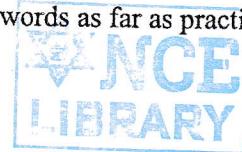


| Exam.       | Regular                    |            |        |
|-------------|----------------------------|------------|--------|
| Level       | BE                         | Full Marks | 80     |
| Programme   | BCE, BEL, BEX,<br>BCT, BGE | Pass Marks | 32     |
| Year / Part | III / II                   | Time       | 3 hrs. |

**Subject:** - Engineering Economics (CE 655)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.



1. "Use the consistent view point" and "Make uncertainty explicit". Explain these two principles of engineering economics. [2+2]
2. a) What is the time value of money? Explain and differentiate nominal and effective interest rate. How long will it take for Rs 25,000 to triple itself, if the interest rate is 8% per year? [1+2+2]
  - b) Airplane ticket price will increase 8% in each of the next four years. The cost of end of the 1<sup>st</sup> year is Rs 2,000. How much needs to be put away now to cover the passenger travel at the end of year for the next 4 years, taking  $i=5\%$ ? [3]
3. a) Consider the following cash flow of project:
 

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]
- b) If you planned to invest in a project which has stated following information regarding investment plan in its proposal: First Cost = Rs 2Lakhs, Project's Life = 4 years, Salvage value = Rs 50 thousands, Gross revenue = Rs 1 lakh, O and M = Rs 30 thousands. Draw your decision based on discounted payback period method and modified benefit cost ratio. You are provided with 14% MARR. [3+3]
- c) Differentiate between Financial and Economic analysis. [2]
4. a) Illustrate with example, why incremental analysis is needed and how it can be performed? [2]
  - b) Based on following information select the best alternative using ERR method. [4]

| Alternative X                       | Alternative Y          |
|-------------------------------------|------------------------|
| Investment = Rs 10,000              | Investment = Rs 15,000 |
| Revenue = Rs 5,000                  | Revenue = Rs 8,000     |
| Life = 5 years                      |                        |
| MARR = 10%, Reinvestment rate = 12% |                        |
| Salvage value = 12% of Investment   |                        |
| O & M = Rs 1,500                    |                        |

- c) 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.

[6]

| Project A               | Project B               |
|-------------------------|-------------------------|
| Investment = Rs 100,000 | Investment = Rs 120,000 |
| Revenue = Rs 25,000     | Revenue = Rs 17,000     |
| Life = 10 years         | Life = 7 years          |

5. a) Why replacement analysis is necessary in economic analysis? How do you make replacement analysis when planning horizon is finite?

[2+2]

- b) A 5- year old defender has a current market value of Rs 40,000, except Operation and Maintenance of Rs 30,000 this year, increasing by Rs 15,000 per year. Future market values are expected to decline by Rs 10,000 per year. The Challenger costs Rs 60,000 and has Operation and Maintenance of Rs 20,000 per year, increasing by Rs 10,000 each year. Salvage value expected at the end of 5 year is Rs 20,000. Calculate the economic service life of both defender and challenger.

[8]

6. a) Perform a sensitivity analysis over a range of  $\pm 15\%$  with 5% increment using AW formulation for i) Initial Investment, ii) Net annual income, iii) Useful life & iv) MARR.

[8]

Given Parameters:

Initial cost = Rs 125,000  
 Salvage value = Rs 25,000  
 Annual Income = Rs 60,000  
 Annual Cost = Rs 20,000  
 Useful Life = 6 Years  
 MARR = 8%

Which parameter is the most sensitive among the given? Give reasons.

- b) A firm plans to install its manufacturing unit either in Butwal or Birganj. Preliminary feasibility study gives the following information depicted in table. Further added cost for advertisement are Rs 200,000 and Rs 250,000 for Butwal and Birganj respectively. Where should the firm target to install its unit?

[4]

|             | Butwal  |         |         | Birganj |         |         |     |
|-------------|---------|---------|---------|---------|---------|---------|-----|
|             | Success | High    | Medium  | Low     | High    | Medium  | Low |
| Probability | 0.2     | 0.5     | 0.3     | 0.3     | 0.4     | 0.3     |     |
| Income      | 400,000 | 300,000 | 150,000 | 500,000 | 350,000 | 100,000 |     |

7. Prepare a schedule of charging depreciation and carry out the book value for each year of a machinery having first cost of Rs. 80,000 with salvage value of Rs 10,000 after 5 years using i) DDB Method  
 ii) SOYD method  
 iii) MACRS method

Also, find after tax net present value based on above calculated SOYD depreciation. Net annual revenues from machinery are Rs 35,000 for 5 years. 25% tax rate and MARR = 15%.

8. What is Actual and Constant Dollar? The cost of apple per kg is Rs 150. The Cost increases to 6%, 8% and 9% per kg in first year, second year and third year respectively. Determine the average inflation rate for 3 years.

[1+3]

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## 2077 Poush



TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
Examination Control Division  
2077 Poush

| Exam.       | Back                       |            |        |
|-------------|----------------------------|------------|--------|
| Level       | BE                         | Full Marks | 80     |
| Programme   | BCE, BEL, BEX,<br>BCT, BGE | Pass Marks | 32     |
| Year / Part | III / II                   | Time       | 3 hrs. |

Subject: - Engineering Economics (CE 655)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
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1. Explain the principles of engineering economy in detail with appropriate examples. [4]
2. a) 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]
  - b) A company is considering investing Rs 5,50,000 in 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%,
    - (i) Determine annual capital cost for the equipment.
    - (ii) Determine the equipment annual savings.
    - (iii) Determine if this is a wise investment. [2+3+2]
3. a) Evaluate IRR (FW formulation) using linear interpolation. MARR = 10%. Also draw UIB diagram in table and graph. [8]

|              |      |     |     |     |     |     |
|--------------|------|-----|-----|-----|-----|-----|
| EOY          | 0    | 1   | 2   | 3   | 4   | 5   |
| CASH INFLOW  | -    | 500 | 560 | 520 | 580 | 540 |
| CASH OUTFLOW | 1000 | 100 | 200 | 200 | 300 | 400 |

- b) What is MARR? Explain the life cycle costing. [4]
4. a) What are the reasons behind the alternative projects being mutually exclusive to each other? Explain with suitable examples. [2]
- b) Based on following information select the best alternative using ERR method [5]
 

|                       |                       |                       |
|-----------------------|-----------------------|-----------------------|
| Alternative X         | Alternative Y         | Alternative Z         |
| Investment = Rs 10000 | Investment = Rs 12000 | Investment = Rs 15000 |
| Revenue = Rs 5000     | Revenue = Rs 7000     | Revenue = Rs 8000     |

Life = 5 years  
MARR = 10%, Reinvestment Rate = 12%  
Salvage value = 12% of investment  
O and M = Rs 1500

- c) 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%. [7]

| Project A              | Project B              | Project C              |
|------------------------|------------------------|------------------------|
| Investment = Rs 100000 | Investment = Rs 120000 | Investment = Rs 150000 |
| Revenue = Rs 25000     | Revenue = Rs 17000     | Revenue = Rs 18000     |
| Life = 9 years         | Life = 7 years         | Life = 5 years         |



## 2077 Poush



5. a) Write down the procedure for replacement analysis under infinite planning horizon. [3]  
 b) Suppose that the firm has a contract to perform a given service on which current defender or challenger is considered for 8 years with the following annual equipment cost:

| End of year | Defender | Challenger |
|-------------|----------|------------|
| 1           | -3078    | -5100      |
| 2           | -3070    | -4291      |
| 3           | -3300    | -4094      |
| 4           | -3576    | -4065      |
| 5           | -3860    | -4110      |
| 6           |          | -4189      |

Determine the best replacement strategy. [7]

6. a) Perform sensitivity analysis over 15% in (i) MARR and (ii) Useful life. Draw sensitivity chart and interpret the result. [6]

| First Cost | Annual Revenue | Annual Expenses | Salvage Value | Useful Life | MARR |
|------------|----------------|-----------------|---------------|-------------|------|
| \$ 25,000  | \$ 12,000      | \$ 4,000        | \$ 5,000      | 5 years     | 10%  |

- b) Explain the decision tree analysis. What would be the effect on BEP and profit/loss, when selling price increase by 20% and fixed cost decrease by 10%. [4+4]  
 Consider following data: Variable Cost per unit = \$ 50  
 Fixed cost = \$ 60,000 Selling price per unit = \$ 80

7. a) You purchased a machine at a cost of Rs 320000 having useful life of 8 years. The estimated salvage value is Rs 50000. For book purpose straight line method is used and for tax purpose the machine is depreciated using MACRS over its 5 year class life. Determine the annual depreciation allowance and resulting book value of a machine for both book and tax purposes. [2+6]

- b) A company requires a machine which costs Rs 50,000 and has a salvage value of Rs 10,000 after 5 years and expected to save the annual benefit of Rs 16000. The depreciation is on SOYD. Calculate the after tax cash flow of a machine if tax rate applicable is 30%. [4]

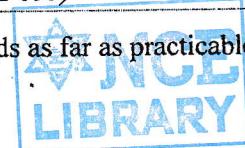
8. What is inflation? Explain constant dollar and actual dollar. Explain deflation method of analysis using suitable example.

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TRIBHUVAN UNIVERSITY  
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**Examination Control Division**  
 2077 Chaitra

| Exam.       | Regular                    |            |        |
|-------------|----------------------------|------------|--------|
| Level       | BE                         | Full Marks | 80     |
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**Subject:** - Engineering Economics (CE 655)



- ✓ Candidates are required to give their answers in their own words as far as practicable.
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1. Explain the role of engineers in Engineering Economic Decisions. [4]
2. What is the time value of money? 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? [1+4]
3. 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]
4. Use IRR to evaluate following project when MARR is 15% per years. [5+1]

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

Make also unrecovered balance diagram.

5. Your college is considering to purchase a machine of Rs. 3,00,000 expecting salvage value Rs. 50,000 at the end of 10<sup>th</sup> year. The use of machine saves Rs. 80,000 per year when it needs Rs. 20,000 operating cost for each year. Find
  - (i) Both types of B/C ratio using AW formulation
  - (ii) Both types of payback periods.
[3+3]
6. Distinguish between financial and economic analysis. [3]
7. Recommend the best period from the following projects using repeatability assumption.  
 Assume MARR = 10% per year. [6]

| 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 |

8. 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]

| 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   |

9. Suppose a company is considering purchasing a new machine that would cost \$1800 and operating cost of \$300 in the first year. For the remaining years, Operating Cost increases by 15% over the previous year's Operating Cost. Similarly, the salvage value declines each year by 20% from the previous year's salvage value. The new machine truck has a maximum life of eight years. MARR = 12% before tax. Find the economic service life to the asset. [8]

10. Explain the procedure for the replacement analysis when the planning horizon is infinite. [4]

11. Perform sensitivity analysis of the following project over a range of  $\pm 30\%$  in; initial investment, net annual revenue, MARR & useful life. Indicate sensitive parameter also. [5+1]

Initial cost = Rs. 4,00,000

Annual revenue = Rs. 1,50,000

Operating cost = Rs. 30,000

Salvage value = Rs. 50,000

Useful life = 7 years

MARR = 11% per year

12. A small hydro project has following estimated data. [5]

Initial investment = Rs. 10,00,000

Energy generated per year = 200MW

Annual operating cost = Rs. 6,00,000

Market price of energy = Rs. 4/KWhr

MARR = 10%

Salvage value = Rs. 1,00,000

Find its break-even point of time.

