Engineering Economics

Me lol

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Notes

- PYQs of BEX/BCT's CE655 and BEI's CE615 are combined.
- CE655 are kept with normal font, while `our CE615 questions are kept in this style`.
- 2069 Poush QP has no marking given for any questions. Any and all markings given for 2069 Poush in this document are assumed that will hopefully reflect the actual markings.
- The question paper for 67 Mangsir and earlier are of different course. So, there will be inherently different kinds of questions being asked.

Contents

1 Introduction

(4 Hours/4 Marks)

1.1 Origin and Principles of Engineering Economy

1. Define engineering economics (**EE**). [1] (**80 Ch**,**76 Bh**, 73 Bh, 71 Bh)
2. Define engineering economy. [1] (74 Bh, 69 Bh)
3. Define economic system. [1] (67 Mng) [2] (65 Ch)
4. Define opportunity cost. [1] (75 Bh)
5. Briefly explain the scope of engineering economics with appropriate example. [3] (**80 Ch**)
6. Explain briefly about the principles of EE. [3] (81 Ash, 74 Bh) [4] (**80 Bh**)
   |→List out principles of engineering economics. [3] (76 Ba, 69 Bh)
   |→State and explain principles of engineering economics. [4] (75 Ba)
   |→Explain principles of EE in detail with appropriate examples. [4] (77 Po)
   |→Write down the principles oF EE Analysis. [3] (73 Bh)
   |→What are the principles of EE? [2] (69 Po)
7. "The study of economic is important for engineers". Justify the statement with a suitable example. [4] (**79 Ch**)
8. "Use the consistent view point" and "Make uncertainty explicit". Explain these two principles of engineering economics. [2+2] (**78 Ch**)
9. Write advantages of socialistic economy. [3] (67 Mng)
10. Explain the term: socialistic economy. [2] (66 Ma)
11. Discuss briefly on the characteristics of capitalistic economy. [2] (65 Ch)

1.2 Role of Engineers in Decision Making

1. Why do engineers need knowledge of economics in decision making process? [1] (81 Ash)
   |→How does principles of EE help in decision making process? [2] (69 Po)
   |→Scarcity is an emerging issue in engineering field. How does the study of economics help to engineers in decision making process? Discuss. [5] (70 Bh)
2. Explain with a suitable example "Engineers play key role in making economic decision of a project" [4] (**81 Bh**) [6] (68 Bh)
3. How an engineer plays an important role in making the economic decisions? Explain. [4] (**77 Ch**, 81 Ba, 80 Ba, 70 Ma)
4. "Engineers make good decision-makers." Justify this statement. [4] (**79 Bh**)
5. Why engineering economics is considered as important aspect for making decisions for engineers? Explain. [3] (**76 Bh**, 75 Bh)
6. Why does an engineer must have the knowledge of economics during decision making process? [1] (76 Ba)

1.3 Cash Flow Diagram

1. Explain the term: cash flow diagram. [2] (66 Ma)

2 Interest and Time Value of Money

(8 Hours/8 Marks)

2.1 Introduction to Time Value of Money

1. What is the time value of money? [1] (**78 Ch**,**77 Ch**)
2. What are the factors to be considered in calculating the time value of money? [1] (**80 Ch**)
3. Explain the concept of 'time value of money' and "interest payment schemes' with suitable examples. [2+2] (**80 Bh**)

2.2 Compound Interest

1. Differentiate between simple and compound interest. [1] (**79 Ch**)

2.2.1 Nominal Interest rate

2.2.2 Effective Interest rate

1. Differentiate the nominal and effective interest with the support of 10% bank's interest which compounds daily. [2+2] (81 Ash)
   |→Difference with example. [2] (**80 Ch**)
   |→Difference. [2] (**78 Ch**, 80 Ba)
   |→Relation. [2] (**79 Ch**)
2. Bank 'A' offers 6.25% interest that compounds daily and Bank 'B' offers 6.4% interest that compounds yearly, which bank do you prefer and why? [2] (**80 Ch**)
3. The total purchase price of a three room set furniture is Rs. 50,000. However after a down payment of Rs. 10,000, two year series end of month payment of Rs. 2200 will have to be made. Determine the nominal and effective interest rate. [3+3] (**68 Bh**)

2.2.3 Continuous Compounding

1. Explain the continuous compounding. [1] (**76 Bh**)

2.2.4 The Five Types of Cash flows

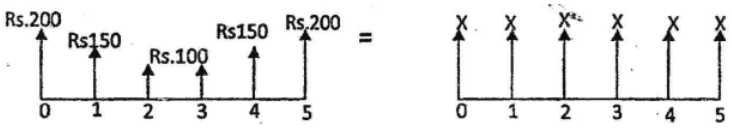
1. Briefly explain different types of cash flows used in economic equivalence with suitable example. [4] (**81 Bh**)

2.3 Numericals

2.3.1 Sinngle and Irregular Cash Flow

1. You have just purchased 100 shares of ABC company at Rs. 100 per share, hoping to sell the stock at double the market price. If the stock price is expected to increase by 20% per year. How long do you wait before selling the stock? [4] (80 Ba)
2. How long will it take for Rs 25,000 to triple itself, if the interest rate is 8% per year? [2] (**79 Ch**,**78 Ch**)

