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Deliverable title	Course Outline		
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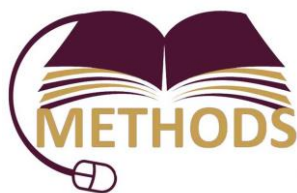
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An-Najah National University

Faculty of Graduate Studies

Course title/code	Energy Conservation	463601
Instructor /office	Dr. Imad Ibrik / iibrik@najah.edu	72033
Semester- Year	Fall 2017	
Compulsory/Elective	Compulsory	
Prerequisites	Null	

Course Description	<p>The Energy conservation course will provide the students with all the information they need to establish and understands the concepts of applying energy audit program for any facility. Energy accounting procedures and process systems analysis, life cycle operating costing and maintenance management.</p> <p>Also energy engineers can gain a better understanding the concepts of power factor improvement, loads management, high efficiency motors, alternative fuel-choices, passive thermal energy, and waster heat recovery system.</p> <p>The course provides Moodle content, activities (assignment, quizzes...etc.) to support face to face lecture. The course also include self-directed learning opportunities by assigning for each learner a building case study which the results, proposal and solution will be presented to their colleagues to help them developing innovative thinking and find appropriate solutions through discussion which improve team work.</p>
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Generic Competences*	Degree competencies
Specific Competences (SCs)	<p>1. <u>Knowledge</u></p> <ul style="list-style-type: none"> • Energy data collection and analysis • Selection and use of metering and monitoring equipment • Development of business cases for energy efficiency projects • Ability to integrate energy efficiency findings into cross business operational plans and practices. • The ability to arrange and retrieve data, knowledge and ideas, research and investigation of specific technical and financial knowledge • The ability to think strategically and creatively • Provide solutions to energy problems

	<p>2. <u>Technical</u></p> <ul style="list-style-type: none">• Write technical report that provide general introduction of institution/building that targeted in study.• Perform energy process calculation and analysis• Using measurement suitable energy tools to collect data• Write analysis report to provide data collection process, solution/suggestion, costing and financial analysis• Find and eliminate energy waste through efficiency improvements process• Develop and deliver presentation of suggestion solution technical analysis <p>3. <u>Transferable</u></p> <ul style="list-style-type: none">• <i>Problem solving skills.</i>• <i>Working well in Teams</i> work through discussion with their colleagues• Ability to listen to others and accept their views during the discussion• Communication skills through <i>Presentation of analysis study process & suggestion for problem solution.</i>• Collecting relevant information regarding energy consumption of building (invoices, power equipment data plate) to improve efficiency with innovative thinking.
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- These competences related also to the project Methods

	Course contents	SC1	SC2	SC3
1	Energy Audit	X	X	X
2	Energy Management	X	X	X
3	Energy Efficient lighting		X	
4	Co-generation: (Boiler & Steam System)		X	
5	Distribution generation & renewable source		X	
6	HVAC(Heating Ventilation and Air conditioning)		X	
7	Solar system technology: (PV system & Solar Water Heater)		X	
8	Energy Accounting and Analysis		X	X
9	Case Study:Data Analysis and Identifying ECMs opportunities for a given facility	X	X	X

		Schedule			
Week	Subject	Activity Description *		Evaluation Criterion	
		Face to Face	Self-study	Description	%
1	Energy auditing basics	<ul style="list-style-type: none"> - Define energy Audit. - Sort types of energy audits. - Illustrate the Certified Energy Manager Program (CEM) 	From Moodle: <ul style="list-style-type: none"> - Read "Energy conservation and auditing" - Read Ch1:energy auditing basics 		
2	The Audit process	<ul style="list-style-type: none"> - Describe the audit process. - Explain pre- site work. - Explain post -site work. - Discuss the audit report 	From Moodle: <ul style="list-style-type: none"> - Solve example bellow about sample residential (home) energy audit. - See video about achieving net zero energy building - Solve Quiz 	Quiz grade = 10	2.5%
3	Electrical system management	<ul style="list-style-type: none"> - Identify energy management - Sort energy management systems. - Describe electrical system distribution audit 	From Moodle: <ul style="list-style-type: none"> - Read CH07 "the electrical system Audit" 		
4	Transformer load	<ul style="list-style-type: none"> - Define energy consumption 			

