Course No.	Course Name	L-T-P - Credits	Year of Introduction
AU204	CI ENGINES & COMBUSTION	4-0-0-4	2016

Course Objectives

- To impart the basic concepts of CI Engine and Combustion
- To know about CI engine emissions and their treatments,
- To differentiate ideal and actual cycles
- To understand FI systems in CI engines

Syllabus

Diesel fuels, Properties and qualities - Combustion in CI engines, P-θ diagram - Air motion- Squish, tumble - Fuel supply system in diesel engines - Diesel injection pump types - C-AV Bosch pump, Modem distributor type pumps - Diesel filters - Advanced fuel injection system- Unit pump & injector- Common Rail (CR) Fuel Injection Systems - Sensors in CI engine - Pollutants in engines. NOx, CO, unburned hydrocarbons - Exhaust gas treatment.- Catalytic converter – Supercharging - effects of supercharging in S.I and C.I engines - Turbo charging - methods of turbo charging - cold starting devices

Expected outcome.

The students will be able to

i. To explain CI Engine and Combustion,
ii. To differentiate and analyse ideal and actual cycles
iii. To diagnose FI systems in CI engines

Text Book:

1. M. L. Mathur, R. P. Sharma - Internal Combustion Engines, DhanpatRai Publications
2. R.K. Rajput, Internal Combustion Engines, Laxmi Publications.
3. V Ganesan, *Internal Combustion Engine* Tata McGraw Hill Publishing Company Ltd., New Delhi 2006.

References:

1. Newton K, Steeds W and Garrett T.K – Motor Vehicle, Butterworth Heinemann Ltd
2. William H Crouse, Donald L Anglin, Automotive Mechanics , Tata McGraw-Hill Publishers
3. Joseph Heitner- Automobile mechanics, CBS Publishers, New Delhi
4. A.W.Judge, Modern petrol engine, Chapman and Hall, London
5. P. M. Heldt – High speed diesel engines, Chillon Co. New York.
6. Taylor, I.C.Engines, MIT Press, England
7. Lichty , I.C.Engines , McGraw Hill Publishing Co.
8. Smith & Stinson, Fuels & Combustion, McGraw-Hill Publishing Co.
9. John B Heywood, Internal Combustion Engine Fundamentals, McGraw Hill Publishing Company
10. Obert E F,Internal Combustion Engine and air Pollution McGraw Hill book company New York.
11. Sharma S.P, Fuels and Combustion, Tata McGraw Hill Publishing Company Ltd., New Delhi
12. Heinz Heisler, Advanced Engine Technology, Society of Automotive Engineers Inc

Course Plan			
Module	**Contents**	**Hours**	**Sem.ExamMarks**
I	Diesel fuels, Properties and qualities, Cetane number, alternative fuels for CI engines Combustion in CI engines, P-θ diagram – parameters affecting Ignition delay, uncontrolled combustion, diesel knock - controlling methods. Diesel knock, comparison with SI knock and control. Air motion- Squish, tumble, swirl motions. Different types combustion chambers in CI engines.	9	15%
II	Fuel supply system in diesel engines: Requirements of diesel injection system, Components of diesel injection system, Diesel filters, fuel feed pump, hand pump, heavy duty air filters, Diesel injection pump types - simple and multiple unit pump, C-AV Bosch pump, Modem distributor type pumps, injection nozzles and types of injectors, Pump-Line-Injector (PLI) Systems	8	15%
FIRST INTERNAL EXAMINATION			
III	Electronic Unit Injectors (EUI) – Advanced fuel injection system- Unit pump & injector- Common Rail (CR) Fuel Injection Systems - Electronic Diesel Control (EDC) - overview & Diagnostics. Sensors in CI engine fuel injection systems – control of fuel injection – Actuators in CRDI systems.	8	15%
IV	Thermodynamics of combustion. Combustion reaction of common fuels. Exhaust gas composition. Testing of IC engines - Indicated power – Brake Power - Volumetric efficiency – Heat balance test - Morse test. Gas Exchange Processes - Valve Flow and Volumetric Efficiency - Valve Timing - Dynamic Behavior of Valve Gear. Flue gas analysis using ORSAT apparatus – liquid fuel, gaseous fuel – combustion equations – problems	9	15%
SECOND INTERNAL EXAMINATION			
V	Pollutants in engines. NOx, CO, unburned hydrocarbons, smoke and particulate. Sources, causes and measurement of exhaust emission, Non exhaust emissions and control methods, Emission norms Exhaust gas treatment.- Catalytic converter – Thermal reaction -Particulate trap. Flue gas analysis. Air fuel ratio from exhaust gas composition. Numerical problems	11	20%
VI	Supercharging: Introduction, Objectives of supercharging, thermodynamic cycle, effects of supercharging in S.I and C.I	11	20%

	engines, performance of the supercharged engine, supercharging limits, and methods of supercharging, superchargers. Turbo charging - methods of turbo charging and its advantages, limitations of turbo charging. Governors (mechanical, pneumatic and hydraulic governors), cold starting devices.		
END SEMESTER EXAM			

Question Paper Pattern

Total marks: 100, Time: 3 hours
The question paper shall consist of three parts

Part A
4 questions uniformly covering modules I and II. Each question carries 10 marks
Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

Part B
4 questions uniformly covering modules III and IV. Each question carries 10 marks
Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

Part C
6 questions uniformly covering modules V and VI. Each question carries 10 marks
Students will have to answer any four questions out of 6 (4X10 marks =40 marks)

Note: In all parts, each question can have a maximum of four sub questions, if needed.