3. Suppose that you make the monthly deposits of Rs. 5,000 each into a bank account that pays an interest rate of 8% compounded weekly for 5 years. After 5 years, interest rate changes to 6% per year. How much money will you have accumulated in this bank account at the end of 8 years?
4. Suppose that you make a deposit of Rs. 5000 per month in a saving account which gives 12% interest compounded quarterly for the first three years and 9% compounded monthly for the last two years. What amount do you expect at the end of 5 years? [3] (77 Po) [4] (**77 Ch**)
5. Two cash flow transactions shown below are said to be equivalent at 10% interest, compounded annually. Find the unknown X value which satisfies the equivalence. [5] (76 Ba)



2.3.2 Uniform Series

6. How many deposits of Rs. 25,000 should make per month so that final accumulation amount will be Rs. 10,00,000 if the bank interest is 6% per year? [4] (**81 Bh**)
7. If you deposited Rs. 5,00,000 now in a bank which gives 6% interest per year. How many times would you be able to draw of Rs. 10,000 per month with that many? [3] (**80 Ch**)
8. Suppose that you are planning to deposit the sum of Rs 10,000 at the end of each month for the next 5 years in a bank which gives the interest rate of 12% compounded quarterly. What will be the maturity of the deposit after 10 years? [4] (81 Ba)
9. How much money should you invest now in a project so that you make 8 end of year withdraws of Rs 20,000 each if the interest rate is 8% compounded quarterly? [3] (**79 Ch**)
10. A machine needs uniform semi-annual cashflow of $10,000 for fuel for 5 years. If interest rate is 12% compounded quarterly, what is its equivalent present worth? [4] (**76 Bh**)
11. What is future equivalent of a continuous funds glow amounting $10,000 per year. N = 12 years, M = ∞, 20% compounding continuously. [3] (**76 Bh**)
12. A man is planning to retire in 25 years. He wishes to deposit regular money every months until he retires so that he will receive annual payments of Rs. 4,50,000 after the first year of his retirement for the next 10 years. How much he deposit if the interest rate is 8%, compounded monthly? [5] (76 Ba)
13. How much rupees should you deposit now in a bank acount that gives 8% interest per year if you wish to draw Rs. 10,000 per month for 10 years? [4] (70 Ma)

2.3.3 Linear Gradient Series

14. A process engineer starts investing his money when he graduates from college. He is able to afford investing $25,000 a year from the time he graduates in four years until the end of eight years. He also plans to invest an additional $5,000 per year (increasing by $5,000 per year) at the end of the year he graduates until year eight. How much will the process engineer have saved by the end of year eight and what is its present worth if the interest rate 10% compounding monthly? [6] (81 Ba)
15. Compute the equivalent linear growth rupees to make economic equivalence for present deposit of Rs. 38,281.23 against one-year withdrawals at the end of two months each (6 number of linearly increased withdrawals in total) with base amount Rs. 5000 at first (at the end of 2^{nd} months) with 12% interest rate compounding quarterly. [6] (**79 Bh**)
16. A couple is planning for their child's education. They wish to deposit Rs. 10,000 now in a bank account that gives 12% per year compounded monthly and increase the amount by Rs. 2,000 each

year from the previous year for next 9 years. How much amount they will expect at the end of 10 years? [5] (**77 Ch**)

2.3.4 Geometric Gradient Series

17. Mr. Hari, father of Ram, had deposited Rs 2,50,000 in a bank 10 years ago at an interest of 10% pa compounds quarterly. After knowing this, Ram is planning to deposit Rs 50,000 at the end of this year and planned to increase the deposit annually by 15% till 5 years' end but with revised interest scheme in the same account. The revised interest scheme is 9.5% interest compounding monthly. What would be the accumulated cash in a bank at the end of 10^{th} year of Ram's first deposit? [6] (81 Ash)
18. While you are planning to deposit Rs 5000 in 3 months interval for 4 years in increasing trend at a 2.5% growth rate per deposit, a bank enticing you with an interest rate of 10% pa compounded semi-annually. What will be equivalent equal annual deposit of that money? [4] (**80 Bh**)

3 Basic Methodologies of Engineering Economic Analysis

(12 Hours/16 Marks)

1. What are sunk costs? [1] (**80 Bh**)
2. What are the relative methodologies of economic analysis? [1] (**76 Bh**)
3. Explain in brief any two relative methodologies of economic analysis with examples. [4] (**76 Bh**)
4. Explain in brief, the absolute and relative measures used under different methodologies of engineering economic analysis. [2] (76 Ba)

3.1 Determining Minimum Attractive (Acceptable) Rate of Return (MARR)

1. Define MARR. [1] (81 Ash, 77 Po)
2. What are the determining factors of MARR to the economy? Explain. [2] (81 Ash) [4] (**71 Bh**)

3.2 Equivalent Worth Methods

1. Define equivalent worth method. [1] (70 Ma)
2. An equipment costing of Rs. 5,00,000 is estimated to have life of 10 years and expected annual revenue is Rs. 1,10,000 with annual cost of Rs. 20,000. Determine the investment decision from PW, AW, and FW method to this equipment when salvage value is Rs. 1,00,000 and MARR is 12%. [6] (69 Po)

