Module (IC Engines) Catalogue

2023-2024

College/ Institute	Erbil Technical Engineering	
Department	Mechanical and Energy	
Module Name	Internal Combustion Engines (IC Engines)	
Module Code	ICE502	
Degree	Technical Diploma ☐ Bachler ■ High Diploma ☐ Master ☐ PhD ☐	
Semester	5	
Qualification	PhD in Mechanical Engineering	
Scientific Title	Lecturer	
ECTS (Credits)	6	
Module type	Prerequisite ☐ Core ■ Assist. ☐	
Weekly hours	4	
Weekly hours (Theory)	(2)hr Class	(24)Total hrs Workload
Weekly hours (Practical)	(2)hr Class	(24)Total hrs Workload
Number of Weeks	12	
Lecturer (Theory)	HINDREN ALI SABER	
E-Mail & Mobile NO.	hindren.saber@epu.edu.iq, 07507430728	
Lecturers (Practical)	HINDREN ALI SABER+ Ahmad Haddad	
E-Mail & Mobile NO.	hindren.saber@epu.edu.iq, 07507430728	
Websites		

Course Book

<table>
<tr><td>Course Description</td><td colspan="5">The course gives students a knowledge and experience about Internal Combustion Engines and helps them develop an understanding of thermodynamics and its applications with theoretical and practical information, the applications involves gasoline engines and diesel engines as well as others thermodynamic cycles and engines with their analysis.</td></tr>
<tr><td>Course objectives</td><td colspan="5">(IC Engines course) aims are using prior knowledge taught in previous subjects, working the capabilities of engineering and making it attractive and useful for students, willing or not to opt for a mechanical profile. To sensitize the students about the relationship between technology and society by analysing the role of IC engines in this binomial and the sustainability of the current model of human activity</td></tr>
<tr><td>Student's obligation</td><td colspan="5">Student's obligation in IC Engines course is:
Attendance in the all lectures.
One or more quizzes in each course.
Attendance in practical hour in IC engines lab.
Other activities like reports and mechanical project.
Exam in end of first course
Practical exam at end of all courses.</td></tr>
<tr><td>Required Learning Materials</td><td colspan="5">Datashow, and PowerPoint program in teaching in computer hall.
White board .
Web site to upload all lecture notes .</td></tr>
<tr><td rowspan="10">Evaluation</td><td colspan="2">Task</td><td>Weight (Marks)</td><td>Due Week</td><td>Relevant Learning Outcome</td></tr>
<tr><td colspan="2">Paper Review</td><td></td><td></td><td></td></tr>
<tr><td rowspan="6">Assignments</td><td>Homework</td><td>5</td><td></td><td></td></tr>
<tr><td>Class Activity</td><td>2</td><td></td><td></td></tr>
<tr><td>Report</td><td>5</td><td></td><td></td></tr>
<tr><td>Seminar</td><td>5</td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td></td><td></td></tr>
<tr><td>Project</td><td>4</td><td></td><td></td></tr>
<tr><td colspan="2">Quiz</td><td>4</td><td></td><td></td></tr>
<tr><td colspan="2">Lab.</td><td>15</td><td></td><td></td></tr>
<tr><td colspan="2">Midterm Exam</td><td>20</td><td></td><td></td></tr>
<tr><td colspan="2">Final Exam</td><td>40</td><td></td><td></td></tr>
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	Total	100		
Specific learning outcome:	(IC engines course) Students combine theory, graphical and analytical skills to understand the Engineering Design. Upon successful completion of the course, the student will be able to understand: 1- Internal combustion engines classifications. 2- Air Standard Cycles. 3- Ideal engines and actual engines. 4- Fuels and combustion. 5- Engine Test & Performance. 6- Power Measurement. 7- Engine Heat Balance. 8- Super Charging and Turbocharger. 9- Emissions & Air Pollution.			
Course References:	**Key reference:** • Internal combustion engine fundamentals, by: John Heywood, pub.: McGraw- Hill (1988) - USA. • The internal combustion engines in theory and practice, 2 vols. by: C. F. Taylor, pub. Wily. • Introduction to internal combustion engines, by: Richard stone, pub.: MacMillan (1992) - USA • Internal combustion engines, by: H. B .Keswani, pub.: Standard Book House-India **Useful Reference:** • Internal Combustion Engines by V. Ganesan			

