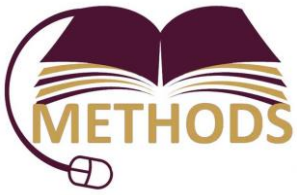

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463602

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**		
Author(s)	**Dr. Imad Ibrik**		
Organisation name(s)	**An-Najah National University**		
WP Number	**5**		
WP Leader	**Birzeit University**		
Due date of delivery		**Project month**	
Submission date	**Sep 1, 2017**	**Project month**	
Total number of pages			

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An-Najah National University

Faculty Graduate Study

RE Energy& Energy Conservation

Course title/code	Economics of Energy Systems	463602
Instructor /office	Dr. Imad Ibrik iibrik@najah.edu	
Semester- Year	Fall 2017	
Program Information	Master Program in "clean Energy and Energy Conservation Engineering"	
Compulsory/Elective	Compulsory Master Degree	
Prerequisites	-	

Course Description	In order to appreciate the issues involved in the economics of the Supply and Demand for energy, it is necessary to commence with an understanding of Energy Statistics. While there are some similarities with other economic statistics, there are significant differences and practices. With this foundation it is possible to address the issues associated with Energy Markets including those for renewable energy. Finally we will examine the economics of energy's impact on the environment and selected policy responses. The systematic evaluation of the economic benefits and costs of projects involving engineering design and analysis. Economic decision-making in an environment of limited resources and uncertainty. Present economy, the economy of multi-year projects, selection among competing alternatives, sensitivity of outcomes to input parameters, before- and after-tax analysis, replacement economy, inflation, and estimation of

	future events. **Course objectives** This course is designed to enhance the student's knowledge of and ability to apply: 1. Identification, formulating and solving engineering problems. 2. Time-money relationships, cash flow, and effects of inflation. 3. Present worth (PW) method, annual worth (AW) method, rate of return (ROR) method, benefit/cost ratio (B/C) method, and incremental rate of return analysis. 4. Depreciation schedules, replacement analysis, and after-tax analysis. 5. Engineering economy principles in conjunction with the Fundamentals of Professional Engineering Examination and Registration Process. **Course Topics** • Foundations: Cash Flow Factors, Combining Cash Flow Factors, Nominal and Effective Interest Rates. • Decision Making: Present Worth Analysis, Annual Worth Analysis, of Return Analysis (Single Project), Rate of Return Analysis (Multiple Projects), Making Choices: The Method, MARR, and Multiple Attributes. • Sensitivity Analysis :Breakeven Analysis, Formalized Sensitivity Analysis • Applications :Replacement and Retention Decisions, Selection of Independent Projects Under Budget Limitation • Advanced Topics: Effects of Inflation, Depreciation Methods, After-Tax Economic Analysis below for deliverables due dates.

Generic Competences*	• *Developing problem solving skills in the field of ecology* • *Developing teamwork management; computer and communication skills* • *Developing and presenting different alternative scenarios for problem solution.* • *Self-regulating study*
Specific Competences (SCs)	• Understand and apply basic economic scientific, political, and statistical principles useful for analyzing and understanding energy markets. • Define clearly the main Economics Basic concepts, Terms and Graphics terminologies. • Illustrate how these concepts and standard economic tools can be used to analyze energy-related policy issues. • Apply this knowledge to the analysis of specific energy issues in Palestine. • Discuss the methods and techniques for analyzing the feasibility of energy projects; give examples of applying different methods in evaluation the feasibilities of energy projects. • Explain the different Energy Tariff Structures and how to use it in our life; develop moral and ethical attitudes toward the use of appropriate energy tariff • Self-regulating study and self-evaluation • Develop quantitative skills to better utilize data to inform strategic decisions. • Be better able to communicate insights arising from the economics perspective on issues affecting the energy sector. • Perform breakeven analysis and sensitivity analysis under uncertainty conditions. • Utilize spreadsheet functions to perform economic calculations. • Express the imperative to focus on reducing fossil fuel based energy in the coming decades and associated opportunities this presents, with consideration of the inherent complexity. • Evaluate options to inform the development of industry strategies to profitably decouple greenhouse gas emissions from the operation of a range of industries, with specific examples. • Identify factors causing rising ‘Peak’ and ‘Base’ load electricity

	demand, and how renewable energy, energy management, and energy efficiency can reduce such demand. • Present how various forms of renewable energy can be generated, with consideration of strengths and weaknesses of each. • Explain specific opportunities to reduce greenhouse gas emissions of a city, with specific reference to the 'Carbon Neutral Adelaide' program.