3.2.1 Annual Worth Method

1. Thw owner of the business company is considering investing Rs. 50,00,000 in a new equipment. He estimates that the cash flows during the first year will be Rs. 50,000 but these will increase by Rs. 25,000 per year the next year and each year thereafter. The equipment is estimated to have 10 years' service life and a net salvage at this time will be Rs. 60,000. The Firm MARR is 12%.
   a Determine the annual capital cost for the equipment [3+3+2] (**81 Bh**)
   b Determine the equivalent annual saving (revenues)
   c Determine if this a wise investment
2. A company is considering investing Rs 5, 50,000 in a new equipment. Net cash flow estimate during first year will be Rs. 50,000 and will increase by Rs. 25,000 per year the next year and each year thereafter. The equipment has 10 years service life and salvage value of Rs. 60,000. Assuming MARR = 12%. [2+3+2] (77 Po)
   (i) Determine annual capital cost for the equipment.
   (ii) Determine the equipment annual savings.
   (iii) Determine if this is a wise investment.
3. If a machine will be operated according to varying hours. 1200 hrs in the first year, 2100 hrs in the second year, 1800 hrs in the third year and 15000 hrs in the fourth year. Compute the annual equivalent saving or cost per machine hour, if the firm's MARR is 13% with annual worth of Rs. 75000. [5] (**79 Bh**)
4. Evaluate the project by using AW formulation of the project at i = 12%. [4] (**74 Bh**)

EOY	0	1	2	3	4	5
Clash Flow	-3,000	800	1,000	1,100	1,210	1,464

3.3 Rate of Return Methods

1. Define rate of return method. [1] (70 Ma)

3.3.1 Internal Rate of Return Method

1. Define IRR. [2] (**71 Bh**)

2. Explain drawbacks of IRR with examples. [3] (**79 Ch**, 68 Jth)
   |→Explain any two drawbacks of IRR with example. [3] (**74 Bh**)
   |→Explain limitations of IRR with examples. [2] (76 Ba)

3. A machine cost Rs. 20 million with no salvage value. Rs 8 million revenues per year can be gained. Given: useful life = 4 years. Tax rate = 50%, MARR = 10%. Use straight line depreciation method to evaluate (i) PW (ii) IRR. [10] (68 Jth)

4. Evaluate IRR (FW formulation) using linear interpolation. MARR = 10%. Also draw U/B diagram in table and graph. [8] (77 Po)

EOY	0	1	2	3	4	5
Cashflow Inflow	-	500	560	520	580	540
Cashflow Outflow	1000	100	200	200	300	400

5. Evaluate IRR of the following project and decide whether the project is acceptable or not? Also draw investment Balance diagram. Use AW formulation for calculation. [8] (80 Ba)
   Initial investment = Rs. 50,000
   Annual Revenue = Rs. 20,000
   Salvage value = Rs. 10,000
   Useful life = 6 years
   MARR = 10%

6. Consider the following cash flow of project: [8] (**78 Ch**)
   Initial investment = Rs. 25,000
   Net annual revenue = Rs. 8,000
   Salvation value after 5 years = Rs. 5,000
   Calculate IRR of the project. Is the investment on this project accepted?
   Assume MARR = 20%. Show that unrecovered project balance in graphical as well as tabular form. [8] (**78 Ch**)

7. Compute IRR by using trial and error process of the following project. Determine also investment decision. [4] (70 Ma)
   Initial investment = Rs. 25,000
   Annual revenue = Rs. 8,000
   Salvage value = Rs. 5,000
   Useful life = 5 years
   MARR = 20%

8. Calculate IRR and show the unrecovered balance diagram in both tabular and graphical form of the following cash flows. MARR = 20%. [7] (**80 Bh**)

EOY	0	1	2	3	4	5
Outflows	60,000	10,000	0	50,000	20,000	0
Inflows	0	30,000	40,000	10,000	70,000	70,000

9. Find IRR of the following project with initial investment of Rs. 500,000 and Salvage value of Rs. 100,000. The benefit and annual O and M cost are given below: Also draw the investment Balance

Diagram. [6] (**79 Ch**)

EOY	1	2	3	4	5
Benefit	105,000	115,000	125,000	135,000	145000
O and M cost	5,000	10,000	15,000	20,000	25,000

10. Use IRR to evaluate following project when MARR is 15% per year. [5+1] (**77 Ch**)

EOY	0	1	2	3	4	5
Cashflow (Rs.)	-60,000	20,000	40,000	-40,000	50,000	70,000

Make also unrecovered balance diagram.

11. Use IRR method to evaluate following project when MARR is 15%. Make also unrecovered balance graph. [5] (**73 Bh**)

EOY	0	1	2	3	4	5
Cashflow	-60,000	20,000	40,000	-40,000	50,000	70,000

12. Use IRR method to evaluate following project when MARR is 20% [4] (69 Po)

Year	0	1	2	3	4	5
Cashflow	-60,000	20,000	40,000	50,000	50,000	70,000

13. Find the IRR of the following cash flow of a project. If MARR = 20%, comment on the acceptability of the project. Show investment balance diagram. [8] (**68 Bh**)

Year	0	1	2	3	4	5
Cashflow	-20,000	+8,000	+17,000	+19,000	+18,000	-10,000

3.3.2 External/Modified Rate of Return Method

1. How does ERR method eliminates some of drawbacks of IRR? [3] (68 Jth)

2. Find the IRR and ERR of the following CF. MARR = 11% and Reinvestment rate = 15%. [6] (**81 Bh**)

EOY	0	1	2	3	4	5
Cashflow	-50,000	-20,000	+25,000	+35,000	+30,000	+25,000

3. Find IRR and ERR of the following project. MARR = ϵ = 15%. [6] (**71 Bh**)

Year	0	1	3	4	5
Cashflow	-50	-10	30	40	50

4. Calculate both IRR and ERR. MARR = ϵ = 12%. [6] (**75 Bh**)

EOY	0	1	2	3	4	5
C/F	-45,000	-4,000	+9,000	+40,000	+60,000	+10,000

5. Calculate ERR of the project and comment on its acceptability if MARR = 20% and reinvestment rate is 15%. [6] (**81 Bh**)