Course topics (Theory)	**Week**	**Learning Outcome**
Introduction to internal combustion engine and heat engines classification.	1	
Engine's performance parameters and characteristics	2-3	
Air Standard Cycles and their analysis	4-5	
Internal combustion engines fuels and combustion	6-7	
Engine testing and basic measurement of I.C. engines and Engine Heat Balance	8-9	

Fuel- Air cycles" variation of specific heats, effect of engine variables and Actual Cycles (real cycles).	10	
Two stroke engine and scavenging of two stroke engine	11	
Supercharging and Turbo charging and its effect on engine performance	12	
Practical Topics	**Week**	**Learning Outcome**
1. Internal Combustion Engines Parts	1-2	
2. Spark Ignition Engine (Morse test)	3-4	
3. Engine Breathing – Part Load Performance	5-6	
4. Spark Ignition Engine – Mixture Loop	7-8	
5. Spark Ignition Engine – Ignition Loop	9-10	
6. Engine Fail Diagnostics Test	11-12	

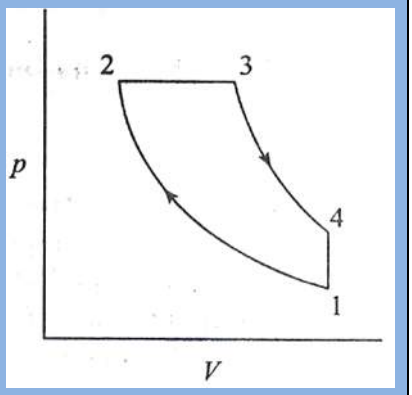
Questions Example Design

1. Compositional:

Q / In an ideal Diesel cycle, the pressure and temperature are 1.03 bar and 27°C respectively. The maximum pressure in the cycle is 47 bar and the heat supplied during the cycle is 545 kJ/kg. Determine (i) the compression ratio (ii) the temperature at the end of

compression (iii) the temperature at the end of constant pressure combustion and (iv) the air-standard efficiency. Assume γ = 1.4 and Cp = 1.004 kJ/kg K for air.

Solution:



$p_2 = p_3 = 47 \times 10^5$ N/m^2

$\frac{P_2}{P_1} = (\frac{V_1}{V_2})^{\gamma} = r^{\gamma}$

$r = (\frac{P_2}{P_1})^{\frac{1}{\gamma}} = (\frac{47}{1.03})^{\frac{1}{1.4}} = 15.32$

$\frac{T_2}{T_1} = (\frac{V_1}{V_2})^{(\gamma-1)} = r^{(\gamma-1)} = 15.32^{0.4} = 2.979$

$T_2 = 2.979 \times 300 = 893.7\ K = 620.7\ ^oC$

Heat supplied /kg = $C_p (T_3 - T_2) = 545$

$T_3 - T_2 = \frac{545}{1.004} = 542.8$

$T_3 = 542.8 + 893.7 = 1436.5$ K $= 1163.5\ ^oC$

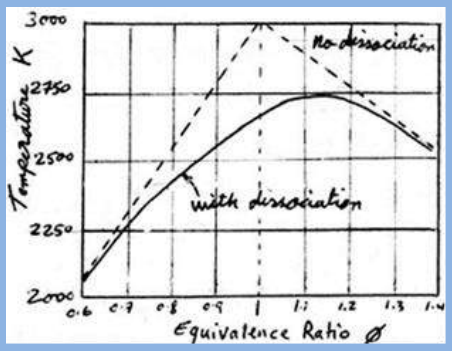
$\eta = 1 - \frac{1}{r^{(\gamma-1)}} [\frac{(r_c)^{\gamma}-1}{\gamma(r_c)-1}]$, $r_c = \frac{V_3}{V_2} = \frac{T_3}{T_2} = \frac{1436.5}{893.7} = 1.61$

$\eta_{Diesel} = 1 - [\frac{1}{1.4 \times 15.32^{0.4}} \times (\frac{1.61^{1.4}-1}{0.61})] = 0.6275 = 62.75\ \%$

2. Sketching or Drawing type of exams:

Q/ Draw effect of dissociation temperature at different ϕ.

Solution:



3. Multiple choices:

Q/ Morse test can be conducted for engines have:

a) single cylinder b) supercharger c) multi-cylinders d) all of these

Solution: c) multi-cylinders

Extra notes:

External Evaluator

After viewing this course catalogue and its syllabus it is seems to me very good and sufficient to covers the required areas for students to understand fundamentals of IC Engines and their analyses with best regards.

Dr. Banipal N. Yaqop