13. Define the term book value and salvage value. [2]

14. You purchased a machine at a cost of Rs. 3,20,000 having useful life of Rs. 8 years. The estimated salvage value is Rs. 50000. Determine the annual depreciation schedule using DDB, SOYD and sinking fund method. Assume  $i\% = 12\%$ . [8]

15. Define inflation. What are its causes? Find rate of inflation per year when price of a product has increased from Rs. 5,00,000 to Rs. 6,30,000 over the period of 3 years. [1+1+2]

Or,

Define Actual dollar and Constant dollar. Calculate NPV if  $i$  is 6% and inflation rate is 8% of the following cashflow. [1+3]

| Year                   | 0     | 1    | 2    | 3    |
|------------------------|-------|------|------|------|
| Actual dollar cashflow | -1000 | +500 | +500 | +500 |

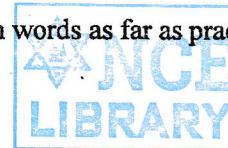
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TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2076 Baisakh

| Exam.       | Back                       |            |        |
|-------------|----------------------------|------------|--------|
| Level       | BE                         | Full Marks | 80     |
| Programme   | BCE, BEL, BEX,<br>BCT, BGE | Pass Marks | 32     |
| Year / Part | III / II                   | Time       | 3 hrs. |

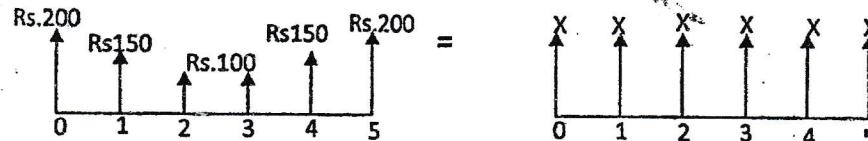
**Subject: - Engineering Economics (CE 655)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
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- ✓ Assume suitable data if necessary.



1. Why does an engineer must have the knowledge of economics during decision making process?  
List out principles of engineering economics. [1+3]

2. a) The 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]



b) A man in 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]

3. a) Explain the limitations of IRR with suitable examples. Compute ERR for a project with following projected cash flows: [2+4]

| EOY        | 0         | 1        | 2        | 3         | 4        | 5        | 6       |
|------------|-----------|----------|----------|-----------|----------|----------|---------|
| Cash Flows | -3,00,000 | 1,50,000 | 2,00,000 | -1,00,000 | 2,00,000 | 1,50,000 | -50,000 |

Take MARR=12%  $\epsilon=15\%$  (if needed)

b) Explain in brief, the absolute and relative measures used under different methodologies of engineering economic analysis. Assess the feasibility by computing both types of payback periods from the following information regarding an engineering project. [2+4]

| EOY        | 0          | 1        | 2         | 3         | 4        | 5         |
|------------|------------|----------|-----------|-----------|----------|-----------|
| Cash Flows | -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.a) Why incremental analysis is essence during comparative analysis of alternatives using BCR, IRR and ERR? Illustrate with the help of example. Compare the following mentioned projects using IRR method MARR=14%. [2+6]

| Alternatives | Investment | Gross Revenues | O & M    | Salvage Value     | Life Span (years) |
|--------------|------------|----------------|----------|-------------------|-------------------|
| Project A    | 20,00,000  | 8,50,000       | 3,50,000 | 15% of First Cost | 8                 |
| Project B    | 25,00,000  | 9,00,000       | 3,50,000 |                   |                   |
| Project C    | 40,00,000  | 9,50,000       | 2,50,000 |                   |                   |
| Project D    | 35,00,000  | 10,00,000      | 3,00,000 |                   |                   |

b) Explain Capitalized Worth Four projects are being considered with the estimated cash flow over 10 years. Recommend which investment alternative should be selected? Assume MARR=10%. [2+6]

| Project            | A                  | B      | C      | D      |
|--------------------|--------------------|--------|--------|--------|
| Initial Investment | 320000             | 250000 | 720000 | 800000 |
| life               | 5                  | 6      | 7      | 8      |
| Annual revenues    | 70000              | 50000  | 120000 | 160000 |
| Salvage Value      | 40000              | 30000  | 50000  | 60000  |
| B & C              | Mutually Exclusive |        |        |        |
| D                  | Contingent on C    |        |        |        |
| A                  | Contingent on B    |        |        |        |

5. a) Write down the reasons of replacement of an existing asset.
- b) A chemical plant owns a filter press that was bought 3 years ago for Rs. 30,000. Now it has a market value of Rs. 9000, a life of 5 years, and a salvage value of Rs. 2000 at that time. The challenger has a cost of Rs. 36,000, a life of 5 years, and estimated market value of Rs. 12,000 after 5 years. 5 years planning period to be used and the MARR is 15%. The operating and maintenance cost of the alternatives are given in the following table:

[4]

| End of Year | Defender | Challenger |
|-------------|----------|------------|
| 0           | 0        | 0          |
| 1           | 7,000    | 0          |
| 2           | 8,000    | 1,000      |
| 3           | 9,000    | 2,000      |
| 4           | 10,000   | 3,000      |
| 5           | 11,000   | 4,000      |

Should the old filter press be replaced now? Use cashflow approach.

[6]

6. a) A newly established hat company estimated following data;  
 Output of hat per annum= 3,00,000 NOS  
 Expected sales revenue per annum= Rs. 1,50,00,000  
 Fixed cost= Rs. 35,00,000  
 Variable cost= Rs. 66,00,000  
 i) Find out break-even level of output  
 ii) If fixed cost increases to Rs. 40,00,000, find out its effect on break-even point.  
 iii) What should be output if profit desired is Rs. 10,00,000 per year?

[5]

- b) Perform sensitivity analysis over  $\pm 25\%$  for the following project on parameters

- i) Initial Investment
- ii) Annual revenue
- iii) Useful life

When  $I=10,000$

$AR = 4,000$  for the 1<sup>st</sup> year that increases by 500 thereafter for next 4 years.  
 MARR= 10% per year

[7]

7. a) List out advantages of depreciation. Calculate depreciation amount for each year using declining balance and MACRS methods.
- $I=10,00,000$  [1+2+3]  
 $N=5$  years  
 $S=2,00,000$   
 (If applicable)

- b) Define direct tax & indirect tax. Prepare after tax cash flow of a project having following cash flow details.

[2+4]

Initial cost = 1,00,000

Useful life = 5 years

Salvage value = 20,000

Annual income = Rs. 20,000 at the end of first year and increases by Rs. 2000/year

Tax rate = 20%

Depreciation method sum of year digit

8. Draw the concept of inflation using suitable example. If the real interest rate is given as 5% and general inflation rate as 8%, calculate MARR. Explain meaning of constant dollar and actual dollar.

[1+1.5+1.5]

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TRIBHUVAN UNIVERSITY  
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**Examination Control Division**  
2076 Bhadra

| Exam.       | Regular                    |            |        |
|-------------|----------------------------|------------|--------|
| Level       | BE                         | Full Marks | 80     |
| Programme   | BCE, BEL, BEX,<br>BCT, BGE | Pass Marks | 32     |
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**Subject:** - Engineering Economics (CE 655)

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1. Define Engineering Economics. Why engineering economics is considered as important aspect for making decisions for engineers? Explain. [1+3]
2. a) 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]
  - b) Explain the continuous compounding. What is future equivalent of a continuous funds flow amounting \$ 10,000 per year.  $N = 12$  years,  $M = \infty$ , 20% compounding continuously. [4]
3. a) What are the relative methodologies of economic analysis? Explain in brief any two of them with suitable examples. [1+4]
  - b) 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 thousands, gross Revenue = Rs 1 Lakh, O&M = Rs 30 thousands. 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]
4. a) Recommend the best project from the following two projects taking study period as 6 years. Assume MARR = 10% per year. [8]

| 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    | 5 years | 8 years |

- b) Recommend the best project from the following cash flow of a mutually exclusive projects using modified benefit cost ratio method. MARR = 10% [6]

| 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  |
| Salvage Value      | 2,25,000  | 3,50,000  |
| Useful life        | 10 years  | 10 years  |

5. a) What is replacement analysis? What factors should be considered in replacement analysis? Explain the cash flow approach and opportunity cost approach. [4]
- b) A new machine costs \$20,000. Future market values are expected to decrease by \$ 2000 each year over the previous year's value. Useful life of the machine is six years. Operating costs are estimated at \$ 3000 during the first year and expected to increase 15% per year thereafter. MARR = 12%. Determine the economic service life of the machine. [4]
- c) Explain the replacement analysis under infinite planning horizon. [4]
6. a) What are the different tools used in economics to assess the risk of any project? Explain each of them briefly. [4]
- b) Perform a sensitivity analysis (Over a range of (  $\pm$  15% with 5% increment) with using IRR (AW formulation) among the parameters (i) useful life (ii) Initial Investment (iii) Revenues. It is given that,  $I = \text{Rs } 1,00,000$   $S_v = \text{Rs } 22,000$  O&M = Rs 12,000 Revenues = Rs 40,000 Useful life = 6 years and MARR = 10% Suggest which of the considered parameter of the project is more sensitive and why? [6]
- c) What is the principle of Risk Adjusted MARR method of evaluating the project's risk? Explain. [2]
7. a) Explain the general procedure for after tax economic analysis with suitable examples. [4]
- b) Compute annual depreciation and book value of year using following depreciation methods: (i) Declining Balance Method (ii) SOYD Method (iii) Sinking Fund Method [6]

| Cost Basis | Salvage Value | Useful Life | MARR |
|------------|---------------|-------------|------|
| \$ 7000    | \$ 2000       | 5 Years     | 10%  |

8. Why inflation is important to engineers for economic analysis? Suppose that the 1<sup>st</sup> year inflation rates for first year and second year are 5% and 8% respectively. Calculate the average inflation rate of two years if the base price is Rs 100. [2+2]

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| Exam.       | Regular                    |            |        |
|-------------|----------------------------|------------|--------|
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**Subject: - Engineering Economics (CE655)**

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1. Define opportunity cost. Why engineering economics is considered as important aspect for making decision for engineers? Explain. [1+3]
2. a) A bank is starting its nominal interest rate of 9% p.a and compounding quarterly. Calculate the effective interest rate (i) a year (ii) a quarter (iii) a month (iv) half year [4]
  - b) If you wish to withdraw Rs 2000 at the end of 1<sup>st</sup> year and expecting to be increased by 15% pa then after till end of 8 years, what amount need to be deposited in a bank right now which has an interest of 15% pa. [4]
3. a) Find both types of B/C ratio using FW formulation from the following cash flow of a project. Initial investment = Rs 5,00,000, Revenue = Rs 5,0000 in the first year and increases by 15000 each year after that, Expenses = 30000 in the first year and increase by 5% each year after that. Salvage value at the end of 8 years = 25000. MARR = 8%. [8]
  - b) Calculate both IRR and ERR. MARR =  $\epsilon = 12\%$ . [6]

| EOY | NCR     |
|-----|---------|
| 0   | -45,000 |
| 1   | -4,000  |
| 2   | +9,000  |
| 3   | +40,000 |
| 4   | +60,000 |
| 5   | +10,000 |

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

|                | 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.