	management-site generation	<p>which define as index of energy efficiency</p> <ul style="list-style-type: none"> - Explain the meaning of increasing efficiency: <ul style="list-style-type: none"> • increasing the production for the same consumption of electrical energy • Or reducing the energy consumption for the same output. 			
5	Co-generation	<ul style="list-style-type: none"> - Explain the co-generation define - Explain benefit of cogeneration - Explain main components & types 			
6	Lighting	<ul style="list-style-type: none"> - Describe lighting system audit. - Explain lighting efficiency. - Explain lighting terminology. - Sort light sources. - Discuss control equipment. - Explain fluorescent lighting control system. 	<p>From Moodle:</p> <ul style="list-style-type: none"> -Read CH07 "the electrical system Audit" -Solve Quiz 6 	Quiz grade = 10	2.5%
7		first exam		20	20%
8	Energy conservation in Boilers and steam system	<ul style="list-style-type: none"> - Explain the combustion audit. - Describe combustion principles. - Discuss boiler efficiency. - Discuss preheat combustion air and heavy fuel oil to increase boiler efficiency. - Explain how to replace exciting boilers with modular boilers. - Explain how to reduce blow down losses - Describe burners. - Explain compressed air audit. 	<p>From Moodle:</p> <ul style="list-style-type: none"> -read Ch10: the physical plant audit 		
9	Distributed generation and renewable	<ul style="list-style-type: none"> - Explain the importance of DG & RES improving the security of 			

	sources	energy supplies - Explain the economic aspect of these sources - Advantages/disadvantage of using DG and RES - Identify reasons for clean energy technologies			
10	PV system	- Explain PV system technology - , components and types - Explain about project design consideration - Application to applied PV technology			
11	Hot water&solar water heater	- Explain the types of solar water heater technology - Identify the factor that effect electrical energy use	From Moodle: read Ch9:Upgrading HVAC Systems for Energy Efficiency Verification of System Performance -see video "energy audit-build it green! –zero energy challenge"		
12	Measurements training & evaluation &Managing effective energy conservation program	- Describe general audit instrumentation. - Explain temperature measurements. - Measure building losses - Describe applications of IR thermography - Illustrate infrared radiation and its measurement. - Measure electrical system performance. - Measure composition system. - Measure HVAC.	From Moodle: - Read file "survey instrumentation". - Read Ch05 of text book - See video about useful tips for saving energy - Solve Quiz 5	Quiz grade = 10	2.5%
13		Second Exam		20	20%
14	Energy Accounting and Analysis	- Set up a spreadsheet to enter,sum,calculate benchmarks,and graph utility information. - Explain energy use index and	From Moodle: - Read file " Energy accounting and analyzing" - Read Ch2:Energy accounting and analysis - See video about energy	Quiz grade = 10	2.5%

		<p>density consumption.</p> <ul style="list-style-type: none"> - Evaluating Tariff structures (kwh,kw, and power factor changes) and the monthly electric bill. - To make a list of the major energy using system in each facility and estimate when each system is in operation throughout the year 	<p>saving in motors</p> <ul style="list-style-type: none"> - Solve Quiz 2 		
15	Case-study: energy Auditing	<ul style="list-style-type: none"> - Presentation of analysis data, problem and suggestion solution by each learner - Discuss the information & solution of analysis report 	<p>From Moodle:</p> <ul style="list-style-type: none"> -see video "energy audit on the iPhone or iPod..." 		
16		Final exam		50	50%

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

The evaluation will be done through first, second & final exam, also quizzes, assignment and the final project for course as follow:

Textbook and References	<ol style="list-style-type: none"> 1. Handbook of Energy Audits, Sixth Edition, Albert Thumann, P.E. 2003. 2. http://moodle.najah.edu/course/ 	
Overall Assessment Criteria	Method	Weight [%]
	Attendance / participation	-
	Quizzes	5
	Midterm	40
	Project/Assignment	5
	Final Exam	50