# Engineering Economics - Course Description - SP 19

Engineering Economics (COMSATS University Islamabad)

## COMSATS UNIVERSITY ISLAMABAD

## Wah Campus

## Department of Management Sciences

### (Allied Department: Electrical Engineering)

| | | |
|---|---|---|
| **Course Title** | : | **Engineering Economics** |
| **Course Code** | : | ECO 300 |
| **Credit Hours** | : | 3(3, 0) |
| **Pre-requisite** | : | Numerical Computations & Operations Management |

### Course Description

The course is designed for the students from the departments of Computer Sciences, Electrical Engineering and Civil Engineering. The primary tasks of an engineer in an organization normally comprises of planning for the acquisition of equipment, designing, installation and producing products economically. In this course economic side of engineering in terms of financial viability of projects is discussed in detail. The emphasis on the systematic evaluation of the costs and benefits associated with proposed technical projects is taught to the participants of the subject. Moreover, the processes of determining exactly which assets to invest in and how much to invest have a great deal of impact on the organization's 'bottom line' – "**the profitability**". Sound engineering economic decisions, considering both time and risk are key to the success of any organization. Furthermore, the student will be exposed to the concepts of the "**time value of money**" and the methods of **discounted cash flow**. Students are prepared to **make decisions** regarding money as capital within a technological or engineering environment. The concepts of engineering economic analyses learned in the regular classes will be applied using **MS Excel** to calculate values of different engineering economic problems to better understand the application of engineering economic analyses in an organization.

### Rationale of the Course

Engineering economics equip learners to be able to evaluate projects from a financial perspective. Optimizing financial performance of a project is a key responsibility of the engineer in the decision making process. Examples of engineering projects would include but not limited to equipment replacement analysis, planning a new product line, and waste management. This course is designed to present engineering students the major concepts and techniques of engineering economic analysis that are needed in the decision making process. The emphasis of this course is on the analytical analysis of money and its impact on decision making.

**Textbook**

1. Engineering Economic Analysis (9th edition) By; Donald G. Newnan; Ted G. Eschenbach; and, Jerome P. Lavelle. Copy rights, 2004 by Oxford University Press, Inc. New York, USA.

**Reference Books**

1. Engineering Economy (6$^{th}$ Edition) by Leland Blank, and Anthony Tarquin. McGraw-Hill Companies, Inc., New York, USA.
2. Engineering Economics And Economic Design For Process Engineers (Ed. 2006) by Thane Brown. Taylor & Francis Group, USA.
3. Engineering Economic (2001) by R. Panneerselvam, PHI learning Pvt. Ltd. India.

**Course Learning Objectives**

This course will provide a thorough introduction to the basic concepts and techniques used in engineering economics for professional analyses of engineering problems relating a vast array of engineering projects. The course will introduce engineering economics problem identification, calculation, comparison of alternative techniques and as a result decision making skills are developed for the selection of best alternative. These alternatives are basically relating costs, benefits and revenues associated with a situation / scenario under evaluation relating a particular engineering project. This course will also introduce students the application of engineering economics concepts and techniques using Microsoft Excel.

**Course Learning Outcomes:**

After studying this course the participants should be able:

1. To understand and learn **basic concepts** used in engineering economics analysis.
2. To create awareness among students regarding engineering economic **decision making process** in-order to **solve real engineering economic problems**.
3. To learn and solve economic problems involving comparison and selection of alternatives by using variety of analytical techniques including; present worth analysis, annual worth analysis, future worth analysis, rate of return analysis, benefit-cost ratio, sensitivity and break-even analyses, payback period analysis and choosing suitable economic analytical instruments for the selection & ranking of mutually exclusive projects, etc. **Microsoft Excel Software** will be used to practically understand **application of concepts, techniques and methods in solving engineering economics problems**.

**Course Schedule**

3 credit hours/week (including MS Excel Sessions)

**Topics Covered**

1. Introduction to Basic Concepts of Engineering Economics and Analyses: (CLO-1)
   Introduction will cover the basic topics including engineering economics problem identification, role of engineering economic analysis, the decision making process, engineering costs, cost estimating, models and benefits, computing cash flows, concept of time value of money & equivalence, single payment and uniform series compound interest formulas, relationship between compound interest factors, concepts of arithmetic and geometric gradient factors, nominal and effective interest rates, concepts in continuous compounding, Islamic reality relating the concepts of interest and riba.

2. Basic Analyses methodologies and Techniques in Engineering Economics (CLO-2)
   Economic criteria for analysis, present worth techniques, annual cash-flow analysis, calculations relating analysis period, rate of return analysis, incremental analysis, elements and incremental rate of return analysis, benefit-cost ratio analysis, payback period analysis, sensitivity and breakeven analysis, the replacement problem and analysis.

3. Estimations of Projects in Engineering Economics  (CLO-3)
   This topic include estimates and their use in economic analysis, a range of estimates, probability and joint probability distribution, expected value, risk and return, meaning and effect of inflation, price indexes, use of price indexes in engineering economics, sources of capital, cost of funds, investment opportunities, selecting and adjusting minimum attractive rate of return to account for risk and uncertainty, capital expenditure project proposals, rationing capital by rate of return and present worth method, ranking project proposals.

