PLANNING FORM FOR AN EDUCATIONAL MODULE

Programme of Studies:	***BSc in Mechanical Engineering, BSc in Automotive Engineering***
Name of the module:	***AMEE431 – Internal Combustion Engine Fundamentals*** ***AUTO 302 – Vehicle Internal Combustion Engines***
Target group:	***Mechanical Engineers – Automotive Engineers***
Level of the unit:	***BSc – 7th (5th)Semester***
Entrance requirements:	
Number of ECTS credits:	***5 (Average student working time: 125 hours)***

Competences to be developed:	
1	Provide the students with fundamental knowledge regarding the classification of internal combustion engine types , the engine components and the relevant nomenclature, the two stroke and four stroke engine operation, the spark ignition (SI) and compression ignition (CI) operation, the engine cooling system, the valves and camshafts – valve timing and variable valve timing -, the fuel injection system and supercharging and turbocharging.
2	Analyse the engine design and operating parameters in terms of important engine characteristics such as the geometrical properties of the internal combustor, the brake torque and power, the indicated work per cycle, the mechanical efficiency, the specific fuel consumption and efficiency and the air to fuel ratio.
3	Application of thermodynamic principles for the calculation of the performance characteristics such as the thermal efficiency, the fuel consumption etc.
4	Provide the students the necessary background regarding fuels for internal combustion engines by means of fuels composition and properties, as well as information on alternative fuels (biodiesel, bioethanol).
5	Analyse the extent and nature of the pollutant formation problem by means of combustion thermochemistry, and explain the existing technologies for the exhaust gas treatment (catalytic converter).

Estimated student's work time distribution in hours:			
Conduct hours		Student's private time	
Lecture	38	Reading textbook	17
Mid-Term Test	2	Reading assignment	9
Final Exam	3	Writing assignment	13
Project Presentation	2	Test Preparation	13
Class Discussion	5	Final Exam Preparation	23
Total:	50	Total:	75

Learning outcomes	Educational activities	Estimated student's work time in hours	Assessment
Engine types and their operation			
Provide the students with fundamental knowledge regarding the classification of internal combustion engine types and their operation.	Lecture 1: Introduction and historical perspective, engine components – nomenclature, engine classifications, two stroke and four stroke engine operation, spark-ignition (SI) and compression ignition (CI) engine operation, engine cooling system, valves and camshafts, fuel injection systems (carburetion, injectors, indirect injection and direct injection) supercharging and turbocharging	10	
	Reading assignment	4	
	Reading selected textbook	3	
	Preparation for Mid-term Test	5	
	Preparation for final exams	4	
	Class discussion	1	

Learning outcomes	Educational activities	Estimated student's work time in hours	Assessment
Engine design and operation parameters			
Analyse the engine design and operating parameters in terms of important engine characteristics	Lecture 2: Important engine characteristics, geometrical properties of reciprocation engines, brake torque and power, indicated work per cycle, mechanical efficiency, specific fuel consumption and efficiency, air/fuel and fuel/air ratios, relationship between performance parameters	10	
	Reading assignment	3	
	Reading selected textbook	4	
	Preparation for Mid-term Test	8	
	Preparation for final exams	6	
	Class discussion	1	

Learning outcomes	Educational activities	Estimated student's work time in hours	Assessment
Thermochemistry of fuel air mixtures			
Application of thermodynamic principles for the calculation of the performance characteristics such as the thermal efficiency, the fuel consumption etc.	Lecture 3: Characterization of flames, ideal gas model, composition of air and fuel, combustion stoichiometry, the first law of thermodynamics and combustion, the second law of thermodynamics and combustion, chemically reacting gas mixtures, thermodynamic cycles related with the ICE	10	
	Writing assignment	5	
	Reading selected textbook	4	
	Preparation for Mid-term Test	-	
	Preparation for final exams	6	
	Class discussion	1	

Learning outcomes	Educational activities	Estimated student's work time in hours	Assessment
Fuels for internal combustion engines			
Background regarding fuels for internal combustion engines	Lecture 4: Provide the students the necessary background regarding fuels for internal combustion engines by means of fuels composition and properties, as well as information on alternative fuels (biodiesel, bioethanol).	3	
	Writing assignment	3	
	Reading selected textbook	2	
	Preparation for Mid-term Test	-	
	Preparation for final exams	3	
	Class discussion	1	

Learning outcomes	Educational activities	Estimated student's work time in hours	Assessment
Pollutant formation and control			
Extent and nature of the pollutant formation problem	Lecture 5: Nature and extent of problem, nitrogen oxides, carbon monoxide, unburned hydrocarbon, particulate emissions, exhaust gas treatment (catalytic converter etc).	5	
	Writing assignment	5	
	Reading selected textbook	4	
	Preparation for Mid-term Test	-	
	Preparation for final exams	4	
	Class discussion	1	

Assessment			
	Mid-Term Tests	2	
	Project Presentation	2	
	Final Exam	3	