- b) Use repeatability assumption to select the best project. [6]

|                  | Project A | Project B | Project C |
|------------------|-----------|-----------|-----------|
| Initial cost     | 1,00,000  | 2,00,000  | 3,00,000  |
| Annual income    | 25,000    | 30,000    | 45,000    |
| Salvage value    | 20,000    | 50,000    | 70,000    |
| Useful life year | 6         | 10        | 15        |
| MARR             | 12%       |           |           |

- c) Define mutually exclusive, independent and contingent projects. 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+2]

5. Define replacement. Explain the main reasons for replacement. Find economic service life from the following data. [1+3+8]

Initial cost = Rs 50,000

Operating cost = Rs 10,000 for the 1<sup>st</sup> year that increases by 15% thereafter

Salvage value = Decreases each year by 20% from previous value

Useful life = 7 years

MARR = 15% per year

6. Enunciate different methods of analyzing the riskiness of the project. Perform sensitivity analysis to identify the most sensitive parameter, among considered parameters by plotting the graph, using IRR computations for a project having following information over the range of  $\pm 15\%$  (interval of 5%) for the parameters: (i) Net Annual Revenues (ii) Salvage Value (iii) Life Span [2+8]

| Investment<br>(Rs) | Net Annual Revenues<br>(Rs) | Salvage Value<br>(Rs) | Life of Project<br>(Year) |
|--------------------|-----------------------------|-----------------------|---------------------------|
| 80,000             | 25,000                      | 10,000                | 12                        |

7. a) Explain the terms depreciation, corporate tax, personal income tax and book value. Show the depreciations and book values in each year for an equipment having following details using MACRS method. [2+4]

Investment (I) = 25,00,000

Useful life (n) = 7 years

- b) Perform after tax cash flow analysis to examine the feasibility of a project having investment of Rs 1,00,000 in a machine, with zero salvage value, 5 years useful life, net annual revenues of Rs 20,000 at the end of first year then after increases by Rs 10,000 pa. Use SL depreciation. Tax rate is 25%. [6]

8. Calculate the equivalent present worth of the project from the following cash flow. Assume inflation free interest rate as 5% and inflation as 10% respectively. [4]

| EOY | Cash flow in Actual \$ |
|-----|------------------------|
| 0   | -7,50,000              |
| 1   | 3,20,000               |
| 2   | 3,75,000               |
| 3   | 3,28,000               |
| 4   | 2,90,000               |
| 5   | 5,80,000               |

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| Exam.       | Back                       |            |        |
|-------------|----------------------------|------------|--------|
| Level       | BE                         | Full Marks | 80     |
| Programme   | BCE, BEL, BEX,<br>BCT, BGE | Pass Marks | 32     |
| Year / Part | III / II                   | Time       | 3 hrs. |

**Subject:** - Engineering Economics (CE655)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. State and explain principles of engineering economics. [4]

2. Define time value of money, nominal and effective interest rate. Calculate future sum at the end of 5<sup>th</sup> year when monthly deposit is Rs 6,000 for 3 years that earns 7% interest per year. [3+3]

3. a) Make investment decision for the following project by using (i) IRR (ii) B/C (iii) Discounted Payback methods. [4+4+4]

Initial cost = Rs. 4,00,000

Annual Revenue = Rs. 1,60,000 for the 1<sup>st</sup> year and decreases by Rs. 10,000 thereafter

Annual Expenses = Rs. 40,000 for the 1<sup>st</sup> year and increases by Rs. 5,000 thereafter

Salvage value = Rs. 1,00,000

Life year = 8

MARR = 9% per year

b) What do you mean by financial and economic analysis? Briefly explain the concept of lifecycle costing. [2+2]

4. a) Compare following two projects by IRR method when i = 10% per year. [4]

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

b) Select the best project by using repeatability assumption when MARR = 13% [4]

|           | Initial cost | Annual revenue | O and M | Life year | Salvage value |
|-----------|--------------|----------------|---------|-----------|---------------|
| Project X | 4,00,000     | 1,75,000       | 50,000  | 4         | 1,00,000      |
| Project Y | 7,00,000     | 2,50,000       | 70,000  | 6         | 1,50,000      |

c) Define independent and contingent projects. Find Present worth from annual cash flow series of Rs. 5,000 forever when i = 8% per year. [1+1+2]

5. What do you mean by replacement analysis and economic service life? What are the procedures for replacement when planning horizon is infinite and finite? Calculate AECs from the following information and determine economic service life. [2+2+2+6]

I = 18,000

N = 8 years

O and M = 3,000 for the 1<sup>st</sup> year and increases by 15% thereafter

S = Decline by 20% each successive year over than previous price

MARR = 12% per year

6. a) Explain the concept of scenario and decision tree analysis. If 20 watt CFL bulb price is Rs. 280 and 100 watt filament bulb price is Rs. 30 at market but their lighting power is equal. Which bulb do you prefer to use in your house when electricity cost is Rs. 12 per unit? [6]
- b) Perform sensitivity analysis for the following project over range of  $\pm 30\%$  in parameters; (i) Initial investment (ii) Annual revenue (iii) life year [6]

|                |              |
|----------------|--------------|
| Initial Cost   | Rs. 5,00,000 |
| Annual revenue | Rs. 1,20,000 |
| Salvage value  | Rs. 80,000   |
| Life year      | 6 year       |
| MARR           | 10% per year |

7. a) Define depreciation. What are the advantages of depreciation concept? Your college is considering purchase vehicle of Rs. 4,00,000 that assigned to 5 years useful life and expected salvage value is Rs. 1,00,000. Calculate depreciation for each year by using declining balance and MACRS. [1+2+3+3]
- b) What do you mean by tax, personal tax and corporate tax? Develop a model to calculate after tax cash flow. [1+1+1+2]
8. What is inflation? List out the impact of inflation. Calculate the rate of inflation when CPI moves from 100 to 250 over three years. [1+2+1]

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04 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2074 Bhadra

| Exam.       |                            | Regular    |        |
|-------------|----------------------------|------------|--------|
| Level       | BE                         | Full Marks | 80     |
| Programme   | BCE, BEL, BEX,<br>BCT, BGE | Pass Marks | 32     |
| Year / Part | III / II                   | Time       | 3 hrs. |

**Subject:** - Engineering Economics (CE655)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Define term Engineering economy. Explain principles of engineering economy. [1+3]
- a) If you make equal monthly deposits of Rs. 5000 into the bank for 10 years, saving accounts that pays interest rate of 6% compounded monthly, what would be the amount at the end of 15 years? [4]
- b) How much rupees should you deposit now so that you will be able to draw Rs.5000 at the end of this month which increases by 2 percent per month for 15 years. Bank interest rate is 5% per year. [4]
3. a) Explain any two drawbacks of IRR with example. Differentiate between Economic analysis and financial analysis. [3+3]
- b) Evaluate the project by using AW formulation of the project at  $i = 12\%$ . [4]

|           |       |     |      |      |      |      |
|-----------|-------|-----|------|------|------|------|
| EOY       | 0     | 1   | 2    | 3    | 4    | 5    |
| Cash flow | -3000 | 800 | 1000 | 1100 | 1210 | 1464 |

- c) Calculate the ERR of the following cash flow. MARR = 12%, reinvestment rate = 14%. [6]

|           |          |        |        |         |        |        |
|-----------|----------|--------|--------|---------|--------|--------|
| EOY       | 0        | 1      | 2      | 3       | 4      | 5      |
| Cash flow | -100,000 | 25,000 | 40,000 | -10,000 | 50,000 | 50,000 |

4. a) Choose the best project among these alternatives using IRR, if MARR = 15% and study period is 10 years. Salvage value is 20%. [6]

| Project            | A   | B    | C    | D'   |
|--------------------|-----|------|------|------|
| First Cost Rs.     | 900 | 1500 | 2500 | 4000 |
| Annual Revenue Rs. | 150 | 276  | 400  | 925  |

- b) Consider the following two mutually exclusive alternatives; recommend the best alternatives using repeatability assumptions. MARR = 15% [16]

|               | Project X (Rs.) | Project B (Rs.) |
|---------------|-----------------|-----------------|
| Initial Cost  | 100,000         | 150,000         |
| Annual Cost   | 25,000          | 12,000          |
| Salvage Value | 40000           | 50000           |
| Useful Life   | 6 years         | 10 years        |

5. Define defender and challenger and Explain economic service life. Company X is going to purchase a router having initial cost Rs.18,000 having salvage value of Rs.12000 at the end of first year and decreases by 20% each year then after for remaining useful life. Annual operation and maintenance cost is Rs. 5000 in first year and increases by Rs.2000 each year. Its useful life is 6 years. Calculate economic service life of the router. [2+2+8]
6. a) A project costs Rs. 125,000 with annual revenue of Rs.65,000 and annual cost of Rs.35,000. Salvage value will be 8% of the initial investment. Perform Sensitivity analysis using PW formulation over a range of  $\pm 40\%$  in i) Initial Investment ii) Annual Revenue iii) Useful Life and iv) MARR. Draw the sensitivity diagram and indicate the most sensitive and least sensitive parameters. [6+2]
- b) Define breakeven point and breakeven volume. How does interest rate change affect the project? [2+2]
7. a) Compute the annual depreciation allowances and the resulting book value using the double declining balance method with Switch over to straight line method.  
Cost of asset = Rs. 100,000, Useful life = 5 years, Salvage Value = 20000 [6]
- b) A company bought a machine at Rs 25000 which is expected to produce benefit of Rs 8000 per year for five years. Its salvage value at the end of five years is Rs 10000. Calculate after tax cashflow if Tax rate is 40% and depreciation is on Sinking fund method.  $I = 20\%$  [6]
8. Define inflation. Calculate IRR if MARR = 12% and inflation rate is 8%. [1+3]

| Year            | 0     | 1    | 2    | 3    | 4    |
|-----------------|-------|------|------|------|------|
| Constant Dollar | -6000 | 1500 | 2000 | 2500 | 3000 |

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| Exam.       |                            | Regular    |        |
|-------------|----------------------------|------------|--------|
| Level       | BE                         | Full Marks | 80     |
| Programme   | BCE, BEL, BEX,<br>BCT, BGE | Pass Marks | 32     |
| Year / Part | III / II                   | Time       | 3 hrs. |

**Subject:** - Engineering Economics (CE655)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Define Engineering Economics. Write down the principles of Engineering Economic Analysis. [4]
2. What is nominal and effective interest rate? Evaluate FW at the end of 10 years with 12% interest rate compounded monthly of a cash flow of Rs. 40,000 at the beginning of each year for 5 years. [2+4]
3. a) Use IRR method to evaluate following project when MARR is 15%. Make also unrecovered balance graph. [5]
 

|           |         |        |        |         |        |        |
|-----------|---------|--------|--------|---------|--------|--------|
| EOY       | 0       | 1      | 2      | 3       | 4      | 5      |
| Cash flow | -60,000 | 20,000 | 40,000 | -40,000 | 50,000 | 70,000 |
- b) Your college is considering to purchase a vehicle of Rs. 3,00,000 expecting salvage value Rs 50,000 at the end of 10<sup>th</sup> year. The use of vehicle saves Rs. 80,000 per year. When it needs Rs. 20,000 operating cost for each year. Find: (i) Both type of B/C ratio by FW formulation (ii) both types of payback period. [4+4]
- c) Distinguish between financial and economic analysis. [2]
4. a) Compare the following two mutually exclusive projects by using (i) Co-terminated (ii) Repeatability assumption taking MARR = 8% [4+4]

|                | Project A | Project B |
|----------------|-----------|-----------|
| Initial cost   | 1,50,000  | 2,00,000  |
| Annual revenue | 90,000    | 1,00,000  |
| Operating cost | 20,000    | 20,000    |
| Life year      | 4         | 6         |
| Salvage value  | 80,000    | 1,20,000  |

- b) Define mutually exclusive, contingent and independent projects with suitable example. [3]
5. What are the procedure for replacement analysis when planning horizon is infinite? [4+8]

Find economic service life from the following information.