EOY	0	1	2	3	4	5	6
Net Clash Flow	-150,000	+30,000	+50,000	+60,000	+80000	-35000	+45,000

6. Calculate ERR of the following cash flow MARR = 11%, reinvestment rate 13%. [5] (**79 Bh**)

EOY	0	1	2	3	4	5
C/F	-80,000	22,000	38,000	45,000	-17,000	48,000

7. Compute ERR for a project with following projected cash flows: [4] (76 Ba)

EOY	0	1	2	3	4	5	6
C/F	3,00,000	1,50,000	2,00,000	-1,00,000	2,00,000	1,50,000	-50,000

Take MARR = 12%, ϵ = 15% (if needed)

8. Calculate the ERR of the following cash flow. MARR = 12%, reinvestment rate = 14%.

EOY	0	1	2	3	4	5
C/F	-100,000	25,000	40,000	-10,000	50,000	50,000

[6] (**74 Bh**)

9. Equipment costs Rs. 2,50,000 and has salvage value of Rs. 50,000 at the end of its expected life 5 years. Annual expenses will be Rs. 40,000. It will produce a revenue of Rs. 120,000 per year. MARR = 20% = ϵ [4+4+4] (**69 Bh**)
   a. Evaluate IRR using AW formulation.
   b. Evaluate both type of B/C ratio with FW formulation.
   c. Find ERR.

3.4 Public Sector Economic Analysis (Benefit Cost Ratio Method)

1. Caclulate CR and make investment decision using AW method for the project when Initial investment: Rs. 1,00,000, Annual revenue: Rs. 20,000, Annual expense: Rs. 5,000, Salvage value: Rs. 25,000, Project life: 10 years, MARR: 10% per year. [3] (81 Ash)

EOY	0	1	2	3	4	5
Net Clash Flow	-50000	-20000	+25000	+35000	+30000	+25000

2. An Engineering College is considering to purchase a new machine costing of Rs. 4,00,000 having salvage value Rs. 1,00,000 at the end of 5^{th} year. The use of machine will increase revenue by Rs. 1,50,000 that needs fuel cost of Rs. 30,000 per year. Find IRR and B/C ratio when MARR = 10%. [3+3] (81 Ash)

3.4.1 Conventional BCR

1. Machinery costs Rs. 250,000 and has an annual expense of Rs. 40,000. It will generate a revnue of Rs. 120,000 per year and will have a salvage value of Rs. 50,000 after 5 years. Calculate its conventional B/C ratio and ERR if MARR = reinvestment rate = 20%. Use AW formulation. [3+3] (**80 Bh**)

3.4.2 Modified BCR

1. Find both types of B/C ratio using Future Worth formulation. [8] (**81 Bh**)
   Initial Invetment = Rs. 150,000
   Project Life = 5 years
   Salvage value = 50,000
   Annual O & M Cost = Rs. 20,000 and increasing by 8% per year
   Annual Benefits = Rs. 60,000 at the end of year 1 and increasing by Rs. 10,000 each year for 5 years. MARR = 15%.

2. Find both types of B/C ratio using FW formulation from the following from the following cash flow of a project. Initial investment = Rs 5,00,000, Revenue = Rs. 5,000 in the first year and increases by Rs. 15,000 each year after that, Expenses = Rs. 30,000 in the first year and increase by 5% each year after that. Salvage value at the end of 8 years = Rs. 25,000. MARR = 8%. [8] (**75 Bh**)

3. Determine both types of B/C ratio by using FW formulation. [6] (69 Po)
   Initial investment : Rs. 2,50,000
   Annual revenue : Rs. 50,000 at the end of first year and increasing by Rs. 30,000 for each year

Annual O& M cost : Rs. 30,000
Salvage value : Rs. 50,000
Useful life year : 5 years
MARR : 15%

4. Find the acceptibility of a project using both type of B/C ratio. (Use AW method) [10] (**68 Bh**)
   Initial investment = Rs. 180,,000
   Annual Expenses = Rs. 16,000
   Useful life = 10 years
   Annual Benefits = Rs. 53,000 at the end of first year and decreases by Rs. 2,000 each year
   Salvage value = Rs. 40,000
   MARR = 10%

5. Determine both types of B/C ratio using FW and AW formulation. [6] (**79 Ch**)
   Initial Investment = Rs. 250,000 Annual Revenue Rs. 75,000 at the end of 1st yr. and increasing by Rs. 5,000 each yr.
   Annual O and M cost = Rs. 15,000
   Salvage value = Rs. 25,000
   MARR = 10% per yr. bank

6. Find the acceptability of a project using both types of B/C ratio. Use AW method. [10] (**68 Bh**)
   Initial investment = 180,000
   Annual Expenses = 16,000
   Useful life = 10
   Annual benefits = 53000 at the end of 1st year and decreases by 2000 each year.
   Salvage value = 40,000
   MARR = 10%.

7. Calculate both types of BCR of a project with following details. [8] (80 Ba)
   MARR = 15%
   Initial Investment = Rs. 20,000
   Annual income = Rs. 2,000 at the end of first year and increases by 15% every year.
   Annual expense = Rs. 100 at the beginning of first year and increases by Rs. 50 per year.
   Salvage Value = Rs. 2500
   Useful life = 12 years

8. Determine both type of B/C ratio from the following cashflow. [4] (70 Ma)
   Initial investment = Rs. 3,00,000
   Annual revenue = Rs. 85,000
   Annual costs = Rs. 15,000
   Salvage value = 20% of initial investment
   Useful life = 6 years
   MARR = 10%

3.5 Payback Period Method

3.5.1 Simple Payback Period

3.5.2 Discounted Payback Period

1. Your college is considering to purchase a machine of Rs. 3,00,000 expecting salvage value Rs. 50,000 at the end of 10th year. The use of machine saves Rs. 80,000 per year when it needs Rs.