Schedule				
Week/s	**Chapter**	**face-to-face**	**hours**	**Self-study**
1-2	Foundations of Engineering Economy	Basic Concepts, Terms and Graphics : 1.1 Why is Engineering Economy So Important? 1.2 Role of Engineering Economy in Decision Making. 1.3 Performing an Engineering Economy Study. 1.4 Interest Calculations. 1.5 Equivalence. 1.6 Simple and Compound Interest. 1.7 Symbols and Their Meaning. 1.8 Minimum Attractive Rate of Return. 1.9 Cash Flows: their Estimation and Diagramming.	6	Students will present the optimum type of generation sources in Palestine based on economical consideration.

3 - 4	Factors and Their Use	2.1 Derivation of Single – Payment Factors (F/P and P/F). 2.2 Derivation of the Uniform – Series Present – Worth Factor and the Capital – Recovery Factor (P/A and A/P). 2.3 Derivation of the sinking – Fund Factor and the Uniform – Series. Compound – Amount Factor (A/F – F/A). 2.4 Standard Factor Notation and Use of Interest Tables. 2.5 Definition and Derivation of Gradient Formulas. 2.6 Derivation of Present Worth of Geometric (Escalating) Series. 2.7 Interpolation in Interest Tables. 2.8 Present – Worth, Future – Worth, and Equivalent – Uniform – Annual – Worth Calculations. 2.9 Present Worth and Equivalent Uniform Annual Worth of Uniform Conventional Gradients. 2.10 Calculations Involving Geometric Series. 2.11 Calculation of Unknown Interest Rates. 2.12 Calculation of Unknown Years.	3	Students will identify and present How to use the engineering economy factors and the time value of money in practice .
5	Nominal and Effective	3.1 Nominal and Effective Rates. 3.2 Effective Interest – Rate	3	Students will present real formulated cash

	Interest Rates and Continuous Compoundin g	Formulation. 3.3 Calculation of Effective Interest Rates. 3.4 Effective Interest Rates of Continuous Compounding. 3.5 Calculations for Payment Periods Equal to or longer than compounding Periods. 3.6 Calculations for Payment Periods Shorter than Compounding Periods.		flows cases.
6 - 7	Use of Multiple Factors	4.1 Locating the resent Worth and Future worth. 4.2 Calculations for a Uniform Series that Begins after Period l. 4.3 Calculations Involving Uniform – Series and Randomly Placed Amounts. 4.4 Equivalent Uniform Annual Worth of Both Uniform – Series and Randomly placed Amounts. 4.5 Present Worth and Equivalent Uniform Series of Shifted Gradients. 4.6 Decreasing Gradients.	6	Students will learn how to analyze and calculate the equivalent cash flow
8	Present – Worth and Capitalized – Cost Evaluation	5.1 Present – Worth Comparison of Equal – life Alternatives. 5.2 Present – Worth Comparison of Different – life Alternatives. 5.3 Life – Cycle Cost. 5.4 Capitalized – Cost Calculations.	3	Students will learn How to analyze the capitalized cost for a real energy projects in Palestine?

		5.5 Capitalized – Cost Comparison of Two Alternatives.		
9	Equivalent – Uniform – Annual – Worth Evaluation	6.1 Annual – Worth Values for One or More Life Cycles. 6.2 AW by the Salvage Sinking – fund Method. 6.3 AW by the Salvage Present – Worth Method. 6.4 AW by the Capital – Recovery – Plus – Interest Method. 6.5 Comparing Alternatives by Annual Worth. 6.6 AW of a Permanent Investment.	3	Students will determine the feasibility for real energy projects by using AW methods.
10	Rate of Return Computations for a Single Project	7.1 Overview of Rate of Return and its computation. 7.2 Rate – of – Return Calculations using a Present – Worth Equation. 7.3 Rate – of – Return Calculations using an annual – Worth Equation. 7.4 Multiple Values as Possible Rates of Return. 7.5 Composite Rate of Return: Removing Multiple i* Values.		Students will determine the feasibility for real energy projects by using RoR methods.
10	**Midterm Exam**	Chapters 1-7 (Full Session - o Lecture)	1	Open Book/Open notes
11	Rate – of – Return Evaluation for Multiple	8.1 Understanding Incremental Analysis. 8.2 Tabulation of Incremental Cash Flow for Two Alternatives.		Students will learn how to Perform an ROR evaluation of a different projects

	Alternatives	8.3 Interpretation of Rate of Return on Extra Investment. 8.4 Rate of Return Evaluation Using a PW Equation. 8.5 Rate – of – Return Evaluation Using an AW Equation. 8.6 Selection from Multiple Alternatives Using ROR Analysis.		
12	Benefit / Cost Ratio Evaluation	9.1 Classification of Benefits, Costs, and Dis-benefits. 9.2 Benefit, Dis-benefit, and Cost Calculations for a Single Project. 9.3 Alternative Selection by Benefit / Cost Analysis. 9.4 Selection from Alternatives Using Incremental B/C Analysis.		Students will evaluate real energy projects by using Benefit/Costs analysis
13	Determining a Minimum Attractive Rate of Return	10.1 Relating Cost of Capital and MARR. 10.2 Debt-Equity Mix and Weighted Average Cost of Capital. 10.3 Cost of Debt Capital. 10.4 Cost of Equity Capital. 10.5 Variations in MARR. 10.6 Establishing an MARR Value for Decision Making. 10.7 Effect of Debt-Equity Mix on Investment Risk.		Students will learn the methods for selection the best alternatives .
14	Sensitivity Analysis and	11.1 The Approach to Sensitivity		Students will determine the