Initial cost = Rs 50,000

Operation cost = Rs 10,000 for the 1<sup>st</sup> year and increases by 15% thereafter

Salvage value = Decline each successive year by 20% over previous year.

Useful life = 8 years

MARR = 15%

6. Explain about the decision tree analysis. Perform sensitivity analysis of the following project over range of  $\pm 30\%$  at an interval of  $\pm 10\%$  in (i) Initial Investment (ii) Net Annual Revenue and (iii) Useful life. Use PW formulation. [2+10]

|                         |          |
|-------------------------|----------|
| Initial Investment (Rs) | 1,00,000 |
| Net Annual Revenue (Rs) | 40,000   |
| Salvage Value (Rs)      | 15,000   |
| Useful life (years)     | 6        |
| MARR (%)                | 10       |

7. Write down the causes for depreciation of assets. If a machine costing of Rs. 1,00,000 is purchased by expecting salvage value of Rs 20,000 at the end of 6<sup>th</sup> years. Calculate the depreciation amount for each years by SOYD and straight line method. [2+5+5]
8. Define constant dollar and actual dollar amount. Suppose you borrowed Rs.1,20,000 from a bank to buy a bike and you have promised to pay Rs.6000 per month for two years. What is the inflation free interest rate you are supposed to pay if average inflation rate is 0.75% per month. [4+4]

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| Exam.       | Regular / Back        |            |        |
|-------------|-----------------------|------------|--------|
| Level       | BE                    | Full Marks | 80     |
| Programme   | BCE, BEL,<br>BEX, BCT | Pass Marks | 32     |
| Year / Part | III / II              | Time       | 3 hrs. |

**Subject:** - Engineering Economics (CE655)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Define Engineering Economics. Write down the principles of Engineering Economic Analysis. [4]
2. What is nominal and effective interest rate? Evaluate FW at the end of 15 years with 10% interest rate compounded monthly of a cash flow of Rs. 50,000 at the beginning of each year for first 10 years. [3+5]
3. Define IRR. Find IRR and ERR of the following project. MARR =  $\epsilon = 15\%$ . [2+6]

|           |     |     |    |    |    |
|-----------|-----|-----|----|----|----|
| Year      | 0   | 1   | 3  | 4  | 5  |
| Cash flow | -50 | -10 | 30 | 40 | 50 |

4

|                    |  | Machine A |
|--------------------|--|-----------|
| Initial Investment |  | Rs. 6000  |
| Annual Benefits    |  | Rs. 3000  |
| O & M Cost         |  | Rs. 1000  |
| Salvage Value      |  | Rs. 1500  |
| MARR               |  | 10%       |

- a) Evaluate both type of BCR (FW Formulation). Take Useful life = 10 years. [4]
- b) Evaluate both type of Payback Period. If Useful life = 5 years. (Take Standard payback period = 3 years) [4]
- c) Explain the factors affecting determination of MARR. [4]
5. a) Use Repeatability assumption to select the best project from the following three projects. [6]

| Project            | A      | B      | C      |
|--------------------|--------|--------|--------|
| Initial Investment | 100000 | 200000 | 250000 |
| Annual Expenditure | 25000  | 20000  | 15000  |
| Useful Life, Years | 3      | 5      | 7      |
| Salvage Value      | 40000  | 50000  | 60000  |
| MARR               | 14%    |        |        |

- b) Explain about the Sunk Cost, Economic life and reasons for replacement of an asset. The Annual Equivalent Cost of defender and challenger are given in the table below. What is the best replacement strategy? Use MARR = 10%. The planning horizon of the project is 8 years. [8+4]

| End of year (n)    | 1    | 2    | 3    | 4    | 5    | 6    |
|--------------------|------|------|------|------|------|------|
| (AEC) <sub>D</sub> | 5400 | 5200 | 5500 | 5700 | 6200 | 6600 |
| (AEC) <sub>C</sub> | 7700 | 6200 | 5700 | 5600 | 5680 | 5900 |

6. a) For the improvement of a manufacturing plant, following three alternatives are being considered. The estimated investments and the corresponding increment in income are also given as below. Draw decision tree diagram of the situation and decide on the best alternative using FW formulation. MARR = 15%. Life of the Project is 6 years. [6]

| Alternatives | Investment Cost | Sales          |                   |        | Annual Income |
|--------------|-----------------|----------------|-------------------|--------|---------------|
| A            | 1000000         | High Success   | Probability = 0.4 | 500000 |               |
|              |                 | Medium Success | Probability = 0.5 | 300000 |               |
|              |                 | Low Success    | Probability = 0.1 | 125500 |               |
| B            | 600000          | High Success   | Probability = 0.2 | 400000 |               |
|              |                 | Medium Success | Probability = 0.5 | 250000 |               |
|              |                 | Low Success    | Probability = 0.3 | 100000 |               |
| C            | 400000          | High Success   | Probability = 0.5 | 200000 |               |
|              |                 | Medium Success | Probability = 0.1 | 125000 |               |
|              |                 | Low Success    | Probability = 0.4 | 50000  |               |

- b) Perform sensitivity analysis of the following project over a range of 10 to 50 percent in (i) initial investment and (ii) MARR using PW formulation. Assume  $S_v = 0$ . Draw sensitivity diagram also.  $Rs\ 100000$ ,  $Income = Rs\ 40000$ ,  $Life = 10\ years$  [6]
7. What do you mean by depreciation? Explain about the causes of it. Explain about any three methods of depreciation calculation that are used commonly. A machine purchased for Rs. 60,000 by expecting useful life of 10 years. Calculate the depreciation amount for each year by using deciding balance method when rate of depreciation is 20% per year. [6+6]
8. Define Constant dollar amount and Actual dollar amount. Suppose you borrowed Rs. 100000 from a bank to buy a bike and you have promised to pay Rs. 5500 per month for two years. What is the inflation free interest rate you are supposed to pay if average inflation rate is 0.75% per month? [2+4]

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04 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2070 Bhadra

| Exam.       |                                    | Regular    |        |
|-------------|------------------------------------|------------|--------|
| Level       | BE                                 | Full Marks | 80     |
| Programme   | BCE, BEL,<br>BEX, BCT,<br>B.Agric. | Pass Marks | 32     |
| Year / Part | III / II                           | Time       | 3 hrs. |

**Subject:** - Engineering Economics (CE655)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Scarcity is an emerging issue in engineering field. How does the study of economics help to engineers in decision making process? Discuss. [5]
2. What is effective and nominal interest rate? Evaluate FW at the end of 10 years with 8% interest rate compounded continuously of a cash flow of Rs. 500 at the beginning of each year for first 5 years. [2+4]
3. Initial Investment = Rs. 100,000  
Salvage Value = 0  
Annual O&M Cost = Rs. 20,000  
Useful Life = 5 years  
Annual Benefit = 60,000 at the end of first year, thereafter decreases by 4,000 each year for the remaining years.  
  - a) Draw U/B diagram.
  - b) Evaluate conventional BCR using PW formulation. Take salvage value = 10,000.
  - c) Evaluate Discounted Payback Period. Take standard (cut off) Payback Period = 3 years.
4. Use IRR method to select best project. MARR = 12%. [8+4]

|                    | 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 |
| MARR               | 15%  |      |      |      |

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

5. Explain about the reasons for replacement of asset. The Annual Equivalent Cost (AEC) of the defender and challenger are given in the table below. What is the best replacement strategy? Use MARR = 12%. The planning horizon of the project is 8 years. [4+8]

| End of Year (n)    | 1    | 2    | 3    | 4    | 5    | 6    |
|--------------------|------|------|------|------|------|------|
| (AEC) <sub>D</sub> | 5300 | 5250 | 5400 | 5750 | 6200 | 6550 |
| (AEC) <sub>C</sub> | 7700 | 6150 | 5700 | 5600 | 5675 | 5800 |

6. What are the sources of risk in engineering projects in Nepal? A real-state developer seeks to determine the most economical height for a new office building which will be sold after five years. The relevant net annual revenues and net resale values are as given below. [4+8]

|                  | Height      |             |
|------------------|-------------|-------------|
|                  | 4 Floors    | 5 Floors    |
| First Cost       | 125,000,000 | 200,000,000 |
| Annual Revenues  | 19,910,000  | 37,815,000  |
| Net Resale Value | 200,000,000 | 300,000,000 |

The developer is uncertain about the interest rate  $i$  to use, but is certain that it is in the range of 5 to 30%. For each building height, find the range of values of  $i$  for which that building height is the most economical. Draw sensitivity diagram to support your answer.

7. An asset has installed value of 45,000.  $S_s = 0$ . It is classed as a 5 year property. Determine approximate MACRS depreciation schedule. Over 6 years it is estimated to generate revenue of Rs. 23,000 per year with annual operating cost 7300. Required rate of return = 15% after tax. Tax rate = 40%. Evaluate after tax IRR with annual worth method. [6+6]
8. The annual fuel cost required to operate a small solid waste treatment plant are projected to be Rs. 200000 without considering any future inflation. The best estimate indicates that the annual inflation free interest rate  $I'$  will be 6% and the general inflation rate,  $f$ , will be 5%. If the plant has the remaining useful life of four years, what is the present equivalent of its fuel costs? Use actual dollar analysis. [5]

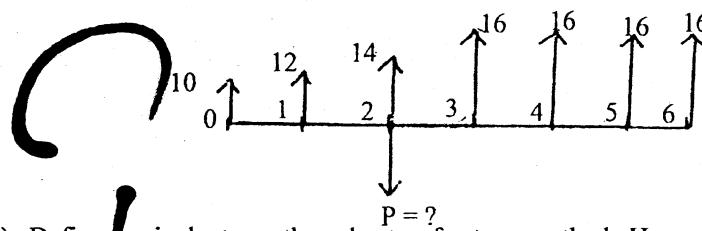
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| Exam.       | New Back (2066 & Later Batch) |            |        |
|-------------|-------------------------------|------------|--------|
| Level       | BE                            | Full Marks | 80     |
| Programme   | BCE, BEL, BEX,<br>BCT         | Pass Marks | 32     |
| Year / Part | III / II                      | Time       | 3 hrs. |

**Subject:** - Engineering Economics (CE655)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Explain the roles of engineers in making economic decision with appropriate examples. [4]
2. a) If you deposit Rs.10000 in a saving account now which gives 10% nominal interest rate, what will be the amount after 5 years if interest is compounded (i) semi-annually [2]  
(ii) Monthly
- b) Find the value of P if  $i=10\%$ . Use gradient formula also. [4]