20,000 operating cost for each year. Find [3+3] (**77 Ch**,**73 Bh**)

a Both types of B/C ratio using AW formulation
b Both types of payback periods.

2. Use the following information to: [4+4] (**71 Bh**)

	Machine A
Initial Investment	6,000
Annual Benefits	1000
O & M Cost	3,000
Salvage Value	1,500
MARR	10%

a. Evaluate both type of BCR (FW Formulation). Take useful life = 10 yrs.
b. Evaluate both types of Payback Period. If useful life = 5 years. Take standard payback period = 3 years.

3. If you planned to invest in a project which has stated following information regarding investment plan in proposal: first Cost = Rs. 2 Lakhs, Project's Life = 4 years, salvage Value = Rs. 50,000, gross revenue = Rs. 1 Lakh, O& M = Rs. 30,000. Draw your decision based on (i) discounted pay back period method (ii) equivalent worth method (iii) modified B/C ratio method and (iv) suitable rate of return method. You are provided with 14% MARR, 3 yrs loan tenure from bank. [3+2+3+3] (**76 Bh**)
|→Only Discounted Payback Period and Modified BCR Method. [3+3] (**78 Ch**)

4. Make investment decision for the following project by using (i) IRR (ii) B/C (iii) Discounted Payback methods. [4+4+4] (75 Ba)
Initial cost = Rs. 4,00,000
Annual Revenue = Rs. 1,60,000 for the 1st year and decreases by Rs. 10,000 thereafter
Annual Expenses = Rs. 40,000 for the 1st year and increases by Rs. 5,000 thereafter
Salvage value = Rs. 1,00,000
Life year = 8
MARR = 9% per year

5. Initial investment = Rs. 100,000 [6+5+5] (**70 Bh**)
Salvage Value = 0
Annual O& M Cost = Rs. 20,000
Useful Life = 5 years
Annual Benefit = Rs. 60,000 at the end of first year, thereafter decreases by Rs. 4,000 each year for the remaining years.

a. Draw U/B diagram.
b. Evaluate conventional BCR using PW formulation. Take salvage value = Rs. 10,000.
c. Evaluate Discounted Payback Period. Take standard (cut off) Payback Period = 3 years.

3.6 Introduction to Lifecycle Costing

1. Explain the life cycle costing. [3] (77 Po)
2. Briefly explain the concept of lifecycle costing. [2] (75 Ba)
3. Assess the feasibility by computing both types of payback periods from the following information regarding an engineering project. [4] (76 Ba)

EOY	0	1	2	3	4	5
Net Clash Flow	-25,00,000	5,20,000	12,00,000	12,00,000	8,00,000	10,00,000
Bank provides a loan for investment @ 16% pa.						

4. From the following cashflow, calculate both type of payback period. MARR = 10%. [4] (**69 Bh**)

EOY	0	1	2	3	4	5
Clash Flow	-3000	800	1000	1100	1210	1464

3.7 Introduction to Financial and Economic Analysis

1. What do you mean by financial and economic analysis? [2] (75 Ba)
2. Differentiate between Financial and Economic analysis of a Project.
[2] (**78 Ch**,**73 Bh**, 80 Ba, 70 Ma) [3] (**79 Bh**,**77 Ch**,**74 Bh**)

4 Comparative Analysis of Alternatives

(8 Hours/12 Marks)

4.1 Comparing Mutually Exclusive Alternatives having Same useful life by

1. (Assumed) What are the reasons behind the alternative projects being mutually exclusives to each other? Explain with suitable examples. [2] (77 Po)

2. (Assumed, no idea) Compute the Imputed Market Value (IMV) for study period 4 years if initial investment is Rs. 1000 and market value after 8 years is Rs. 2000 . Take MARR = 10%. [4] (**79 Bh**)

3. (Assumed) KFC is in the process of forming a separate business unit that provides crunchy fried chicken in Biratnagar. Since the meals are prepared in one central location and distributed by the food delivery throughout the city for its online order. Mr. Harka is the General manager of this unit, and he wishes to choose between two location for the cost economic delivery service as below perform analysis for infinite study period with MARR 8%. [6] (81 Ba)

	Mahindra Chowk Location	Khanar Location
Initial Cost, I	15 lakhs	22 lakhs
Annual O& M Cost	6 lakhs	9 lakhs
Refurbishment Cost	0	2 lakhs every 4 yrs
Trade in value, % of I	20	30
Contract period, years	4	12

4. (Assumed) Recommend the best project from the following two projects if the study period is 5 years. [6] (**80 Bh**)

Project	A	B
Investment	350,000	500,000
Annual Revenue	130,000	175,000
Annual Cost	15,000	25,000
Salvage Value	35,000	50,000
Useful life	6 yrs	8 yrs

5. Nepal government is planning to invest three irrigation projects. The detail cash flow estimation are given below in billions, with MARR = 10% and life of each project is 20 years. [6] (**75 Bh**)

	Koshi	Gandaki	Karnali
Initial cost	20,000	22,000	24,000
Annual benefit	4,000	4,500	5,000
Annual Cost	1,000	1,200	1,400

Compare mutually exclusive project to invest.