4. Use of Microsoft Excel for the application of Engineering Economics Concepts (CLO-4)
   Application of MS Excel to learn and solve economic problems involving comparison and selection of alternatives by using variety of analytical techniques including; present worth analysis, annual worth analysis, future worth analysis, rate of return analysis, benefit-cost ratio, sensitivity and break-even analyses, payback period analysis and choosing suitable economic analytical instruments for the selection & ranking of mutually exclusive projects.

**Assessment Plan**

| Theory | Quizzes | 15% |
|---|---|---|
| | Assignments/Case Studies/MS Excel Practice | 10% |
| | 2 Sessional exams (1$^{st}$ & 2$^{nd}$ sessionals) (10%+15%) | 25% |
| | Terminal exam | 50% |
| | **Total (theory)** | **100%** |

**Final marks**    Theory marks 100 + Lab marks 0

**Learning Outcomes Assessment Plan**

| Sr. # | Course Learning Outcomes | Assessment |
|---|---|---|
| 1. | 1,2 | Assignment 1 |
| 2. | 1,2 | Quiz 1 |
| 3. | 1,2 | Sessional 1 |
| 4. | 1 | Assignment 2 |
| 5. | 1,2 | Quiz 2 |
| 6. | 2 | Assignment 3 /Case Studies |
| 7. | 2,3 | Quiz 3 |
| 8. | 2,3 | Sessional 2 |
| 9. | 4 | Assignment 4/MS Excel Practice |
| 10. | 2,3 | Quiz 4 |
| 11. | 1,2,3,4 | Terminal |

**Table 1 - Assessment Plan for Course Learning Outcomes**

**Computer Resources**

For the purposes of this course, the Microsoft Excel analysis software will be used for application of engineering economics concepts, techniques and methods.

**Mapping Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs):**

**Program Learning Outcomes (PLOs) from PEC:**

**PLO 1 (Engineering Knowledge):** An ability to apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

**PLO 2 (Problem Analysis):** An ability to identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

**PLO 3 (Design/Development of Solutions):** An ability to design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

**PLO 4 (Investigation):** An ability to investigate complex engineering problems in a methodical way including literature survey, design and conduct of experiments, analysis and interpretation of experimental data, and synthesis of information to derive valid conclusions.

**PLO 5 (Modern Tool Usage):** An ability to create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering activities, with an understanding of the limitations.

**PLO 6 (The Engineer and Society):** An ability to apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solution to complex engineering problems.

**PLO 7 (Environment and Sustainability):** An ability to understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.

**PLO 8 (Ethics):** Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.

**PLO 9 (Individual and Team Work):** An ability to work effectively, as an individual or in a team, on multifaceted and /or multidisciplinary settings.

**PLO 10 (Communication):** An ability to communicate effectively, orally as well as in writing, on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PLO 11 (Project Management):** An ability to demonstrate management skills and apply engineering principles to one's own work, as a member and/or leader in a team, to manage projects in a multidisciplinary environment.

**PLO 12 (Lifelong Learning):** An ability to recognize importance of, and pursue lifelong learning in the broader context of innovation and technological developments.

| | | **PLOs** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| **CLO** | **1** | ✓ | | | | | ✓ | | | | | | |
| | **2** | ✓ | ✓ | ✓ | | | | | | ✓ | | | |
| | **3** | ✓ | | | | | | | | | | | |
| | **4** | ✓ | ✓ | ✓ | | ✓ | | | | ✓ | | | ✓ |

**Table 2 – Course Learning Outcomes mapped to Standard Program Outcomes.**

**Tentative Lecture Breakdown (32 Lectures)**

| Topics | No. of lectures |
|---|---|
| Making Economic Decisions (Chapter 1) & Chapter Problems in-class practice Exercise | 2 |
| Engineering Costs and Cost Estimating (Chapter 2) | 2 |
| Interest and Equivalence (Chapter 3) & In-class Engineering Economics problem calculation exercises | 2 |
| More Interest Formulas (Chapter 4) & In-class Engineering Economics problem calculation exercises | 2 |
| Present Worth Analysis (Chapter 5) & In-class Engineering Economics problem calculation exercises | 2 |
| Annual Cash Flow Analysis (Chapter 6) & In-class Engineering Economics problem calculation exercises | 2 |
| Microsoft Excel Practice exercises | 2 |
| Rate of Return Analysis (Chapter 7) & In-class Engineering Economics problem calculation | 2 |
| Incremental Analysis (Chapter 8) & In-class Engineering Economics problem calculation | 2 |
| Other Analysis Techniques (Chapter 9) & In-class Engineering Economics problem calculation | 2 |
| Uncertainty in Future Events (Chapter 10) & In-class Engineering Economics problem calculation | 2 |
| Replacement Analysis (Chapter 13) & In-class Engineering Economics problem calculation | 2 |
| Inflation and Price Change (Chapter 14) & In-class Engineering Economics problem calculation | 2 |
| Selection of Minimum Attractive Rate of Return (Chapter 15) & In-class Engineering Economics problem calculation | 2 |
| Rationing Capital Among Competing Projects (Chapter 17) & In-class Engineering Economics Numerical problem calculation | 2 |
| Sessional I and II | 2 |
| Total Lecture Count | 32 |

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