3. a) Define equivalent worth and rate of return method. How much rupees should you deposit now in a bank account that gives 8% interest per year if you wish to draw Rs.10,000 per month for 10 years? [2+4]
- b) What is the difference between financial and economic analysis? Determine both type of B/C ratio from the following cashflow.  
Initial investment = 3,00,000  
Annual revenue = 85,000  
Annual costs = 15,000  
Salvage value = 20% of initial investment  
Useful life = 6 years  
MARR = 10%
- c) Compute IRR by using trial and error process of the following project. Determine also investment decision. [4]  
Initial investment = 25,000  
Annual revenue = 8,000  
Salvage value = 5,000  
Useful life = 5 years  
MARR = 20%
4. a) Select the best proposal using ERR ( $\epsilon=25\%$ , MARR=20%) [4]

| EOY        | 0     | 1    | 2    | 3    | 4    | 5    | 6    |
|------------|-------|------|------|------|------|------|------|
| Proposal A | -6400 | 2620 | 2900 | 3020 | 3100 | 3100 | 2600 |
| Proposal B | -7550 | 2050 | 4060 | 4000 | 3900 | 3900 | 3400 |

- b) State and explain about the cases of mutually exclusive, contingent and independent projects with example. Compare the following projects by using repeatability assumption when MARR is 12% [4+4]

| Project            | A        | B        |
|--------------------|----------|----------|
| Initial investment | 2,00,000 | 3,00,000 |
| Annual revenue     | 25,000   | 30,000   |
| Annual costs       | 7,000    | 9,000    |
| Useful life year   | 6        | 8        |
| Salvage value      | 10,000   | 20,000   |

5. The new machine costs 10,000 operating cost 2200 in first year, then increases by 20% per year. Market value is 6000 after one year and will decline by 15% each year N = 5 years. If required, old machine can work another 3 years. Market value now is 5000 and will decline by 25% each year. Immediate overhauling to restore to operable condition costs 1200. Operating costs 2000 in the first year increases by 1500 per year thereafter. MARR = 15%

[8+4]

- i) Find the economic service life of this machine (new)  
ii) AEC of defender is as follows:

(AEC)

| N   | 1    | 2    | 3    | 4    |
|-----|------|------|------|------|
| AEC | 5380 | 5203 | 5468 | 5845 |

When should the old machine be replaced with the new machine.

6. a) Explain decision free Analysis:

[4]

- b) Calculate break-even hours of operation per year to become cost equal and recommended economic pump if it is to be operated 5 hours daily at full load.

[8]

|                                 | KHASA Pump                     | SARVO Pump |
|---------------------------------|--------------------------------|------------|
| Capacity                        | 100 hp                         | 100 hp     |
| Purchase cost (Rs.)             | 5,00,000                       | 10,00,000  |
| Tax per year (Rs.)              | 10,000                         | 15,000     |
| Maintenance cost per year (Rs.) | 36,500                         | 29,200     |
| Efficiency                      | 80%                            | 90%        |
| Life year                       | 5                              | 5          |
| Salvage value                   | 20 % of purchase cost for both |            |
| MARR                            | 20% per year                   |            |
| Electricity cost                | Rs. 10/kwhr                    |            |

7. a) Define depreciation. What are the causes for it? If a machine costing of Rs. 1,50,000 is purchased by expecting salvage value Rs.40,000 at the end of 6<sup>th</sup> year. Calculate depreciation amount for each years by

[2+5]

- i) SOYD  
ii) Declining balance

- b) Suppose an equipment purchased for Rs.10,00,000. It is expected to generate income of Rs. 3,50,000 per year during 5 years and corporate income tax rate is 25% per year. Under the recovery periods depreciation are as follows.

[6]

| Year                | 1        | 2        | 3        | 4        | 5        |
|---------------------|----------|----------|----------|----------|----------|
| Depreciation amount | 1,00,000 | 2,00,000 | 2,00,000 | 2,00,000 | 1,00,000 |

Calculate ATCFs and determine profitability (IRR) when MARR is 15% by using PW method.

8. Evaluate the PW of the following project:

[5]

Initial investment = Rs. 1,00,000 → in constant dollars

Annual sales income = Rs. 40,000 → in constant dollars

Annual labour cost = Rs. 3,000 → in constant dollars

Annual material X = Rs. 2,000 → in constant dollars

Annual material Y = Rs. 1,000 → in constant dollars

Salvage Value = 20% of initial investment - in constant dollars

Inflation rate for sales income, labour cost, materials X, material Y and salvage value are 5%, 8%, 0%, 6% and 3% respectively for the project period. Take market interest rate = 20% project life is 4 years.

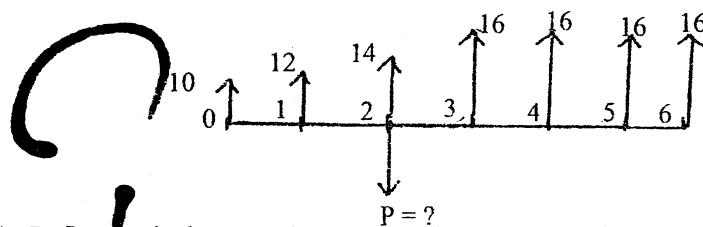
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| Exam.       | New Back (2066 & Later Batch) |            |        |
|-------------|-------------------------------|------------|--------|
| Level       | BE                            | Full Marks | 80     |
| Programme   | BCE, BEL, BEX,<br>BCT         | Pass Marks | 32     |
| Year / Part | III / II                      | Time       | 3 hrs. |

**Subject:** - Engineering Economics (CE655)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Explain the roles of engineers in making economic decision with appropriate examples. [4]
2. a) If you deposit Rs.10000 in a saving account now which gives 10% nominal interest rate, what will be the amount after 5 years if interest is compounded (i) semi-annually [2]  
(ii) Monthly
- b) Find the value of P if  $i=10\%$ . Use gradient formula also. [4]



3. a) Define equivalent worth and rate of return method. How much rupees should you deposit now in a bank account that gives 8% interest per year if you wish to draw Rs.10,000 per month for 10 years? [2+4]
- b) What is the difference between financial and economic analysis? Determine both type of B/C ratio from the following cashflow. [2+4]
 

Initial investment = 3,00,000  
Annual revenue = 85,000  
Annual costs = 15,000  
Salvage value = 20% of initial investment  
Useful life = 6 years  
MARR = 10%
- c) Compute IRR by using trial and error process of the following project. Determine also investment decision. [4]
 

Initial investment = 25,000  
Annual revenue = 8,000  
Savage value = 5,000  
Useful life = 5 years  
MARR = 20%

4. a) Select the best proposal using ERR ( $\epsilon=25\%$ , MARR=20%) [4]

| EOY        | 0     | 1    | 2    | 3    | 4    | 5    | 6    |
|------------|-------|------|------|------|------|------|------|
| Proposal A | -6400 | 2620 | 2900 | 3020 | 3100 | 3100 | 2600 |
| Proposal B | -7550 | 2050 | 4060 | 4000 | 3900 | 3900 | 3400 |

- b) State and explain about the cases of mutually exclusive, contingent and independent projects with example. Compare the following projects by using repeatability assumption when MARR is 12% [4+4]

| Project            | A        | B        |
|--------------------|----------|----------|
| Initial investment | 2,00,000 | 3,00,000 |
| Annual revenue     | 25,000   | 30,000   |
| Annual costs       | 7,000    | 9,000    |
| Useful life year   | 6        | 8        |
| Salvage value      | 10,000   | 20,000   |

5. The new machine costs 10,000 operating cost 2200 in first year, then increases by 20% per year. Market value is 6000 after one year and will decline by 15% each year  $N = 5$  years. If required, old machine can work another 3 years. Market value now is 5000 and will decline by 25% each year. Immediate overhauling to restore to operable condition costs 1200. Operating costs 2000 in the first year increases by 1500 per year thereafter. MARR = 15%

[8+4]

- i) Find the economic service life of this machine (new)
- ii) AEC of defender is as follows:

(AEC)

| N   | 1    | 2    | 3    | 4    |
|-----|------|------|------|------|
| AEC | 5380 | 5203 | 5468 | 5845 |

When should the old machine be replaced with the new machine.

6. a) Explain decision free Analysis:

[4]

- b) Calculate break-even hours of operation per year to become cost equal and recommended economic pump if it is to be operated 5 hours daily at full load.

[8]

|                                 | KHASA Pump                     | SARVO Pump |
|---------------------------------|--------------------------------|------------|
| Capacity                        | 100 hp                         | 100 hp     |
| Purchase cost (Rs.)             | 5,00,000                       | 10,00,000  |
| Tax per year (Rs.)              | 10,000                         | 15,000     |
| Maintenance cost per year (Rs.) | 36,500                         | 29,200     |
| Efficiency                      | 80%                            | 90%        |
| Life year                       | 5                              | 5          |
| Salvage value                   | 20 % of purchase cost for both |            |
| MARR                            | 20% per year                   |            |
| Electricity cost                | Rs. 10/kwhr                    |            |

7. a) Define depreciation. What are the causes for it? If a machine costing of Rs. 1,50,000 is purchased by expecting salvage value Rs.40,000 at the end of 6<sup>th</sup> year. Calculate depreciation amount for each years by

[2+5]

- i) SOYD
- ii) Declining balance

- b) Suppose an equipment purchased for Rs.10,00,000. It is expected to generate income of Rs. 3,50,000 per year during 5 years and corporate income tax rate is 25% per year. Under the recovery periods depreciation are as follows.

[6]

| Year                | 1        | 2        | 3        | 4        | 5        |
|---------------------|----------|----------|----------|----------|----------|
| Depreciation amount | 1,00,000 | 2,00,000 | 2,00,000 | 2,00,000 | 1,00,000 |

Calculate ATCFs and determine profitability (IRR) when MARR is 15% by using PW method.

8. Evaluate the PW of the following project:

[5]

Initial investment = Rs. 1,00,000 → in constant dollars

Annual sales income = Rs. 40,000 → in constant dollars

Annual labour cost = Rs. 3,000 → in constant dollars

Annual material X = Rs. 2,000 → in constant dollars

Annual material Y = Rs. 1,000 → in constant dollars

Salvage Value = 20% of initial investment - in constant dollars

Inflation rate for sales income, labour cost, materials X, material Y and salvage value are 5%, 8%, 0%, 6% and 3% respectively for the project period. Take market interest rate = 20% project life is 4 years.

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03 \* TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**

2069 Poush

| Exam. New Back (2066 & Later Batch) |                         |            |        |
|-------------------------------------|-------------------------|------------|--------|
| Level                               | BE                      | Full Marks | 80     |
| Programme                           | BCE,<br>BEL,BEX<br>BCT. | Pass Marks | 32     |
| Year / Part                         | III / II                | Time       | 3 hrs. |

**Subject:** - Engineering Economics (CE655)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt any Five questions.
- ✓ All questions carry equal marks.
- ✓ Assume suitable data if necessary.