4.1.1 Payback Period Method and Equivalent Worth Method

4.1.2 Rate of Return Methods and Benefit Cost Ratio Method

1. Recommend the best project from the following two projects. Use IRR method. MARR = 10% per year. [6] (81 Ba)

Project	A	B
Initial Cost	350,000	500,000
Annual O& M Cost	130,000	175,000
Annual Cost	35,000	25,000
Salvage Value	35,000	50,000
Useful life	8 yrs	8 yrs

2. These projects are being considered with the estimated cash flow over 10 years. Recommend which investement alternative should be selected using IRR method? Assume MARR = 10%.

Project	A	B
Investment	350,000	500,000
Annual Cost	130,000	175,000
Salvage Value	15,000	25,000
Useful life	6 years	8 years

[8] (**80 Bh**)

3. Consider the following three sets of mutually exclusive alternatives. Which project would you select based on BCR? When MRR = 15%. [6] (**80 Ch**)

Year	Project A	Project B	Project C
0	-2,000	-1,000	-3,000
1	1,500	800	1,500
2	1,000	500	2,000
3	800	500	1,000

4. Three projects are being considered with the estimated cash flow over 10 years. Recommend which investment alternative should be selected using IRR method? Assume MARR = 10%. [8] (**80 Bh**)

Project	A	B	C
Initial Investment	320,000	250,000	720,000
Annual Revenues	70,000	50,000	120,000
Annual Expenses	7,000	5,000	12,000
Salvage Value	40,000	30,000	50,000

5. Select the best project using IRR method if MARR = 10% and market value at the end of useful life of each project is zero. [8] (80 Ba)

Project	A	B
Initial investment	3500	5000
Annual Benefit	1900	2500
Annual O and M	645	1383
Useful Life	4 years	8 years

6. (Assumed) Use the modified B/C ratio method with AW formulation to select the preferred dedsign from the following mutually exclusive projects. Take MARR = 9% per year and the analysis period of 15 years each. [6] (**79 Ch**)

Factors	Design 1	Design 2	Design 3
Capital Investment	1,240,000	1,763,000	1,475,000
Salvage Value	90,000	160,000	120,000
Annual O and M cost	201,000	215,000	204,000
Annual benefit	315,000	367,000	355,000

7. Select the best project using ERR method. Take MARR = 10% and Reinvestment rate = 20%.

	Project ABC	Project XYZ
Initial investment	12,000	16,000
Annual revenue	5,000	6,000
Useful life	5 years	5 years
Salvage value	2,000	2,5000

[4] (**79 Bh**)

8. Based on following information select the best alternative using ERR method. [4] (**78 Ch**)

	Alternative X	Alternative Y
Investment	10,000	15,000
Revenue	5,000	8,000

Take Life = 5 years, MARR = 10%, Reinvestment rate = 12%, salvage value = 12% of Investment and O & M = Rs. 1,500.

9. Based on following information select the best alternative using ERR method. [5] (77 Po)

10. You are planning to invest in a project for 7 years. Based on the following information, which option would you prefer over others and why? Take MARR = 11%. Use suitable methodology.

	Project A	Project B
Investment	100,000	120,000
Revenue	25,000	17,000
Life	10 years	7 years

[6] (**78 Ch**)

11. Using the IRR method, recommend the best project from the following set of mutually exclusive projects taking 10-year useful life for all alternatives. Assume MARR = 10%. [8] (**77 Ch**)

Project	A	B	C
Initial Investment	1,80,000	1,00,000	2,80,000
Annual revenues	53,000	35,000	77,000
Salvage Value	18,000	10,000	28,000
Annual operating cost	16,000	12,000	28,000

12. Select the best proposal using ERR (ϵ = 25%, MARR = 20%) [4] (70 Ma)

EOY	0	1	2	3	4	5	6
Proposal A	-6400	2620	2900	3020	3100	3100	2600
Proposal B	-7500	2050	4060	4000	3900	3900	3400

13. Compare the following mentioned projects using IRR method MARR = 14%.

Project	A	B	C	D
Investment	20,00,000	25,00,000	40,00,000	35,00,000
Gross revenues	8,50,000	9,00,000	9,50,000	10,00,000
O & M	3,50,000	3,50,000	2,50,000	3,00,000

Take salvage value = 15% of First Cost and life span as 8 years. [6] (76 Ba)

14. Compare following two projects by IRR method when i = 10% per year. [4] (75 Ba)

Project	Initial Cost	Annual revenue	Annual cost	Salvage value	life year
A	5,00,000	2,00,000	50,000	80,000	7
B	7,00,000	3,00,000	1,00,000	1,50,000	7

15. Choose the best project among these alternatives using IRR, if MARR = 15% and study perido is 10 years. Salvage value is 20%. [6] (**74 Bh**)

Project	A	B	C	D
First Cost	900	1500	2500	4000
Annual Revenue	150	276	400	925

16. Use IRR method to select best project. MARR = 12%. [8+4] (**70 Bh**)

	A	B	C	D
Initial investment	1100	1500	2750	2000
Annual income	500	700	1200	950
Useful life	4	4	4	4
Salvage value	250	500	800	1000

Select the best combination if A, B and C are mutually exclusive.

17. Three mutually exclusive alternatives are to be compared by the rate of return method and are described below. MARR = 10%. Salvage value is 20% of first cost. Which option has the highest IRR and what is it? Recommend the best alternative. [8] (**68 Bh**)

	A	B	C
First cost	70,000	60,000	100,000
Annual income	15,000	10,000	18,000
Useful life	8	8	8

4.2 Comparing Mutually Exclusive Alternatives having different useful lives by

1. Explain the techniques for comparing mutually exclusive alternatives having unequal useful lives. [3] (81 Ash)
2. You are panning to invest in a project for 7 years. Based on the following information, which option would you prefer over others and why? Take MARR = 11%.