	Expected – Value Decisions	Analysis. 11.2 Determining Sensitivity to Parameter Estimates. 11.3 Sensitivity Analysis Using Three Estimates. 11.4 Economic Variability and the Expected Value. 11.5 Expected – Value Computations for Alternatives. 11.6 Alternative Selection Using Decision Trees.		sensitivity analysis of different parameters for real projects
15	More on Variation and Decision Making Under Risk	12.1 Interpretation of Certainty, Risk, and Uncertainty. 12.2 Elements Important to Decision Making Under Risk. 12.3 Random Samples. 12.4 Expected Value and Standard Deviation. 12.5 Monte Carlo Sampling and Simulation Analysis. 12.6 Multiple – Criteria Evaluation.		Group of Students will present their decisions for solving real energy problems
16	Tariffs	13.1 Flat rate tariff 13.2 Sliding Scale tariff 13.3 Two part tariff 13.4 Penalties in tariff structure		Students will compare the different tariff structures at the level of energy end-use for distribution companies.
17	**Final Exam**	Comprehensive	2	Open book notes

Textbook and References	**Text book:** 'Engineering Economy' – 7th Edition Authors: Leland T. Blank & Anthony J. Tarquin. McGraw-Hill - ISBN 0073376301 **References** 1. W.G. Sullivan, E.M Wicks, C.P. Koelling, Engineering Economy, Global Edition, 16/E, ISBN-13: 9781292019499 2. 'Basics of Engineering Economy', Anthony J. Tarquin. McGraw-Hill – ISBN 978–0–07–340129–4 ISBN 0–07–340129–3 (hard copy : alk. paper) 3. 'Engineering Economy Analysis', Newman, Lavelle And Eschenbach, Engineering Press (8th edition).

Overall Assessment Criteria

GRADING/EVALUATION OF THE STUDENT:

Evaluation is a shared responsibility between the teacher and the student. The purpose of the evaluation is to demonstrate how well the professor has taught and the student has learned specific course materials, the principles, concepts and terms relevant to Economics of Energy Systems, and to determine the students' ability to apply that knowledge to specific situations.

Grade Method:

Many lecture periods will have a graded component or exercise. These may be Moodle online assignments, quizzes, in-class assignments, homework, or the evaluation of the student's participation and attitude. These components will total twenty-five percent (25%) of the total course score. It is important that students complete their assignments accurately, neatly, and submit them on time.

Assignments received past the due date will be devalued 15% for each day that the item is late. No class assignment of any student will be graded (for credit) once the same assignment is corrected and returned to the class.

Up to eight (10) quizzes will be conducted during lecture periods. These quizzes will cover material from readings, previous assignments, or lectures. The best five (5) quiz scores will be factored into the student grade. Each quiz will be worth 2% of the total course score.

Two progress exams will be given during the semester and will be worth 30% (15% each) of the total course score. No make-up examination will be given without a written medical excuse, family emergency, or prior permission from the instructor. Students are responsible for all material covered in the class whether presented orally during the lectures or assigned (homework and reading).

Each student will conduct a project addressing an Economics of Energy Systems /topic by researching, developing, and preparing an Economics of Energy Systems resource portfolio. Topics must be approved by the instructor. Final projects will be presented in class (oral presentation), during the 16th week (final week; date TBA). The project will be worth 25% of the total course score.

Student Assessment

Midterm Exam/s	30 %
Self-Study: Assignments and Quizzes /Problems, Projects / Presentations, Participation ….etc.	30%
Final Exam	40 %
TOTAL	100%

Grading Scale:

A: 90-00%

B: 80-89%

C: 70-79%

D: 60-69%

E: Below 60%

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Course Evaluation

Course evaluation is part of the course. This evaluation should offer guidance in the future development and planning of the course. Course evaluations should be documented and made available to the students.

Overall, there are 3 different surveys which need completing by students. All of these surveys have been made on Survey Monkey. They should be completed online, and can be disseminated to students simply by forwarding the survey links below:

Digital Habits Survey (Students) - https://www.surveymonkey.co.uk/r/METHODSDHSANNU

Student Evaluation Survey Stage 1 – https://www.surveymonkey.co.uk/r/METHODSSE1ANNU

Student Evaluation Survey Stage 2 – https://www.surveymonkey.co.uk/r/METHODSSE2ANNU