1. a) What are the principles of engineering economics? How does it help to decision making process?  
b) Differentiate between simple interest and compound interest. How many deposits of Rs.50, 000 each should make per month so that the future amount will be Rs. 20, 00,000 if the bank interest rate is 10% per year?
2. a) 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%.  
b) Use IRR method to evaluate following project when MARR is 20%.

| End of year | cash flow |
|-------------|-----------|
| 0           | -60,000   |
| 1           | 20,000    |
| 2           | 40,000    |
| 3           | 50,000    |
| 4           | 50,000    |
| 5           | 70,000    |

3. a) Determine both types of B/C ratio by using FW formulation:

|                          |  |
|--------------------------|--|
| 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  |
| MARR                     | 15%  |

- b) Recommend the best project from the following information by using repeatability assumption when MARR is 12%.

| Project                 | A        | B        |
|-------------------------|----------|----------|
| Initial investment(Rs.) | 4,00,000 | 7,00,000 |
| Annual revenue(Rs.)     | 1,75,000 | 2,50,000 |
| Annual cost (Rs.)       | 25,000   | 35,000   |
| Salvage value (Rs.)     | 40,000   | 70,000   |
| Useful life(year)       | 6        | 8        |

4. a) What do you mean by replacement analysis? Determine the choice between defender and challenger with following information from AEC approach when useful life is 5 years and MARR is 10%.

| Item                    | Defender  | Challenger |
|-------------------------|-----------|------------|
| Initial investment(Rs.) | 25,00,000 | 35,00,000  |
| Annual cost(Rs.)        | 10,00,000 | 7,50,000   |
| Salvage value(Rs.)      | 5,00,000  | 12,00,000  |

- b) Define economic service life of an asset. From the following information find the economic service life of an asset.

|                                |  |
|--------------------------------|--|
| Initial investment(Rs.)        | 50,000   |
| Annual operating cost<br>(Rs.) | 10,000 for the first year and increasing by 15% over the previous year |
| Salvage value(Rs.)             | Declining each year by 20% from the previous year's salvage value      |
| Useful life (year)             | 7  |
| MARR                           | 15%  |

5. a) Perform sensitivity analysis of the following project over a range of  $\pm 30\%$  in i) initial investment ii) net annual revenue iii) useful life year. Draw also sensitivity diagram.

|                         |          |
|-------------------------|----------|
| Initial investment(Rs.) | 5,00,000 |
| Net annual revenue(Rs.) | 1,20,000 |
| Salvage value(Rs.)      | 80,000   |
| Useful life(year)       | 6        |
| MARR                    | 10%      |

- b) If the cost of 25 watt CFL bulb is Rs.260 whereas the cost of 100 watt Filament bulb is Rs.35 but these bulbs have equal lighting power. Which bulb do you prefer in your use and why? When electricity cost is Rs.11 per unit (kw-hr).

6. a) What do you mean by depreciation and what are its causes? A machine purchased for Rs. 50,000 by expecting useful life of 10 years. Calculate its depreciation amount for each year by using declining balance method when rate of depreciation is 20% per year.

- b) Write short notes on  
 i) MACRS for depreciation  
 ii) Inflation and CPI  
 iii) Market interest rate and inflation free interest rate.

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03 TRIBHUVAN UNIVERSITY  
 INSTITUTE OF ENGINEERING  
**Examination Control Division.**  
 2069 Bhadra

| Exam.       | Regular (2066 & Later Batch) |            |        |
|-------------|------------------------------|------------|--------|
| Level       | BE                           | Full Marks | 80     |
| Programme   | BCE, BEL,<br>BEX, BCT        | Pass Marks | 32     |
| Year / Part | III / II                     | Time       | 3 hrs. |

**Subject:** - Engineering Economics (CE655)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Define engineering economy. Enlist the principles of engineering economy. [1+3]

2. Ramesh, a Civil Engineer is planning to place a total of 20% of his salary, which is Rs. 250000. per year now, each year in mutual fund. He expects 7% salary increase each year for next 15 years. If the mutual fund will average 10% annual return, what will be the sum-amount at the end of 15 years? If salary increases by Rs 25000 per year. What will be the amount? [4+4]

3. a) From the following cashflow [4]

| EOY       | 0     | 1   | 2    | 3    | 4    | 5    |
|-----------|-------|-----|------|------|------|------|
| Cash flow | -3000 | 800 | 1000 | 1100 | 1210 | 1464 |

Calculate both type of payback period. MARR = 10%.

b) Equipment costs 2,50,000 and has salvage value of 50,000 at the end of its expected life 5 years. Annual expenses will be 40,000. It will produce a revenue of 120,000 per year. MARR = 20%. =  $\epsilon$  [4+4+4]

- Evaluate IRR using AW formulation.
- Evaluate both type of B/C ratio with FW formulation.
- Find ERR.

4. From the following information select the best project.

|   | Project A | Project B |
|---|-----------|-----------|
| Initial Investment                      | 35,000    | 50,000    |
| Annual Revenue                          | 16,450    | 25,000    |
| Annual costs                            | 3,000     | 13,830    |
| Useful life                             | 4 years   | 8 years   |
| Salvage value at the end of useful life | 0         | 0         |

MARR = 10%

When service period required is:

- 4 years by FW method
- 8 years by IRR method with PW formulation

[4]

[8]

5. What is the economic service life of an asset? Find the economic service life of a new electric lift truck which costs \$ 20,000, have a operating cost of \$1000 in the first year and have salvage value of \$12,000 at the end of the first year. For the remaining years,

operating costs increase each year by 10% over the previous years operating costs. Similarly the salvage value declines each year by 20% from the previous years salvage value. The lift truck has a maximum life of 7 years. An overhaul costing of \$3000 and \$5000 will be required during the fifth and seventh year of service respectively. The firm's required rate of return is 15% per year.

**OR**

A firm has a contract to provide printing service to IOE for next 8 years. It can provide the service using its old printing machine (the current defender) or the newly bought machine (the challenger). After the contract work neither the old machine nor the new machine will be retained. Considering the annual equivalent costs of the old machine and new machine as follows, what are their economic service life? And what is the best replacement strategy?

[2+10]

| Number of years (n) | Annual equivalent cost (Rs) |             |
|---------------------|-----------------------------|-------------|
|                     | Old machine                 | New machine |
| 1                   | 515,000                     | 750,000     |
| 2                   | 510,000                     | 615,000     |
| 3                   | 550,000                     | 586,000     |
| 4                   | 596,000                     | 583,000     |
| 5                   | 644,000                     | 590,000     |

6. a) Calculate breakeven volume of a cable manufacturing company from the following data: Total cost = Rs. 1,200,000; Variable cost = Rs. 400,000 Income from sales = 15,00,000. at production of 5000 unit.

[4]

- b) A proposal is described by the following estimates: P = \$20000, S = 0, N = 5 and net annual receipts = \$7000. A rate of return of 20 percent is desired on such proposals. Construct a sensitivity graph of the life, annual receipts, and rate of return for deviations over a range of  $\pm 20$  percent. To which element is the decision most sensitive?

[8]

7. a) Define depreciation and list out important methods of calculating depreciation deductions.

[4]

- b) A machine costs Rs 15000. Its useful life is 5 years and salvage value is Rs 900. Compute the annual depreciation allowances and resulting book values using double declining balance depreciation methods.

[8]

8. a) Define inflation. List out its effects. If the inflation rate is 5% per year and the market interest rate is 13% per year. What is the implied interest (inflation free) rate in inflationary economy?

[1+1+2]

**OR**

A series of five constant dollar (or real dollar) income (beginning with \$5000 at the end of the first year) are increasing at the rate of 7% per year for five years. Inflation free interest rate is 5% and inflation is 8%. Is it feasible investment if investment cost is \$20,000?

[4]

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**Examination Control Division**

2068 Bhadra

| Exam.       | Regular / Back       |            |        |
|-------------|----------------------|------------|--------|
| Level       | BE                   | Full Marks | 80     |
| Programme   | BCE, BEL<br>BEX, BCT | Pass Marks | 32     |
| Year / Part | III / II             | Time       | 3 hrs. |

**Subject:** - Engineering Economics

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt any **Five** questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

1. a) "Engineers play the important role in making the economic decision". Do you agree with this statement? Discuss. [6]

- b) The information given below shows the records of a manufacturing company comparing the actual data with the data from the standard cost card. Calculate all the variances. Also indicate the favorable and adverse variances. [10]

|          | Production<br>(Units) | Direct<br>Material<br>(Kg.) | Direct<br>Material<br>cost (Rs.) | Working<br>Days | Fixed<br>Overheads<br>(Rs.) | Variable<br>overheads<br>(Rs.) |
|----------|-----------------------|-----------------------------|----------------------------------|-----------------|-----------------------------|--------------------------------|
| Standard | 10                    | 50                          | 10000                            | 12              | 5000                        | 25000                          |
| Actual   | 8                     | 45                          | 9000                             | 10              | 6000                        | 20000                          |

2. a) Mr. Kumar has inspected his yearly household expenses for the last 10 years. Cost averages were steady at Rs 100000 per year for the first 5 years, but have increased consistently by Rs 15000 per year for each of the last 5 years. Calculate total present worth in year zero. Use gradient formula. [8]

- b) Use discounted payback period method to select the best option: [8]

|          | Initial Investment | Annual Income | Useful Life | Salvage Value |
|----------|--------------------|---------------|-------------|---------------|
| Option A | Rs. 1000000        | Rs 15000      | 10 yrs      | Rs 20000      |
| Option B | Rs 150000          | Rs 20000      | 12 yrs      | Rs 40000      |

3. a) 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]

| End of Year | Net Cash flow in RS. |
|-------------|----------------------|
| 0           | -20000               |
| 1           | +8000                |
| 2           | +17000               |
| 3           | +19000               |
| 4           | +18000               |
| 5           | -10000               |

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

|                      | X      | Y      | Z       |
|----------------------|--------|--------|---------|
| First cost, Rs.      | 70,000 | 60,000 | 100,000 |
| Annual income, Rs.   | 15000  | 10000  | 18000   |
| Economic life, years | 8      | 8      | 8       |

4. a) The total purchase price of a three room set furniture is Rs. 50000. However after a down payment of Rs 10000, two year series end of month payment of 2200 will have to be made. Determine the nominal and effective interest rate. [3+3]

- b) Find the acceptability of a project using both types of B/C ration. (Use AW method) [10]

|                                 |  |
|---------------------------------|--|
| Initial investment = Rs. 180000 | Annual Benefits = 53000 at the end of first year and decreases by Rs. 2000 each year |
| Annual Expenses = Rs. 16000     | Salvage value = Rs. 40000  |
| Useful life = 10 years          | MARR = 10%   |

5. a) Select the best project from the following two projects. (Use Repeatability and PW method). [8]

|                      | Project A | Project B |
|----------------------|-----------|-----------|
| Initial Cost (Rs)    | 150000    | 180000    |
| Annual Expenses (Rs) | 35000     | 31000     |
| Annual Revenues (Rs) | 8500      | 10500     |
| Salvage Value (Rs)   | 50000     | 80000     |
| Useful Life          | 6 years   | 9 years   |
| MARR                 | 15%       |           |

- b) Two types of power converters, alpha and beta are under consideration for a specific application. An economic comparison 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]

|                               | Alpha  | Beta    |
|-------------------------------|--------|---------|
| Purchase price Rs             | 750000 | 2000000 |
| Annual operating cost, Rs.    | 200000 | 100000  |
| Estimated service life, years | 5      | 9       |
| Salvage value, Rs.            | 0      | 400000  |

6. a) Following table shows the demand of meat when the price is shown in Rs. Make the hypothesized regression equation and find the consumption if the price is set to be Rs. 35 per kg. [6]

| SN | Price of meat per kg | Consumption in kg |
|----|----------------------|-------------------|
| 1  | 25                   | 80                |
| 2  | 38                   | 70                |
| 3  | 28                   | 78                |
| 4  | 30                   | 73                |
| 5  | 27                   | 78                |
| 6  | 40                   | 68                |
| 7  | 42                   | 65                |
| 8  | 32                   | 74                |

- b) The purchase of a rental property is being considered in a neighborhood where real estate prices are increasing rapidly. The following estimates have been developed for a preliminary before-tax analysis: [10]

| First cost, Rs | Annual income from rent, Rs. | Annual Maintenance, Rs. | Investment Period | Resale value | MARR |
|----------------|------------------------------|-------------------------|-------------------|--------------|------|
| 140000         | 30000                        | 7500                    | 6 yrs             | 1,50,000     | 10%  |

Construct sensitivity chart for joint variation within a  $\pm 30\%$  range of annual income and MARR. Indicate the acceptance and rejection zones.

