



# Buddha Institute of Technology Gorakhpur

Department of Mechanical Engineering

ALLOTTMENT BASED ON COMPETENCY SKILLS

Academic Session: July – Dec 2022

Name of the Staff	Mr. Vishnu Pratap Singh
Area of Specialization	Production Engineering
Subject Allotted	I C Engine Fuel & Lubrication

Sl. #	Course Code	Course Title	Semester	Theory/Practical
1.	KME054	I C Engine Fuel & Lubrication	V Sem Batch B	Theory


**HOD**

## Course Outcome and Programme Outcome

Program	: B. Tech.
Branch	: ME
Semester	: V
Session	: 2022-23
Name of the Course	: I C Engine Fuel & Lubrication
Code	: KME054
Name of the Course Instructor	: Vishnu Pratap Singh
Designation	: Assistant Professor
Department	: Mechanical Engineering

### **Description of the Course Outcome:**

<b>CO</b>	<b>After completion of the course students will be able to:</b>
KME054	Understand working principle, performance parameters and testing of IC Engines.
KME054	Understand the combustion phenomena in SI and CI engines and factors influencing combustion chamber design.
KME054	Understand the fuel injection system in SI and CI engines and working of different components of IC engine like carburetor and turbocharger.
KME054	Understand the important qualities of IC engine fuels, then interpret different alternative fuels for IC engines and method to control the exhaust emissions from IC engines.
KME054	Understand the essential systems of IC engine like cooling system, lubrication system, ignition system etc. and latest trends and developments in IC Engines.

Buddha Institute of Technology, Gorakhpur			
Department: Mechanical Engineering			
Academic Semester: July – Dec 2022			
Semester: V	Section: B	Course Code: KME054	Course: I C Engine Fuel and Lubricants
Course Instructor: Mr. Vishnu Pratap Singh		Contact Hours /week: 05	# of credits: 03
CIE Marks: 50		SEE Marks:100	Exam Hours: 03

Prerequisites if any:			
Code No	Course Name	Description	Semester
RME302	Thermodynamics	Basic Thermodynamics	III

Content delivery:	Chalk & Board, DLP, System/Laptop with social media videos
-------------------	--

<b>COURSE SYLLABUS:</b>			
<b>ModuleNo</b>	<b>Contents of Module</b>	<b>Hrs</b>	<b>COs</b>
1	<p><b>INTRODUCTION TO I.C ENGINES:</b> Engine classification and basic terminology, Two and four stroke engines, SI and CI engines, Valve timing diagram, Valve mechanism- Push rod type, Overhead type (SOHC,DOHC). Thermodynamic analysis of Air standard cycles: Otto cycle, Diesel cycle, Dual cycle, Comparison of Otto, Diesel and Dual cycles Fuel air cycle, factors affecting the fuel air cycle, Actual cycle.</p> <p><b>TESTING AND PERFORMANCE:</b> Performance parameters, Basic measurements, Blow by measurement, Testing of SI and CI engines.</p>	14	CO1
2	<p><b>COMBUSTION:</b> Stages of Combustion in SI &amp; CI engine, Factors affecting combustion, Flame speed, Ignition Delay, Abnormal combustion and its control.</p> <p><b>COMBUSTION CHAMBER:</b> Squish, Swirl &amp; tumble, Combustion chamber design for SI &amp; CI engine &amp; factors affecting it.</p>	10	CO2
3	<p><b>CARBURETION:</b> Mixture requirements, Carburetors and fuel injection system in SI Engine, MPFI, Scavenging in 2 Stroke engines.</p> <p><b>FUEL INJECTION IN CI ENGINES:</b> Requirements, Types of injection systems, Fuel pumps, Fuel injectors, Injection timings.</p> <p><b>TURBOCHARGING &amp; ITS TYPES:</b> Variable Geometry Turbocharger, Waste Gate Turbocharger, Effect of turbocharging on power &amp; emission.</p>	11	CO3
4	<p><b>ENGINE EMISSION AND CONTROL:</b> Pollutant, Sources and types, Effect on environment and human health, formation of NO<sub>x</sub>, Hydrocarbon Emission Mechanism, Carbon Monoxide Formation, Particulate emissions, Methods of controlling Emissions, Catalytic converters and Particulate Traps, Selective Catalytic Reduction(SCR), Diesel Oxidation Catalyst (DOC).</p> <p><b>FUELS:</b> Fuels for SI and CI engine, Important qualities of SI and CI engine fuels, Rating of SI engine and CI engine fuels, Dopes, Additives, Gaseous fuels, LPG, CNG, Biogas, Producer gas, Alternative fuels for IC engines.</p>	10	CO4
5	<p><b>ENGINE COOLING AND LUBRICATION:</b> Different cooling systems, Radiators and cooling fans, Engine friction, Lubrication principle, Type of lubrication, Lubrication oils, Crankcase ventilation.</p> <p><b>IGNITION SYSTEM IN SI ENGINE:</b> Ignition system requirements, Magneto and battery ignition systems, ignition timing and spark plug, Electronic ignition.</p> <p><b>RECENT TRENDS IN IC ENGINE:</b> Lean burn engine, Stratified charge spark ignition engine, Homogeneous charge spark ignition engine, GDI.</p>	12	CO5

