

Course No.	Course Name	L-T-P -Credits	Year of Introduction
AU201	S.I. ENGINES & COMBUSTION	3-1-0-4	2016
<b>Course Objectives</b> <ul style="list-style-type: none"> <li>To impart basic concepts of SI Engine and Combustion, automotive engines</li> <li>To know constructional details of engine components.</li> <li>To differentiate ideal and actual cycles</li> <li>To understand lubrication, cooling, ignition and fuel systems in SI engines.</li> </ul>			
<b>Syllabus</b> I.C Engine cycles and analysis: Otto & diesel cycle, Comparison of air standard cycle & fuel air cycle - actual cycle-losses in actual cycle - Combustion in SI engines- P-θ diagram- Stages of combustions - Abnormal combustion – Knock theories - rating of fuels - Octane number, Alternative fuels - Air fuel mixture requirements – Solex Carburettor- Fuel injection systems in SI engines - Combustion System Design- Ignition System Overview - distributor less ignition - CDI & Coil on plug type of ignition system - Constructional details of engine components: Cylinders –cylinder liners, engine block, types of cylinder head - Two stroke engines: Port timing diagrams - Comparison of Scavenging Systems - Valve and valve mechanism - OHV, OHC, DOHC, variable valve timing systems - Intake system components - Intake manifold - Waste heat recovery, Exhaust mufflers - Cooling system - types of cooling systems - components of water cooling - Lubrication system - types of lubricants – properties - lubrication systems			
<b>Expected outcome.</b> The students will be able to <ol style="list-style-type: none"> <li>explain basic concepts of SI Engine and Combustion, automotive engines</li> <li>identify engine components and their functions</li> <li>differentiate ideal and actual cycles and problems</li> <li>analyse lubrication, cooling, ignition and fuel systems in SI engines.</li> </ol>			
<b>Text Book:</b> <ol style="list-style-type: none"> <li>M. L. Mathur, R. P. Sharma - Internal Combustion Engines, Dhanpat Rai Publications</li> <li>R.K. Rajput, Internal Combustion Engines, Laxmi Publications</li> <li>V Ganesan, <i>Internal Combustion Engine</i> Tata McGraw Hill Publishing Company Ltd., New Delhi 2006.</li> </ol>			
<b>References:</b> <ol style="list-style-type: none"> <li>Heinz Heisler, Advanced Engine Technology, Society of Automotive Engineers Inc</li> <li>William H Crouse / Donald L Anglin, Automotive Mechanics, Tata McGraw-Hill Publishers</li> <li>I.C.Engines By Lichty., McGraw Hill</li> <li>Fuels &amp; Combustion By Smith &amp; Stinson., McGraw-Hill</li> <li>John B Heywood, Internal Combustion Engine Fundamentals, McGraw Hill Publishing Company.</li> <li>Obert E F, Internal Combustion Engine and air Pollution McGraw Hill book company New</li> </ol>			

York.

7. Sharma S.P, Fuels and Combustion, Tata McGraw Hill Publishing Company Ltd., New Delhi.

8. A.W. Judge, Modern petrol engine, Chapman and Hall, London

### Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	I.C Engine cycles and analysis: Otto & Diesel cycle, Comparison of air standard cycle & fuel air cycle, effects of variation of specific heat, dissociation effect, and numerical problems related, actual cycle-losses in actual cycle - Efficiencies of real Engines	9	15%
II	Combustion in SI engines- P-θ diagram- Stages of combustions- Ignition lag. Flame Propagation- factors / engine variables affecting combustion stages. Different combustion chambers in SI engines.  Abnormal combustion – Knock theories - detonation effects- factors and variables affecting knock-surface ignition. Fuels – Qualities & properties - rating of fuels - Octane number, Alternative fuels.	9	15%
<b>FIRST INTERNAL EXAMINATION</b>			
III	Air fuel mixture requirements – Solex Carburetor. Stoichiometric and excess air calculations. Fuel injection systems in SI engines - nozzle- direct and indirect injections. MPFI systems and GDI engines. Combustion System Design - Port Injection Combustion Systems - Direct Injection Spark ignition (DISI) Introduction - Spark Ignition and Ignition Timing - Ignition System Overview - The Ignition Process - Ignition Timing Selection and Control – Battery & magneto ignition system – distributor less ignition - CDI & Coil on plug type of ignition system	9	15%
IV	Constructional details of engine components: Cylinders – cylinder liners, engine block, types of cylinder head, gasket materials. Piston - types, materials, piston rings, piston pins, connecting rod, crank shaft, flywheel, cam shaft, valve, valve mechanism, hydraulic tappets.  Two stroke engines: Port timing diagrams, Symmetrical & unsymmetrical timing, Three port engine. Theoretical Scavenging processes, Scavenging parameters, Comparison of Scavenging Systems; Cross flow, loop flow, uniflow, Pre blow down, Blow down. Scavenging pumps, blowers.	9	15%
<b>SECOND INTERNAL EXAMINATION</b>			

<b>V</b>	Valve and valve mechanism: Angle of seat, Operating Conditions, operating temperatures, valve cooling, Sodium cooled valves, Valve rotators, valve seats, valve guides, , valve springs, valve clearance & timing, OHV, OHC, DOHC, variable valve timing systems – V TECH.VVT. Camshaft,-drives of cams, cam types, tappets, push rods, rocker arms  Intake system components, Discharge coefficient, Pressure drop, Air filters, Intake manifold, connecting pipe. Exhaust system components: Exhaust manifold and exhaust pipe, Spark arresters, Waste heat recovery, Exhaust mufflers, Type of mufflers.	12	20%
<b>VI</b>	Cooling system: Necessity of engine cooling, operating temperatures, types of cooling systems: Direct air cooling, Indirect or water cooling, Liquid cooling, Pressure sealed cooling, Evaporative cooling or steam cooling, components of water cooling system, antifreeze solution, temperature gauges.  Lubrication system: Functions, lubrication principles, classification of lubricants, types of lubricants, properties of lubricants, service ratings of oils, oil additives, specification of lubricants, crankcase ventilation, lubrication systems, pre-lubrication systems, effect of engine conditions on lubricating oil, consumption of lubricating oil, Components of lubrication system, Oil pressure warning system, oil pressure gauges, chassis lubrication.	12	20%
<b>END SEMESTER EXAM</b>			

### 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.