7. Write short notes on: (any four) [4x4]

- a) Drawbacks of IRR method
- b) Capital recovery cost
- c) Decision tree analysis
- d) Declining balance method of depreciation
- e) Methods of demand analysis

| Exam.       | Back                  |            |       |
|-------------|-----------------------|------------|-------|
| Level       | BE                    | Full Marks | 80    |
| Programme   | BCE, BEL,<br>BEX, BCT | Pass Marks | 32    |
| Year / Part | III / II              | Time       | 3 hrs |

**Subject:** - Engineering Economics

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt any **Five** questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

1. a) Differentiate between nominal and effective interest? Calculate both nominal and effective annual interest if you deposit now, Rs 1,00,000 and you can draw Rs 1000 per month for ever. [6]

b) 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]

2. a) Explain decision tree analysis. [6]

b) Select the best project using IRR method. Useful life of all projects are 15 years. MARR = 10%. [10]

| Particulars        | Project A | Project B | Project C |
|--------------------|-----------|-----------|-----------|
| Initial investment | 7500,000  | 5500,000  | 4000,000  |
| Annual revenue     | 960,000   | 720,000   | 600,000   |
| Salvage value      | 7500,000  | 5500,000  | 4000,000  |

3. a) What are the drawbacks of IRR method? How does ERR method eliminates some of these drawbacks. [6]

b) Perform cost variance analysis. [10]

|                              | Standard (Rs) | Actual (Rs) |
|------------------------------|---------------|-------------|
| Production (Units)           | 9,000         | 8,000       |
| Direct Labour (Hours)        | 72,000        | 60,000      |
| Direct Labour cost (Rs.)     | 756,000       | 600,000     |
| Fixed overhead cost (Rs.)    | 900,000       | 810,000     |
| Variable overhead cost (Rs.) | 684,000       | 630,000     |

4. a) Explain the methods for assessing risk/uncertainty. [6]

b) Perform sensitivity analysis over a range of  $\pm 30\%$  in (i) initial investment (ii) annual net revenue (iii) useful life. [10]

|                                  |                            |
|----------------------------------|----------------------------|
| Initial Investment = Rs. 100,000 | Salvage value = Rs 10,000  |
| Annual benefits = Rs 25,000      | Annual expenses = Rs 3,000 |
| Useful life = 10 years           | MARR = 10%                 |

Draw sensitivity diagram and interpret the result.

5. a) Evaluate the modified B/C ratio for the problem in Q 4(b). [6]  
 b) Select the best project. Required study period is 5 years. [10]

|                          | Project P | Project Q |
|--------------------------|-----------|-----------|
| Initial Investment(Rs.)  | 5,00,000  | 3,50,000  |
| Annual net revenue (Rs.) | 2,00,000  | 1,75,000  |
| Salvage value(Rs.)       | 50,000    | 35,000    |
| Useful life (Years)      | 6         | 5         |
| MARR                     | 10%       | 10%       |

6. a) Define engineering economics. Explain capitalistic OR Socialistic economy. [6]  
 b) Evaluate ERR. MARR = 10% E=8% [8]

| EOY          | 0        | 1       | 2       | 3        | 4        | 5        |
|--------------|----------|---------|---------|----------|----------|----------|
| Cash inflow  | -        | +40,000 | +150,00 | +120,000 | +800,000 | +200,000 |
| Cash outflow | -480,000 | -80,000 | -50,000 | -500,000 | -200,000 | -400,000 |

- c) What are the elements of cost? [2]
7. Write short notes: (*any 4*) [4x4]
- a) Sources of uncertainty
  - b) Market research
  - c) Continuous compounding
  - d) Job and process costing
  - e) Statistic approach to demand analysis

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| Exam.       | Regular / Back        |            |        |
|-------------|-----------------------|------------|--------|
| Level       | BE                    | Full Marks | 80     |
| Programme   | BCE, BEL,<br>BEX, BCT | Pass Marks | 32     |
| Year / Part | III / II              | Time       | 3 hrs. |

*Subject* - Engineering Economics

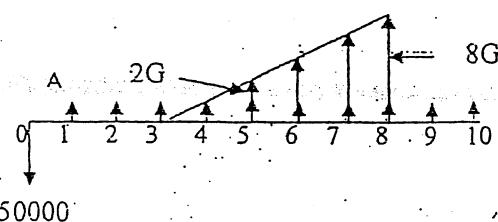
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt any Five questions.
- ✓ The figures in the margin indicate Full Marks.
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1. a) Define economic system. Write advantages of socialistic economy. [1+3]
- b) Explain overhead cost and opportunity cost. [4]
- c) The following information has been obtained from the records of a manufacturing company using standard costing system. [8]

|                                 | Estimated   | Actual      |
|---------------------------------|-------------|-------------|
| Production Units                | ~ 1,500     | 600         |
| Cement (bags)                   | 5           | 3,600       |
| Cement Cost (Rs.)               | 3,500       | 216,000     |
| Skilled Labour (mason) Days     | 2           | 900         |
| Skilled Labour (mason) Cost Rs. | 300 per day | 325 per day |
| Fixed Overhead (Rs)             | 10,000      | 15,000      |

Find all the variances (Including all its components)

2. a) Mr. Basnet purchases a car which cost Rs. 20,00,000. He pays 40% as down payment. Remaining amount will be paid on installment basis and wishes to pay Rs. 25,000 per month for next five years. What annual interest rate will he be paying? At the end of 3rd year, what lump sum amount should he pay to clear all his dues? [4+4]
- b) Find the value of A and G if  $i = 10\%$ .  $A = 3G$  [8]



3. a) Describe any two drawbacks of IRR. [4]
- b) Use ERR method to evaluate the project with following cash flow. MARR =  $\epsilon = 10\%$ . [6]

| Year      | 1 <sup>st</sup> | 2 <sup>nd</sup> | 3 <sup>rd</sup> | 4 <sup>th</sup> | 5 <sup>th</sup> | 6 <sup>th</sup> |
|-----------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Cash flow | -8,00,000       | 2,00,000        | 2,00,000        | -50,000         | 4,00,000        | 4,00,000        |

- c) A preliminary estimate of a multipurpose hydropower project produced the following data. [6]

| Initial Investment | Annual Power sales | Annual irrigation benefit | Annual recreational benefit | Annual operation and maintenance | Life of the project | Salvage value |
|--------------------|--------------------|---------------------------|-----------------------------|----------------------------------|---------------------|---------------|
| Rs. 50 crore       | Rs. 8 crore        | Rs. 1 crore               | Rs. 2 Crore                 | Rs. 1.5 crore                    | 50 yrs              | Rs. 40 crore  |

Give your suggestion to the government about the implementation of the project.  
Take MARR = 8%.

4. a) Recommend which one is best out of the following three mutually exclusive projects.  
Study period is 10 years. MARR = 12%. [8]

| Project            | A        | B        | C        |
|--------------------|----------|----------|----------|
| Initial Investment | 5,00,000 | 6,00,000 | 7,00,000 |
| Annual Revenues    | 1,50,000 | 1,50,000 | 1,70,000 |
| Annual cost        | 25,000   | 25,000   | 25,000   |
| Salvage value      | 1,00,000 | 1,00,000 | 70,000   |
| Useful life        | 4        | 6        | 8        |

- b) Define capitalized worth. How much money should Mr X should deposit now in a bank which gives 12% interest annually, so that he can draw (i) Rs 3000 per month plus Rs. 20,000 annually and Rs. 50,000 in every five years for infinite period. [2+6]

5. a) Explain mutually exclusive and independent projects. [4]  
b) Select the best alternative using incremental IRR methods. Useful life is 10 years and salvage value is 25% of initial investment. MARR = 10%. [12]

| Project            | A   | B   | C   | D   |
|--------------------|-----|-----|-----|-----|
| Initial Investment | 600 | 500 | 800 | 700 |
| Annual Revenues    | 150 | 125 | 175 | 160 |
| Annual Cost        | 40  | 25  | 30  | 35  |

6. a) What will be the impact of change in value of present worth of the following project if changes occurs in (i) Initial investment (ii) net annual income and (iii) Useful life by ±25%? Draw necessary graph also. [10]

|                    |              |
|--------------------|--------------|
| Initial Investment | Rs. 4,00,000 |
| Net Annual income  | Rs. 50,000   |
| Useful life        | 12 years     |
| MARR               | 15%          |

- b) Based on the following data, forecast the demand of CFL for next five years. [6]

| Year          | 2007     | 2008     | 2009     | 2010     |
|---------------|----------|----------|----------|----------|
| Demand (Nos.) | 1,00,000 | 1,25,000 | 2,00,000 | 3,00,000 |

7. Write short notes on: (any four) [4x4]

- a) Taxation system in Nepal
- b) Methods of calculating depreciation
- c) Decision tree analysis
- d) Market Research
- e) Factors affecting demand

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**Subject:** - Engineering Economics

- ✓ Candidates are required to give their answers in their own words as far as practicable.
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1. a) Explain the terms, socialistic economy and cash flow diagram. [4]

b) In the standard card, it is observed that one unit of product 'X', requires fixed overhead of 2 hrs at the rate of Rs. 15/hr. During the month of February, 800 units are produced at the actual fixed overhead of Rs. 18/hr in 1800 hours. Budgeted fixed overhead is Rs. 30,000. Perform cost variance analysis. [6]

c) Evaluate both type of B/C ratio using PW. [6]

Initial cost = Rs. 25 lakh

Salvage value = Rs. 5 lakh

Useful life = 10 years

Annual benefits = Rs. 10 lakh

Annual O & M = Rs. 5 lakh

MARR = 8%

2. a) Explain incremental analysis or break-even analysis. [4]

b) Select the best project using, ERR method. MARR = 18%. E = 12%. [8]

| Year      | 0       | 1       | 2       | 3       | 4       | 5       |
|-----------|---------|---------|---------|---------|---------|---------|
| Project A | -40,000 | -38,000 | +35,000 | +35,000 | +35,000 | +35,000 |
| Project B | -60,000 | +25,000 | +40,000 | -50,000 | +50,000 | +75,000 |

c) Fixed cost = Rs. 60 million, Variable cost/unit = Rs. 50,000, Selling price/unit = Rs. 8,000. Find BEP volume. What would be the effect on profit/loss when  $S_p$  increases by 20%. [4]

3. a) How much money should Mr Ram deposit now in a bank so that he and his successor can draw Rs 5000 bimonthly for infinite period? Interest rate is 12 % per year. [6]

b) Select the best combination of the project where A is independent and B is contingent on C. [10]

| Project            | A      | B      | C      |
|--------------------|--------|--------|--------|
| Initial Investment | 40,000 | 70,000 | 50,000 |
| Annual Revenues    | 15,000 | 20,000 | 20000  |
| Annual cost        | 2,500  | 3,500  | 0      |
| Useful life (Yrs.) | 8      | 8      | 8      |

The Investment is limited to Rs. 120,000. MARR = 10%.