**COURSE OUTCOMES:** At the end of the Course, the Student will be able to:

KME054	Understand working principle, performance parameters and testing of IC Engines.
KME054	Understand the combustion phenomena in SI and CI engines and factors influencing combustion chamber design.
KME054	Understand the fuel injection system in SI and CI engines and working of different components of IC engine like carburetor and turbocharger.
KME054	Understand the important qualities of IC engine fuels, then interpret different alternative fuels for IC engines and method to control the exhaust emissions from IC engines.
KME054	Understand the essential systems of IC engine like cooling system, lubrication system, ignition system etc. and latest trends and developments in IC Engines.

#### Mapping of CO v/s PO:

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
KME054.1	3	3	3	2	2	-	-	-	-	-	-	2
KME054.2	-	-	2	1	-	2	-	-	-	2	1	2
KME054.3	-	-	2	1	-	-	-	-	-	2	1	2
KME054.4	-	-	3	1	-	2	3	-	-	2	1	2
KME054.5	-	-	2	1	-	1	-	-	-	2	1	2

Correlation levels: 1-Slight (Low)      2-Moderate (Medium)      3-Substantial (High)

#### Mapping of CO v/s PSO:

	PSO1	PSO2
KME054.1	3	3
KME054.2	3	3
KME054.3	3	3
KME054.4	3	3
KME054.5	3	3

Gap in the syllabus	NA
---------------------	----

Topics to be covered beyond syllabus	NA
--------------------------------------	----

#### Assessment Methodologies:

Sl. No.	Description	Type
1	Student Assignment	Direct
2	Internal assessment	Direct
3	University exam	Direct
4	Student feedback	Indirect
5	Alumni feedback	Indirect
6	Employers feedback	Indirect

### LESSON PLAN

Lecture #	Module #	Topics	RBT Levels	Course Outcome Mapping	Planned Date	Actual Date	Faculty Sign	Remarks
1	1	Introduction to I.C Engines <b>Engine classification and basic terminology</b>	L2, L3, L4	CO1	22/8/22			
2		Two and four stroke engines SI and CI engines			23/8/22			
3		<b>Tutorial</b> Valve timing diagram			24/8/22			
4		Valve mechanism- Push rod type, Overhead type (SOHC, DOHC)			25/8/22			
5		Thermodynamic analysis of Air standard cycles, Otto cycle Diesel cycle, Dual cycle			29/8/22			
6		<b>Tutorial</b> Comparison of Otto, Diesel and Dual cycles			30/8/22			
7		Fuel air cycle Factors affecting the fuel air cycle			31/8/22			
8		Actual cycle <b>Tutorial</b>			1/9/22			
9		<b>Testing and Performance: Performance parameters, Basic measurements</b>			5/9/22			
10		Blow by measurement, Testing of SI and CI engines			6/9/22			
11		Combustion: Stages of Combustion in SI engine			7/9/22			
12		Factors affecting combustion Factors affecting combustion			8/9/22			

13		<b>Tutorial</b> Flame speed, Ignition delay			12/9/22			
14		<b>Abnormal combustion and its control combustion chamber design for SI engines</b>			13/9/22			
15		Combustion: Stages of Combustion in CI engine			14/9/22			
16		Ignition delay, Knock and its control			15/9/22			
17		Combustion chamber design of CI engines			22/9/22			
18		Squish, Swirl & tumble <b>Tutorial</b>			3/10/22			
19		Carburetion, Mixture requirements			6/10/22			
20		Fuel injection system in SI Engine, MPFI			8/10/22			
21		Scavenging in 2 Stroke engines			10/10/22			
22		<b>Tutorial</b> Fuel injection in CI engines, Requirements			11/10/22			
23	<b>2</b>	Types of injection systems	<b>L2</b>	<b>CO2</b>	12/10/22			
24		Fuel pumps, Fuel injectors, Injection timings			13/10/22			
25		Turbo charging & its types			17/10/22			
26		<b>Tutorial</b>			18/10/22			
27		Variable Geometry Turbocharger			19/10/22			
28		Waste Gate Turbocharger			20/10/22			
29		Effect of turbo charging on power & emission			31/10/22			
30		Engine Emission and Control: Pollutant, Sources and types			1/11/22			
31	<b>3&amp;4</b>	Effect on environment and human health	<b>L2</b>	<b>CO3 &amp;CO4</b>	2/11/22			
32		formation of NOx, Hydrocarbon Emission Mechanism			3/11/22			

