# Engineering Program

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| **Specialization** | **Engines Systems** |
| **Course Number** | **20309111** |
| **Course Title** | **Engines 1** |
| **Credit Hours** | **3** |
| **Theoretical Hours** | **3** |
| **Practical Hours** | **0** |

❖ **تطبق هذه الخطة الدراسية اعتباراً من بداية العام الجامعي 2009/2008**

**Brief Course Description:**
Definition and introduction ICE fundamental of engine Operation , engine types and classifications, Engine constructions, Engine measurements and Performance Ignition system, Engine system ( Lubricating , Cooling , Fuel , including Carburetor and Electronic fuel-injection system ).

**Course Objectives:**
Upon the completion of this course, the student will be able to:
1. Know types of engines .
2. Know operation of Internal Combustion Engines( ICE) .
3. Know fuel used in engines ( Gasoline and Diesel )
4. Know each part and component and operation of ICE.

**Detailed Course Outline:**

| Unit Number | Unit Title | Unit Content | Time Needed |
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| **1.** | **Introduction to the Internal Combustion Engines** | ▪ Types of ICE<br>▪ Systems of ICE<br>▪ Importance of (ICE,s) in different fields.<br>▪ Difference between (ICEs)and other engines types ,steam engines, electric vehicles, and | |
| **2.** | **Classification of ICE according to:** | ▪ Number and arrangement of cylinders.<br>▪ Valve arrangement in cylinder head.<br>▪ No of cycles in Engine.<br>▪ Types of fuel used and types of ignition systems like gasoline and diesel engines | |
| **3.** | **Engine Operation** | ▪ Four stroke operation for Gasoline and diesel Engines.<br>▪ Engine diagram between pressure and crankshaft angles for four stroke engines (Gasoline & Diesel).<br>▪ Engine pressure –volume diagrams with the relation of rpm and piston displacement of gasoline engine.<br>▪ Two stroke engine operation.<br>▪ Engine pressure – volume diagram for two stroke gasoline and diesel engines. | |
| **4.** | **Piston Engine Construction** | ▪ Engine cylinder block types and operation.<br>▪ Cylinder operation and designs.<br>▪ Piston types and operation.<br>▪ Piston rings types and operation.<br>▪ Cylinder head , types and operation.<br>▪ Combustion chamber types. | |

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| | | ▪ Connecting Rods. types and operations.<br>▪ Crank shafts . types & operation.<br>▪ Crank shafts . bearings.<br>▪ Vibration dampers.<br>▪ Engine caskets.<br>▪ Part attached to cylinder<br>▪ Intake and exhaust manifolds.<br>▪ Oil pan. | |
| **5.** | **Valve and valve trains** | ▪ Cam and cam shafts and operation.<br>▪ Mechanical and Hydraulic valve. Construction parts and cooling.<br>▪ Spring and oil seals for valve.<br>▪ Valve seals and types.<br>▪ Valve filter and types.<br>▪ Rocker arms.<br>▪ Valve Timing and types.<br>▪ Engine Timing gears and types.<br>▪ Valve operation and Engines timing operation. | |
| **6.** | **Performance Measurement** | ▪ Bore and Stroke.<br>▪ Piston Displacement.<br>▪ Top and Bottom dead centers.<br>▪ Compression Ratio and effect of increasing CR on engine operation.<br>▪ Mean effective pressure .<br>▪ Engine friction and Indicated power out put.<br>▪ Volumetric friction and indicated efficiency.<br>▪ Power out put calculation.<br>▪ Engine Torque and relation with power out put and engine speed and diagram.<br>▪ Delivery of air-fuel mixture. | |
| **7.** | **Automotive Engine Fuels** | ▪ Gasoline Sources . Types and Volatility.<br>▪ Antiknock value in gasoline and | |

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| | | facts effect knocking.<br>▪ Octane No. Rating , measuring , anti knocking value during combustion and chemical control effectuating.<br>▪ Types of abnormal combustion and normal combustion.<br>▪ Diesel fuels. Types , classification, volatility , and viscosity.<br>▪ Cetare No. And conditions effect on it.<br>▪ Diesel fuels additives.<br>▪ Diesel fuels combustion and condition effect on it.<br>▪ Detonation of diesel fuel and factor effect on it. | |
| **8.** | **Gasoline Engine Fuel and Exhaust System.** | ▪ Purpose of the fuel system.<br>▪ Components of gasoline fuel system and operations(Tank, fuel pump, filter, lines, carburetors, indicators and others).<br>▪ Component of Gasoline carburetor operation and types.<br>▪ Carburetor cycles and systems.<br>▪ Mechanical and Electrical fuel pumps.<br>▪ Condition effect cerebration .<br>▪ Fuel filter . dry and oil bath filters.<br>▪ Crank case ventilation , and exhaust gas recalculation .<br>▪ Exhaust system , muffler, and exhaust pipes.<br>▪ Exhaust gases treatment and its effects. | |
| **9.** | **Gasoline Fuel Injection Systems** | ▪ Types of Gasoline injection system and its advantages.<br>▪ Electronic Gasoline injection System .Components and | |

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| | | operation.<br>▪ Electronic Fuel Injection Controls.<br>▪ Injectors types and operation components.<br>▪ Difference and advantages between carburetor injection fuel system. | |
| **10.** | **Diesel Fuel . Injection system** | ▪ Diesel Fuel . Injection Systems requirements.<br>▪ Types of fuel . Injection systems.<br>▪ Cam operated 1-line plunger pump components and operation.<br>▪ Rotary distributed pump , components and operation.<br>▪ Governors , types ( Centrifugal weights, vacuum)<br>▪ Automotive advance system of injection.<br>▪ Diesel fuel injection and different factors affected by.<br>▪ Fuel injectors – types and classification component and operation.<br>▪ Diesel engine combustion chambers – types and its effect on combustion. | |
| **11.** | **Engine Cooling Systems** | ▪ Purpose of the cooling systems.<br>▪ Types of the cooling systems( water-air ).<br>▪ Component of water cooling system. Function of each pan and explain cooling circulation in the system.<br>▪ Radiators types and materials.<br>▪ Antifreeze Solution.<br>▪ Temperature Indicators. | |
| **12.** | **Engine Lubricating Systems** | ▪ Purpose of the lubricating system.<br>▪ Types of lubricating systems. | |

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| | | ▪ Components of lubricating. Operation Of each part.<br>▪ Oil filter . types and purposes.<br>▪ Oil indicators. | |
| **13.** | **Wangle (Rotary Engine ,Gax (Stirling) Engine and Turbo charger Engines.** | ▪ Wankle ( Rotary ) Engines Components and operation.<br>▪ Gas(Stirling) Engine components and operation.<br>▪ Turbo-Charger operation engines and advantages of turbo charging. | |

**Evaluation Strategies:**

| Exams | | Percentage | Date |
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| Exams | First Exam | 20% | |
| | Second Exam | 20% | |
| | Final Exam | 50% | |
| Homework and Projects Discussions and lecture Presentations | | 10% | |
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**Teaching Methodology:**

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**Text Book**

محركات الاحتراق الداخلي المؤلف سفيان توفيق احمد سعيد

**References**

1. Automotive Engines (6th addition) Willian H Crones and Donald L Anglin Mc Graw hill 1991.
2. Automotive Fuel , Lubricating and cooling systems Willian H Crones and Donald L Anglin Mc Graw hill 1991.
3. Internal Combustion Engines . Colin R Ferguson , John Wiley & Sons 1985.