4. a) Panchakanya has recorded the sales of its products in different years as below. Forecast the sales for year 2020. [8]

| Year                   | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|------------------------|------|------|------|------|------|------|------|
| Sales (Rs. in Million) | 500  | 550  | 575  | 675  | 650  | 700  | 780  |

- b) Write short notes on any two: [2x4]

- i) Advantages of Payback Period
- ii) Depreciation Methods
- iii) Job and Process Costing

5. a) Explain repeatability and cotermination assumptions. [8]

b)

| Project | Initial Investment (NRs.) | Annual Revenue (NRs.) | Annual Expenses (NRs.) | Salvage Value | N      | MARR |
|---------|---------------------------|-----------------------|------------------------|---------------|--------|------|
| P       | 5000                      | 3000                  | 2000                   | 1000          | 8 year | 12%  |
| Q       | 3500                      | 2000                  | 800                    | 350           | 4 year | 12%  |

Select the best (i) if study period is 10 years (ii) using capitalized worth method. [8]

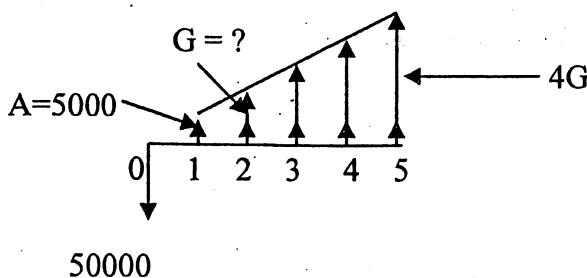
6. a) Explain tax and depreciation or decision tree. [4]

b) A machine costs Rs. 20 million and expect to save Rs. 4 million/year, Tax rate = 50%, MARR = 10%. Evaluate the PW. [4]

c) Perform sensitivity analysis over  $\pm 30\%$  in initial cost and useful life. Draw sensitivity diagram and interpret the result for the problem no 1(c). [8]

7. a) Define 'Capital Recovery Cost'. Mr. Fox purchased a motorbike which cost Rs. 2,00,000. He pays 30% as down payment. Remaining amount will be paid on installment basis and wishes to pay Rs. 10,000 per month for 20 months. What annual interest rate is he paying? [2+6]

- b) Find the value of G if  $i = 10\%$  [8]



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Subject: - Engineering Economics

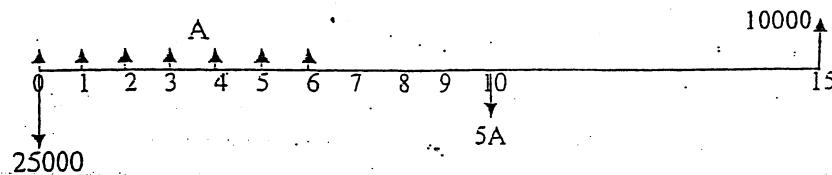
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt any Five questions.
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- ✓ Assume suitable data if necessary.

1. a) Define economic system. Discuss briefly on the characteristics of capitalistic economy. [2+2]
- ~~b)~~ b) What are the elements of cost? Discuss briefly on the prime cost and overhead costs. [2+2]
- c) The following information has been obtained from the records of a manufacturing company using standard costing system [8]

|                            | Standard | Actual |
|----------------------------|----------|--------|
| Production (Unit)          | 3000     | 2500   |
| Working days               | 27       | 25     |
| Fixed overhead variance    | 14000    | 12500  |
| Variable overhead variance | 10000    | 11000  |

Find all the variances (Including all its components).

2. a) Find the value of A if  $i = 15\%$  [8]



- ~~b)~~ b) Mr. X receives a loan of Rs 120,000 from a bank at an interest rate of 12 % per year.
- i) He wishes to repay the loan in monthly installment with Rs. 3000 per month. How many installments are necessary to complete his payment? [4]
  - ii) What annual interest rate is he paying if the Bank asks him to pay Rs 5000 per month for 30 times? [4]
3. a) A construction company needs an equipment which costs Rs 10,00,000 and has salvage value of Rs. 1,00,000 at the end of 10 years. The equipment supplier is also willing to provide the equipment on hire for Rs 1,25,000 per year for 10 years. What will you do? Purchase or Hire. MARR = 12% [6]
- ~~b)~~ b) Find IRR of the following project with initial investment of the Rs 5,00,000 and Salvage value of Rs 1,00,000 at the end of 5 year. The Annual benefit and Operation and Maintenance cost are as following. [10]

| End of Year | Benefit | Operation and Maintenance |
|-------------|---------|---------------------------|
| 1           | 105000  | 5000                      |
| 2           | 115000  | 10000                     |
| 3           | 125000  | 15000                     |
| 4           | 135000  | 20000                     |
| 5           | 145000  | 25000                     |

Draw unrecovered investment balance diagram also

4. a) From the following four mutually exclusive projects recommend the best one using Payback Period, IRR and BCR methods. The study period is 5 years and  $MARR = \epsilon = 15\%$ . [16]

| Project            | A      | B      | C      | D      |
|--------------------|--------|--------|--------|--------|
| Initial investment | 500000 | 400000 | 700000 | 600000 |
| Net annual revenue | 125000 | 110000 | 170000 | 135000 |

Salvage Value is 20 % of the initial investment.

5. a) What is breakeven value? Discuss with suitable example. [6]

- b) Nepal Airlines is planning to purchase a Jet plane. The estimate on two types of plane under consideration are; [10]

| Project               | Plane A      | Plane B      |
|-----------------------|--------------|--------------|
| First investment cost | 25,00,00,000 | 30,00,00,000 |
| Annual O & M          | 1,50,00,000  | 1,00,00,000  |
| Useful Life           | 4 years      | 6 years      |
| Salvage value         | 5,00,00,000  | 6,00,00,000  |
| MARR = 12 %           |              |              |

Which plane is the best one if it is believed that the plane will be used for i) 4 years and ii) infinite period?

6. a) Define the concept of certainty, Uncertainty and Risk. [4]

- b) Perform sensitivity analysis of a following project over a range of  $\pm 30\%$  in i) Initial investment ii) Net annual cash flow using annual worth formulation. [6]

|                         |              |
|-------------------------|--------------|
| Initial Cost            | Rs. 5,00,000 |
| Annual revenue          | Rs. 75,000   |
| Annual maintenance cost | Rs. 10,000   |
| Useful life             | 10 years     |
| Salvage value           | Rs. 50,000   |
| MARR                    | 10%          |

- c) Following data shows the demands for fish when the prices are as shown. Calculate the hypothesized regression equation. What shall be the demand if the price is set to be Rs. 60 per kg? [6]

| S.N | Price per kg. | Quantity (tones.) | S.N | Price per Kg. | Quantity (tones). |
|-----|---------------|-------------------|-----|---------------|-------------------|
| 1   | 64            | 65                | 5   | 82            | 51                |
| 2   | 53            | 75                | 6   | 59            | 65                |
| 3   | 67            | 56                | 7   | 67            | 63                |
| 4   | 52            | 69                | 8   | 71            | 55                |

7. Write short notes on any four [4x4]

- a) Job and process costing
- b) Drawbacks of IRR
- c) Depreciation
- d) Factors affecting demand
- e) Methods of demand analysis

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- ✓ Take MARR = 10% if not specified.
- ✓ Draw necessary cash flow diagrams.
- ✓ Assume suitable data if necessary.

1. Select the best project.

[16]

|   | Project A | Project B |
|---|-----------|-----------|
| Initial investment (Rs.)                | 3,50,000  | 5,00,000  |
| Annual revenues (Rs.)                   | 1,90,000  | 2,50,000  |
| Annual expenses (Rs.)                   | 64,500    | 1,38,000  |
| Useful life (years)                     | 4         | 8         |
| Salvage value at the end of useful life | 0         | 0         |

Use

- Repeatability assumption
- Study period is 4 years
- Infinite project life

2. a) Recommend the best using ERR method  $\epsilon = 20\%$

[12]

| ERR   | Project | End of the cash flows (in Rs. '000) |     |     |     |     |     |     |
|-------|---------|-------------------------------------|-----|-----|-----|-----|-----|-----|
|       |         | 0                                   | 1   | 2   | 3   | 4   | 5   | 6   |
| 28.3% | A       | -640                                | 262 | 290 | 302 | 310 | 310 | 260 |
| 26.4% | B       | -680                                | -40 | 392 | 380 | 380 | 380 | 380 |
| 28.5% | C       | -755                                | 205 | 406 | 400 | 390 | 390 | 324 |

b) Recommend the best using payback period for the problem no. 2(a). [4]

3. a) Explain the mutually exclusive project, independent projects and contingent with suitable examples. [6]

b) Forecast the sales for year 2010. [10]

| Year           | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|----------------|------|------|------|------|------|------|------|------|
| Sales Rs. '000 | 416  | 287  | 307  | 268  | 378  | 523  | 457  | 587  |

4. a) Calculate variance for the following: [8]

|                         | Standard   | Actual     |
|-------------------------|------------|------------|
| Production units        | 9,300      | 10,500     |
| Direct labour hours     | 102,300    | 136,500    |
| Fixed overhead (Rs.)    | 21,483,000 | 28,392,000 |
| Variable overhead (Rs.) | 15,345,000 | 17,199,000 |

- b) Perform sensitivity analysis over  $\pm 30\%$  (varying in increment of 10%) in (i) initial investment (ii) annual net revenue (iii) useful life. Draw sensitivity diagram and interpret the result. [8]

Initial investment = Rs. 20,000

Useful life = 10 years

Revenues/Year = Rs. 6,000

Expenses/Year = Rs. 2,000

5. a) Find the required annual receipts 'A' for the following investment proposal:- [8]

Initial investment = Rs. 10,00,000

Salvage value = Rs. 1,00,000

O & M expenses/year = Rs. 50,000.

| End of year | 1        | 2        | 3        | 4         | 5         |
|-------------|----------|----------|----------|-----------|-----------|
| Benefits    | A+70,000 | A+80,000 | A+90,000 | A+100,000 | A+110,000 |

- b) Find the modified B/C ratio for the problem no. 5(a) [8]

6. a) Explain the economic system. [8]

- b) Find IRR and show the unrecovered investment balance in the graphical and tabular form. [8]

Investment (First) Cost = Rs. 2,50,000

Revenues/Year = Rs. 1,00,000

Expenses/Year = Rs. 30,000

Salvage Value = Rs. 50,000

Useful life = 5 years

7. a) Explain the uncertainty and its sources. Differentiate between nominal interest rate and effective interest rate. If monthly interest rate is 1%, what will be the quarterly interest rate? [4+4]

- b) Explain tax and depreciation with suitable examples. Find BEP volume for the following project: [4+4]

Fixed cost = Rs. 24 lakh

Selling price = Rs. 800 per unit

Variable cost = Rs. 500 per unit

What would be effect on BEP, when fixed cost increases by 10% and variable decreases by 20%?

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