33		Carbon Monoxide Formation, Particulate emissions			7/11/22			
34		Methods of controlling Emissions, Catalytic converters and Particulate Traps			8/11/22			
35		<b>Tutorial</b> Selective Catalytic Reduction (SCR), Diesel Oxidation Catalyst (DOC			9/11/22			
36		Fuels: Fuels for SI and CI engine			10/11/22			
37		Important qualities of SI and CI engine fuels, Rating of SI engine and CI engine fuels			14/11/22			
38		Dopes, Additives, Gaseous fuels, LPG, CNG			15/11/22			
39		<b>Tutorial</b>			16/11/22			
40		Biogas, Producer gas, Alternative fuels for IC engines			17/11/22			
41		Engine Cooling and Lubrication: Different cooling systems			21/11/22			
42		Radiators and cooling fans			22/11/22			
43		Engine friction, Lubrication principle			23/11/22			
44		<b>Tutorial Type of lubrication</b>			24/11/22			
45		<b>Lubrication oils, Crankcase ventilation</b>			25/11/22			
46		Ignition System in SI Engine: Ignition system requirements			5/12/22			
47	5	Battery ignition system <b>Tutorial</b>	L2	C05	6/12/22			
48		Magneto ignition system, Ignition timing Spark plug, Electronic ignition			7/12/22			



49	Recent trends in IC engine: Lean burn engine Stratified charge spark ignition engine			8/12/22				
----	---	--	--	---------	--	--	--	--

**\*L1 - Remembering; L2 - Understanding; L3 - Applying; L4 - Analysing; L5 - Evaluating; L6 - Creating**

**Literature:**

**Text Books:**

1. I.C Engine: V. Ganeshan, Tata McGraw Hill Publications

**Reference Books:**

1. A course in Internal combustion engines: M. L. Mathur and R. P. Sharma, Dhanpat Rai & Sons Publications

**Sample Questions:**

Question No.	Questions
1	Compare the Otto, diesel and dual cycle.
2	Define four stroke S I engine. Explain with suitable sketch the working of four stroke S I engine.
3	Discuss the valve timing diagram of four stroke S I engine.
4	Compare the two stroke and four stroke cycle engine.
5	How the thermal efficiency vary with equivalence ratio for air standard, fuel-air and actual cycle.
6	Describe with suitable sketch combustion phenomenon in S I engine.
7	Describe the phenomenon of detonation or knocking in S I Engine. On what factors does detonation depends.
8	Explain the carburetion and working of a simple carburetor in a S I engine. Explain the carburetion by compensating jet method with sketch.
9	Explain the working of MPFI engine.
10	Describe a high tension magneto ignition system.
11	Show the various stages of combustion in C I engine on the pressure-crank angle diagram. Also discuss the effect engine load, speed, injection timing and cetan number on the delay period in C I engine.
12	What are the types of combustion chamber used in C I engine.
13	What are the cause of knock in C I engine? How it is controlled?
14	Explain the type of fuel injection system in diesel engine.
15	Enumerate pollutants emitted from S I engine. How can these pollutants be controlled? Compare gasoline engine with a diesel engine regarding their pollution emission.
16	Describe briefly classification of cooling system.
17	Classify various systems of engine lubrication. Explain splash lubrication system.
18	What is crank case ventilation? What are its different types?
19	Explain the rating of S I Engine fuels.
20	Explain why additives or dopes are mixed in fuel? What are the requirements of good additives?
21	Explain the working of Waste Gate Turbocharger.
22	Explain the effect of turbocharging on power & emission.
23	Define Lean burn engine.
24	Explain the working of Stratified charge spark ignition engine.
25	Explain the working of Homogeneous charge spark ignition engine.

Assessment rubrics that is going to be adopted for direct attainment is depicted in below table

<b>Level of Achievement</b>	<b>Elaboration on Course Grading Description</b>	<b>Bench Mark Set (Out of 50)</b>
<b>Excellent (A)</b>	The Student's performance is outstanding in almost all the intended course learning outcomes	40 to 50
<b>Good (B)</b>	The student's performance is good in most of the intended course learning outcomes.	30 to 40
<b>Marginal (C)</b>	The student's performance is barely satisfactory. It marginally meets the intended course learning outcomes	20 to 30
<b>Fail (F)</b>	The Students performance is inadequate. Student fails to meet many of the intended course learning outcomes	Less than 20

NHCE/LPT/003