Project	A	B	C
Investment	100,000	120,000	150,000
Revenue	25,000	17,000	18,000
Life	9yrs	7yrs	5yrs

[7] (77 Po)

3. Recommend the best project from the following two projects taking study period as 6 years. Assume MARR = 10% per year.

Project	A	B
Initial Investment	350,000	500,000
Annual Revenue	130,000	175,000
Annual Cost	15,000	25,000
Useful life	5	8
Salvage Value	35,000	50,000

[6] (**76 Ch**)

4. From the following information select the best project. MARR = 10%. [4+8] (**69 Bh**)

	A	B
Initial investment	35,00	50,000
Annual income	16,450	25,000
Annual costs	3,000	13,830
Useful Life	4	8
Salvage value	0	0

5. Two types of power converters, alpha and beta are under consideration for a specific application. An economic comparision is to be made at an interest rate of 12% and the following cost estimates have been obtained. Select the best option by calculating present worth of both the projects if it will be operated for 4 years only. [8] (**68 Bh**)

	Alpha	Beta
Purchase price	750,000	2,000,000
Annual O/C	200,000	100,000
Estimated service life	5	9
Salvage value	0	400,000

6. Select the best project. Required study period is 5 years with MARR = 10%. [10] (68 Jth)

Project	P	Q
Initial Investment	5,00,000	3,50,000
Annual net revenue	2,00,000	1,75,000
Salvage value	50,00	35,000
Useful life	6	5

4.2.1 Repeatability Assumption

1. (Assumed) Compare repeatibility assumption and co-terminated assumption as per their suitability. [4] (80 Ba)

2. Select the best project using Repeatability assumption and PW formulation. If MARR = 10%.

	A	B	C
Investment	4500	3470	5640
Net Annual benefit	2100	1800	2500
Useful life	3yrs	4yrs	6yrs
Salvage value	450	280	360

[8] (**81 Bh**)

3. (Assumed) How much should you deposit now in an account which gives 8% interest per year if you wish to draw Rs. 5,000 per month + Rs 100,000 each year + Rs 300,000 in every 4 years for infinite period. [3] (**80 Ch**)

4. Use repeatability assumption to select the best project from the following three projects.

Project	A	B	C
Initial Investment	100,000	200,000	300,000
Annual Expenditure	25,000	20,000	15,000
Useful life (yrs)	3	5	6
Salvage Value	40,000	50,000	60,000
MARR	14%		

[6] (**79 Ch**)

5. Recommend the best project from the following projects using repeatibility assumption. Assume MARR = 10% per year. [6] (**77 Ch**)

Project	A	B	C
Investment	500,000	700,000	900,000
Annual Revenue	175,000	250,000	325,000
Annual Cost	25,000	40,000	60,000
Salvage Value	50,000	70,000	90,000
Useful LIfe	6 years	8 years	10 years

6. Use repeatibility assumption to select the best project. Use MARR = 12% [6] (**75 Bh**)

Project	A	B	C
Initial cost	100,000	200,000	300,000
Annual income	25,000	30,000	45,000
Salvage Value	20,000	50,000	70,000
Useful LIfe	6 years	10 years	15 years

7. Select the best project by using repeatability assumption when MARR = 13%. [4] (75 Ba)

Project	Initial Cost	Annual revenue	O & M	Salvage value	life year
A	4,00,000	1,75,000	50,000	1,00,000	4
B	7,00,000	2,50,000	70,000	1,50,000	6

8. Consider the following two mutually exclusive alternatives; recommend the alternatives using repeatibility assumptions. MARR = 15%.

Project	Initial Cost	Annual Cost	Salvage Value	Useful Life
A	100,000	25,000	40,000	6
B	150,000	12,000	50,000	10

[6] (**74 Bh**)

9. Compare the following two mutually exclusive projects by using repeatibility assumption taking MARR = 8%. [4] (**73 Bh**)

Project	Initial Cost	Annual revenue	Operating Cost	Salvage Value	Useful Life
A	150,000	90,000	20,000	80,000	4
B	200,000	100,000	20,000	120,000	6

10. Use repeatability assumption to select the best project from the following projects. [6] (**71 Bh**)

Project	Initial Investement	Annual Expenditure	Useful Life	Salvage Value
A	100,000	25,000	3	40,000
B	200,000	20,000	5	50,000
C	250,000	15,000	7	60,000

Assume MARR = 14%.

11. Compare following projects by using repeatibility assumption when MARR is 12%. [4] (70 Ma)

Project	Initial Investement	Annual revenue	Annual Costs	Useful Life	Salvage Value
A	200,000	25,000	7,000	6	10,000
B	300,000	30,000	9,000	8	20,000

12. Recommend the best project from the following information by using repeatability assumption when MARR = 12%. [6] (69 Po)

Project	Initial Investement	Annual revenue	Annual Costs	Useful Life	Salvage Value
A	400,000	175,000	25,000	6	40,000
B	700,000	250,000	35,000	9	70,000

13. Select the best project from the following two projects. Use repeatability and PW method. Use MARR = 15%. [8] (**68 Bh**)

Project	Initial cost	Annual expenses	Annual revenues	Useful Life	Salvage Value
A	150,000	35,000	8,500	6	50,000
B	180,000	31,000	10,500	9	80,000

4.2.2 Co-terminated Assumption

1. Recommended the best project from the following cash flow of a mutually exclusive projects using modified benefit cost ratio method. MARR=10%.

