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| Pokhara University Faculty of Science and Technology | |
| Course Code: MGT 250 (3 Credit) | Full Marks: 100 |
| Course Title: Engineering Economics (3-1-0) | Pass Mark: 45 |
| Nature of the Course: Theory and Tutorial | Total Lectures: 45 hours |
| Level: Bachelor/ Year: III/ Semester: VI | Program: Bachelor in Civil Engineering |

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| 1. Course Description: |
| The course introduces concepts and economic analysis procedures to assist with decision-making in engineering projects. Concepts include fundamentals of economics and engineering economics, cost analysis, time value of money and cash flow diagrams; interest rates, different techniques of evaluation, risk, replacement, depreciation and inflation. Economic analysis procedure includes selection and ranking of projects and analyze the associated risk including, replacement analysis, calculation of depreciation amount and adjustment of taxes and inflation. |
| 2. General Objectives: |
| The basic purpose of this course is to provide a sound understanding of concepts and principles of economy and engineering economy and to develop proficiency with methods for making rational decisions regarding financial analysis of engineering problems likely to be encountered in professional practice. |
| 3. Methods of Instructions: |
| Lecture, tutorials, discussions, assignments, quizzes, project work |

| Specific Objective | 4 Course Content |
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| <ul style="list-style-type: none"> Explain the meaning and principles of economics Describe the law of demand, Law of supply, production and utility theory Explain the meaning and importance of engineering economics and its principles | Unit 1: Basics of Engineering Economics (3 hrs) |
| | 1.1 Definition of economics and principles of economics |
| | 1.2 Introduction to demand, supply, production, and utility |
| | 1.3 Definition of engineering economics, principles of engineering economics and its applications. |
| <ul style="list-style-type: none"> Describe various elements and types of cost | 1.4 Terminologies used in engineering economic analysis |
| | Unit 2: Cost Concept and Analysis (3 hrs) |
| | 2.1 Elements of cost-material, labor and expenses |
| | 2.2 Various types of costs: Direct cost, indirect cost, fixed cost, variable cost, marginal cost, opportunity cost, sunk cost, manufacturing cost and non manufacturing cost. |

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| | Unit 3: Interest and Time Value of Money (6 hrs) |
| <ul style="list-style-type: none"> Define different types of interest rates and describe their relationship. Develop interest formulas for equivalent calculations of different types of cashflows | 3.1 Simple interest, compound interest, nominal interest rate and effective interest rates 3.2 Economic equivalence: Definitions, simple calculations, and general principles 3.3 Development of formulas for equivalence calculations: Types of cashflows, single cashflow formulas, equal payment series, linear gradient series, geometric gradient series, irregular (mixed payment) series. |
| | Unit 4: Basic Methodologies of Engineering Economic Studies (6hrs) |
| <ul style="list-style-type: none"> Define and describe minimum attractive rates of return Explain the process to calculate Payback period, equivalent worth, internal and external rates of return as well as Benefit cost ratio and their interpretation To explain the meaning and differences of economic and financial analysis | 4.1 Minimum attractive rate of return (MARR) : Concept and its calculation 4.2 Payback period: Simple and discounted 4.3 Equivalent worth: Present worth, future worth and annual worth 4.4 Rate of return: Internal rate of return (IRR) and External rate of return (ERR) 4.5 Benefit cost ratio: Normal, conventional and modified 4.6 Economic and financial analysis: Basic concept |
| | Unit 5: Comparative Analysis of Alternatives (6 hrs) |
| <ul style="list-style-type: none"> To be able to rank and select the projects having same and different useful lives economically and financially based on values obtained from Payback period, Equivalent worth, rate of return and benefit cost ratio To be able to select combinations of projects. | 5.1 Concept of mutually exclusive, independent and contingent projects 5.2 Comparing alternatives having same useful life 5.2.1 Payback period, present worth and future worth methods 5.2.2 IRR, ERR and BCR method using incremental analysis 5.3 Comparing alternatives having different useful lives: 5.3.1 Repeatability assumptions 5.3.2 Co-terminated assumptions 5.3.3 Capitalized worth method 5.4 Selecting best project for different combinations of project among mutually exclusive, independent and contingent project |
| | Unit 6: Replacement Analysis (4 hrs) |
| <ul style="list-style-type: none"> To explain the process to calculate the economic service life of the machine To be able to decide the right time to replace the existing | 6.1 Basic concept of defender and Challenger 6.2 Economic service life 6.3 Replacement strategies under finite and infinite planning horizon |

