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**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

<b>Deliverable title</b>	<b>Course Outline</b>
<b>Author(s)</b>	<b>Ali Othman Ahmad Manasrah Eman Abdelhafez</b>
<b>Organisation name(s)</b>	<b>Al-Zaytoonh University of Jordan (ZUJ)</b>
<b>WP Number</b>	<b>5</b>
<b>WP Leader</b>	<b>Birzeit University</b>

**Project co-ordinator name, title and organisation:**

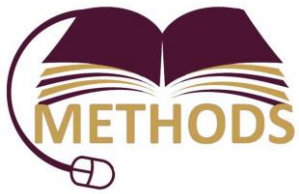
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## Al-Zaytoonh University of Jordan (ZUJ)

### Faculty of Engineering and Technology

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

<b>Course Description</b>	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.
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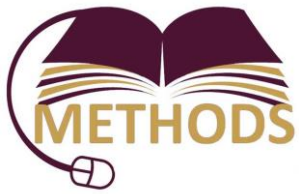
<b>Generic Competences*</b>	The course contributes to building the fundamental basic concepts of thermodynamics and provides an ability to solve common engineering problems, including problems involving basic heat engines, refrigeration machines and heat pumps.
<b>Specific Competences (SCs)</b>	<ol style="list-style-type: none"> <li>1. To enable students to evaluate properties of working fluids using thermodynamic tables ,equation of states and ideal gas relations</li> <li>2. To apply energy conservation principle to both closed and open systems</li> <li>3. To introduce the students to the concept of heat engine and heat pump</li> <li>4. Introduce the concept of entropy, and apply entropy balance to thermodynamic systems.</li> </ol>

- These competences related also to the project Methods

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



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