Project	A	B
Initial Investment	24,00,000	35,50,000
Annual Revenue	8,20,000	12,00,000
Annual Cost	1,10,000	1,40,000
Useful life	10	10
Salvage Value	2,25,000	3,50,000

[6] (**76 Bh**)

4.2.3 Capitalized Worth Method

1. Explain Capitalized Worth. [2] (76 Ba)
2. What are the conditions to apply capitalized worth method? [2] (**80 Ch**)
3. (Assumed) Why do we need incremental analysis? [2] (**80 Ch**)
   |→ and explain with example. [2] (76 Ba)
   |→ and illustrate with example, and how it can be performed? [2] (**78 Ch**)
4. (Assumed) Evaluate the following projects using the study period of 5 years. MARR = 8%.

	X	Y
Investment	1,00,000	1,50,000
Annual Cost	40,000	25,000
Useful life	5yrs	9yrs
Salvage value	10,000	15,000

[6] (**81 Bh**)

5. Compare the following two mutually exclusive projects by using co-terminated assumption taking MARR = 8%. [4] (**73 Bh**)

Project	Initial Cost	Annual revenue	Operating Cost	Salvage Value	Useful Life
A	150,000	90,000	20,000	80,000	4
B	200,000	100,000	20,000	120,000	6

4.3 Comparing Mutually Exclusive, Contingent and Independent Projects in Combination

1. Define mutually exclusive, independent and contingent projects. [2] (**80 Bh**,**80 Ch**,**75 Bh**)
   |→ and give examples. [3] (**73 Bh**) [4] (**79 Ch**, 70 Ma)
2. Define independent and contigent projects. [2] (75 Ba)
3. How much should you deposit at present that earns 12% interest per year when you can draw Rs 10,000 per month for (i) 50 years (ii) Forever. [2] (**75 Bh**)
4. Find present worth from annual cash flow series of Rs. 5,000 forever when i = 8% per year. [2] (75 Ba)
5. The total purchase price of a three room set furniture is Rs. 50,000. However after a down payment of Rs. 10,000, two year series end of month payment of 2200 will have to be made. Determine the nominal and effective interest rate. [3+3] (**68 Bh**)
6. The following are five proposed projects being considered by an engineer in an integrate system for a company. The interrelationships among the projects and respective cash flows for the coming budgeting period are as shown. [10] (81 Ash)
   Project A_1 and Project A_2: Mutually exclusive and independent on B set.
   Project B_1 and Project B_2: Mutually exclusive and contingent on the accent on acceptance on A_2.
   Project C: Contingent on the acceptance of B_1.
   Assume MARR = 8% per year and all the equipment's are having useful life of years.
   Determine what combination of projects is best if the capital to be invested is
   i) Unlimited
   ii) Limited to 48,000.

	A_1	A_2	B_1	B_2	C
Initial Investment	50,000	30,000	14,000	15,000	10,000
Annual Benefits	20,000	12,000	4,000	5,000	6,000

7. Prepare all possible mutual exclusive combinations for the following properties of projects A, B, C, D and E. [4] (**79 Bh**)
   - Project A and B are mutually exclusive projects.
   - Project C and D are mutually exclusive and contingent on acceptance of Project A.

- Project E is contingent an acceptance of Project D

8. Four projects are being considered with the estimated cash flow over 10 years. Recommend which investment alternative should be selected? Assume MARR = 10%.

Project	A	B	C	D
Initial Investment	320,000	250,000	720,000	800,000
Life	5	6	7	8
Annual revenues	70,000	50,000	120,000	160,000
Salvage Value	40,000	30,000	50,000	60,000

B & C are mutually exclusive, D is contingent on C and A is Contingent on B. [6] (76 Ba)

5 Replacement Analysis

(8 Hours/12 Marks)

1. What do you mean by replacement analysis. [1] (81 Ash)

5.1 Fundamentals of Replacement Analysis

5.1.1 Basic Concepts and Terminology

5.1.2 Approaches for Comparing Defender and Challenger

5.2 Economic Service Life of Challenger and Defender

5.3 Replacement Analysis When Required Service Life is Long

5.3.1 Required Assumptions and Decision Framework

5.3.2 Replacement Analysis under the Infinite Planning Horizon

5.3.3 Replacement Analysis under the Finite Planning Horizon

6 Risk Analysis

(8 Hours/12 Marks)

6.1 Origin/Sources of Project Risks

6.2 Methods of Describing Project Risks

6.2.1 Sensitivity Analysis

6.2.2 Breakeven Analysis

6.2.3 Scenario Analysis

6.3 Probability Concept of Economic Analysis

6.4 Decision Tree and Sequential Investment Decisions

7 Depreciation and Corporate Income Taxes

(8 Hours/12 Marks)

7.1 Concept and Terminology of Depreciation

7.2 Basic Methods of Depreciation

7.2.1 Straight line method

7.2.2 Declining Balance Method

7.2.3 Sinking Fund Method

7.2.4 Sum of the Year Digit Method

7.2.5 Modified Accelerated Cost Recovery System (MACRS)

7.3 Introduction to Corporate Income Tax

7.4 After Tax Cash flow Estimate

7.5 General Procedure for Making After Tax Economic Analysis.

8 Inflation and Its Impact on Project Cashflows

(4 Hours/4 Marks)

8.1 Concept of Inflation

8.2 Measuring Inflation

8.3 Equivalence Calculation Under Inflation

8.4 Impact of Inflation on Economic Evaluation