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| machine by new one. | |
| | Unit 7: Risk Analysis (6 hrs) |
| <ul style="list-style-type: none"> To define risk and their origin in Engineering projects To explain different methods of dealing with project risk and their application | 7.1 Concept and sources of risk in engineering project 7.2 Methods of dealing with risk: 7.2.1 Breakeven analysis 7.2.2 Sensitivity analysis 7.2.2 Decision tree analysis 7.2.4 Scenario analysis 7.2.5 Concept of Monte Carlo simulations |
| | Unit 8: Depreciation and Taxes (6 hrs) |
| <ul style="list-style-type: none"> Define depreciation, depletion, their causes and explain their application Explain the process to calculate depreciation and corresponding Book values uses various methods. Define different types of taxes Explain the process to prepare after tax cashflow and profitability | 8.1 Depreciation and depletion, causes and application 8.2 Methods of depreciation: Straight line method; Units of production method; Sum of year digit method; Declining balance methods; MACRS method and Sinking fund method 8.3 Depletion: Cost depletion and percentage depletion 8.4 Taxes: Direct and indirect tax, tax rates and VAT 8.5 After tax cashflow calculation, NPV and IRR calculations |
| | Unit 9: Capital Budgeting Decision (3 hrs) |
| <ul style="list-style-type: none"> Define capital budgeting decision Explain sources of fund/method of financing with their advantages and disadvantages To calculate the cost of capital | 9.1 Define capital budgeting their importance 9.2 Methods of financing: Equity financing, debt financing and Capital structure their merits and demerits 9.3 Cost of capital: Cost of equity, cost of debt and cost of capital |
| | Unit 10: Inflation (2 hrs) |
| <ul style="list-style-type: none"> Define inflation, their causes and explain the methods to explain inflation To derive the relationship between inflation, Interest rate and inflation adjusted interest rate Define constant dollar and actual dollar, explain their relationship | 10.1 Meaning and measure of Inflation 10.2 Actual vs constant dollar 10.3 Market and inflation free interest rates 10.4 Constant dollar and actual dollar analysis |

| 5. List of Tutorials | |
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| SN | Tutorials |
| 1. | Application of simple interest, compound interest, nominal interest rate and effective interest rates; Calculation of present value, future value, annual value for different types of |

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| | cashflows (Unit 3) |
| 2. | Payback period (simple and discounted), Net present value, Net Future Value, Net Annual Value, IRR/ERR, Benefit Cost Ratio (Conventional and modified) calculation (Unit 4) |
| 3. | Ranking of project using all methods and perform incremental analysis for projects having same useful life where applicable; Ranking of projects having different useful lives (Repeatability, co- terminated and capitalized worth methods); Selection of combinations of projects (Unit 5) |
| 4. | Find Economic service life, Finding best replacement strategy for finite and infinite planning horizon. (Unit 6) |
| 5. | Breakeven analysis, Sensitivity analysis and Decision tree analysis (Unit 7) |
| 6. | Calculate depreciation amount and corresponding book values using different methods of depreciation; Prepare after tax cash flow and find corresponding NPV and IRR. (Unit 8) |
| 7. | Calculate cost of capital for debt and equity financing (Excluding and including tax) (Unit 9) |
| 8. | Calculate average inflation, Relationship between inflation, interest rate and inflation free interest rates; Find NPV and IRR for Actual dollar and Constant dollar cashflow (Unit 9) |

6. Evaluation System and Students' Responsibilities

Evaluation System

The internal evaluation of a student may consist of attendance/class participation, assignment, project report and internal Assessment. The tabular presentation of the internal evaluation is as follows:

| Internal Evaluation | Weight | Marks | External Evaluation | Marks |
|----------------------------------|--------|-----------|---------------------------------|-----------|
| Theory | | 50 | Semester End examination | 50 |
| Attendance & Class Participation | 10% | | | |
| Assignments | 20% | | | |
| Project Report | 10% | | | |
| Internal Assessment | 60% | | | |
| Total Internal | | 50 | | 50 |
| Full Marks: 50 + 50 = 100 | | | | |

Students' Responsibilities

Each student must secure at least 45% marks separately in internal assessment and practical evaluation with 80% attendance in the class in order to appear in the Semester End Examination. Failing to get such score will be given NOT QUALIFIED (NQ) to appear the Semester-End Examinations. Students are advised to attend all the classes, formal exam, test, etc. and complete all the assignments within the specified time period. Students are required to complete all the requirements defined for the completion of the course.

8. Prescribed Books and References

Text Books:

1. Fundamentals of Engineering Economics by Chan S Park; Pearson
2. Engineering Economy by by [William Sullivan](#) , [Elin Wicks](#) , [C Koelling](#); Pearson

References:

1. A text book of Engineering Economics by OP Giri
2. Principles of Engineering Economic analysis by D Adhikari,
3. Fundamentals of Engineering Economic Analysis by SK Shrestha, Bikash Gautam