubricating oils.</p> <p>TLO 5.3 Introduce the ISO cleanliness code for lubricants.</p> <p>TLO 5.4 Explain the functions and types of additives used in lubricants.</p>	<p>5.1 Various properties of lubricating oil</p> <p>5.2 Gradation of lubricating oil</p> <p>5.3 Introduction of ISO cleanliness code</p> <p>5.4 Function and type of additives of lubricating oil</p>	8	7
Unit-6 Alternative Fuels	<p>TLO 6.1 Describe different types of alternative fuels.</p> <p>TLO 6.2 Explain the economics of alternative fuels including their merits and demerits.</p>	<p>6.1 Alternative fuels and their economics – Alcohol, Ethanol, Methanol, Hydrogen, LPG, CNG, Bio Gas, Bio diesel</p> <p>6.2 Biodiesel, Ethanol, Solar Energy, Wind Energy</p>	8	6
Unit-7 Measurement of Various Properties of Fuels & Lubricants	<p>TLO 7.1 Describe measurement techniques for various fuel and lubricant properties.</p> <p>TLO 7.2 Explain safety precautions required while measuring properties of fuels and lubricants.</p>	<p>7.1 Measurement of various properties of fuels & lubricants</p> <p>7.2 Safety precautions while measuring properties of fuels & lubricants</p>	8	6

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL			
Sr. No.	Practical/Laboratory Learning Outcome (LLO)	Practical Titles	Relevant COs
1	LLO 1.1 Crude oil distillation is the initial step in refining, where crude oil is heated and separated into various components based on boiling points.	Draw the chart & Describe distillation process of crude oil.	CO1, CO5
2	LLO 2.1 The flash point is the lowest temperature at which a fuel's vapour forms an ignitable mixture with air, while the fire point is the temperature at which the fuel continues to burn after ignition.	Determination of flash and fire point of given sample of fuel.	CO2, CO5
3	LLO 3.1 Viscosity measures a fluid's resistance to flow. The kinematic viscosity of lubricating oil is determined using an Ostwald viscometer.	Determination of viscosity of lubricating oil at different temperature.	CO2, CO4, CO5
4	LLO 4.1 Specific gravity is the ratio of the density of a substance to the density of a reference substance (usually water).	Determination of specific gravity of given sample of fuel by Westphal Balance.	CO2, CO5
5	LLO 5.1 API gravity is a measure of how heavy or light petroleum liquid is compared to water.	Study of measuring API gravity of fuel.	CO2, CO5
6	LLO 6.1 The carbon residue indicates the amount of carbonaceous material remaining after a fuel has been evaporated and pyrolyzed.	Determination of carbon residue of lubricating oil.	CO2, CO5
7	LLO 7.1 Cloud Point: The temperature at which wax crystals first appear in the oil. Pour Point: The lowest temperature at which the oil will still flow.	Determination of cloud and pour point of given sample of oil.	CO2, CO5

VII. SUGGESTED MICRO PROJECT / ASSIGNMENTS / ACTIVITIES FOR SELF LEARNING / SKILL DEVELOPMENT (SELF LEARNING)
<ol style="list-style-type: none"> 1. Collect information about the basic requirements of a fuel and lubricant. 2. Classify various types of fuels and lubricants with their uses and sources. 3. Analyze the effect of SI engine fuel properties on engine performance. 4. Explain combustion in SI engines, including normal and abnormal combustion. 5. Classify and describe types of lubricating oils. 6. Explain the distillation process to extract lubricating oil from crude oil. 7. Introduce the ISO cleanliness code for lubricants. 8. Describe different types of alternative fuels. 9. Describe measurement techniques for various fuel and lubricant properties.

VIII. LIST OF INSTRUMENTS / EQUIPMENT / TRAINER BOARD	
1.	Say bolt Viscometer Apparatus, Red Wood Viscometer, Engler Viscometer, Kinematic Viscometer Used to measure viscosity of fuels and lubricants.
2.	Abeles Flash Point Apparatus, Pensky-Marten Flash & Fire Point Apparatus, Cleveland Flash Point Apparatus
3.	Bomb Calorimeter Measures the heat of combustion and calorific value of fuels.
4.	Determines low-temperature operational limits of petroleum products.
5.	Carbon Residue Test Apparatus, Rams bottom Carbon Residue Apparatus Evaluates coke-forming tendencies of fuels.
6.	Distillation Range Apparatus Assesses boiling range characteristics as per ASTM D86/IP123.
7.	Measures vapour pressures—an important volatility metric for gasoline.
8.	Tests the separation ability of oil and water mixtures.
9.	Copper Corrosion Test Apparatus (copper strip tarnish)
10.	Evaluates corrosivity of petroleum products to certain metals.

IX. LIST OF REFERENCE BOOKS			
Sr.No.	Title	Author	Publication
1	Internal combustion engines	V.M. Domkundwar	Dhanpat Rai Publishing Company (P) Ltd
2	Automobile Engineering	K. M. Gupta	Umesh Publication
3	Internal Combustion Engine	R. K. Rajput	Laxmi Publication

X. LINK OF LEARNING WEB RESOURCE	
1	https://onlinecourses.nptel.ac.in/noc23_ch64/preview
2	https://onlinecourses.nptel.ac.in/noc25_ch92/preview
3	https://nptel.ac.in/courses/112102014
4	http://www.youtube.com/watch?v=_hwzJUDWIQQ
5	http://www.youtube.com/watch?v=vscX_zawdQw
6	http://lubricantspecialist.files.wordpress.com/2011/10/basic-of-lubricantslubrication.ppt
7	For mock test https://www.vskills.in/practice/petrol-and-diesel-engine-mechanic-mock-test

XI. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE							
Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	Introduction to Fuels	CO1	6	4	4	4	8
2	Properties and Additives of Fuel	CO2	6	4	4	4	8
3	Combustion Process and Rating of Fuels	CO3	10	5	5	5	14

4	Introduction to Engine Friction and Lubricants	CO4	4	4	4	4	6
5	Properties, Gradation and Additives of Lubricants	CO2,CO4	7	4	5	5	8
6	Alternative Fuel	CO5	6	3	4	3	8
7	Measurement of Various Properties of Fuels & Lubricant	CO5	6	3	4	3	8
Grand Total			45	27	30	28	60

XII. COs AND POs AND PSOs MAPPING

Course outcome (Cos)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS01	PSO2	PSO3
CO1	3	3	2	1	1	3	0	2	1	1
CO2	3	3	3	3	2	2	2	3	2	3
CO3	3	3	3	2	2	2	2	2	2	3
CO4	3	3	2	2	2	2	0	2	3	2
CO5	3	3	3	1	2	3	0	3	1	1

Legends: -3- *High* 2-*Moderate/Medium* 1-*Slight/Low* 0-*None*