Co-funded by the Erasmus+ Programme of the European Union

Project Title: Modernization of Teaching Methodologies in Higher Education: Eu Experience For Jordan And Palestinian Territory

Project acronym: METHODS

Project Number: 561940-EPP-1-2015-1-JO-EPPKA2-CBHE-JP

Funding scheme: Erasmus+ Programme (Capacity-Building projects in the field of Higher Education (E+CBHE))

Start date of the project: 15/10/2015 **Duration:** 36 months

Deliverable title	**Course Outline**
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WP Number	**5**
WP Leader	**Birzeit University**

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Al-Zaytoonh University of Jordan (ZUJ)

Faculty of Engineering and Technology

Course title/code	Thermodynamics 1	0911221
Instructor /office	Ali Othman Ahmad Manasrah Eman Abdelhafez	
Semester- Year	Fall- 2017/2018	
Compulsory/Elective	Compulsory	
Prerequisites	Physics 1	

Course Description	Thermodynamic concepts and definitions,; properties of pure substances, equation of states; work and heat;, internal energy and enthalpy; conservation of mass; SSSF processes; the second law, heat engines and refrigerators,, Carnot cycle; entropy, Clausius inequality, principle of the increase of entropy, entropy balance.

Generic Competences*	The course contributes to building the fundamental basic concepts of thermodynamics and provides an ability to solve common engineering problems, including problems involving basic heat engines, refrigeration machines and heat pumps.
Specific Competences (SCs)	1. To enable students to evaluate properties of working fluids using thermodynamic tables ,equation of states and ideal gas relations 2. To apply energy conservation principle to both closed and open systems 3. To introduce the students to the concept of heat engine and heat pump 4. Introduce the concept of entropy, and apply entropy balance to thermodynamic systems.

- These competences related also to the project Methods

	Course Contents	**SC1**	**SC2**	**SC3**	**SC4**
1	Introduction and Basic Concepts	x			
2	Properties of Pure Substances	x			
3	Energy, Energy Transfer, and General Energy Analysis		x		
4	Energy Analysis of Closed Systems		x		
5	Mass and Energy Analysis of Control Volumes		x		
6	The 2nd. Law of Thermodynamics			x	
7	Heat engine and heat pumps			x	
8	Entropy				x

Schedule				
Week	**Subject**	**Activity Description ***	**Evaluation Criterion**	
			Description	**%**
1	Basic concepts and definitions			
2	Phase diagrams of real fluids			
3	Thermodynamic tables	Inverted Classroom (Post quizzes)	quiz	5%
4	Properties of Ideal fluids			
5	Energy analysis of closed system	Inverted Classroom (Post quizzes)	quiz	5%
6	Energy analysis of closed system			
7	Energy analysis of open system			
8	Second law of thermodynamics			
9	Heat engine			
10	Heat pump	Inverted Classroom (Post quizzes)	quiz	5%
11	Carnot cycle			
12	Entropy			
13	Principle of entropy increase			
14	Entropy balance	Inverted Classroom (Post quizzes)	quiz	5%
15	Irreversibility			
16	Isentropic efficiency			

* PBL, MOOC, Inverted Classroom should be introduced within activity description

Textbook and References	Thermodynamics – An Engineering Approach, Y.A. Cengel & M.A. Boles, 8th Edition, McGraw-Hill (2014)	
Overall Assessment Criteria	**Method**	**Weight** [%]
	Quizzes	20
	First Exam	15
	Second Exam	15
	Final Exam	50

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