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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, BEL,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 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 (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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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%. = ε [4+4+4]
- i) Evaluate IRR using AW formulation.
- ii) Evaluate both type of B/C ratio with FW formulation.
- iii) 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:

- i) 4 years by FW method [4]
- ii) 8 years by IRR method with PW formulation [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 ± 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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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 (Units)	Direct Material (Kg.)	Direct Material cost (Rs.)	Working Days	Fixed Overheads (Rs.)	Variable overheads (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 described 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

04 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2070 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE, BEL, BEX, BCT, B.Agri.	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Engineering Economics (CE655)

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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) _D	5300	5250	5400	5750	6200	6550
(AEC) _C	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]

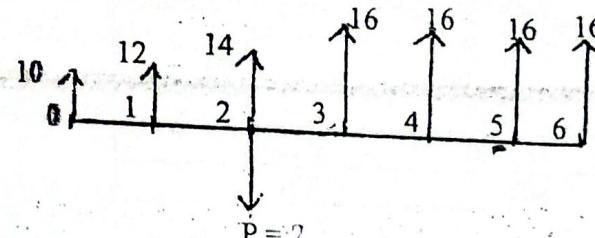
15+

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Programme	BCE, BEL, BEX, BCT	Full Marks 80
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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

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 where 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

- MC
5. The new machine costs 10,000 operating cost 1200 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. [4]

6. a) Explain decision free Analysis:
 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 6th year. Calculate depreciation amount for each years by
 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. [2+5]

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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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 = ϵ = 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) _D	5400	5200	5500	5700	6200	6600
(AEC) _C	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
		High Success	Medium Success	Low Success	
A	1000000	Probability = 0.4	500000		
		Probability = 0.5	300000		
		Probability = 0.1	125500		
B	600000	Probability = 0.2	400000		
		Probability = 0.5	250000		
		Probability = 0.3	100000		
C	400000	Probability = 0.5	200000		
		Probability = 0.1	125000		
		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.

[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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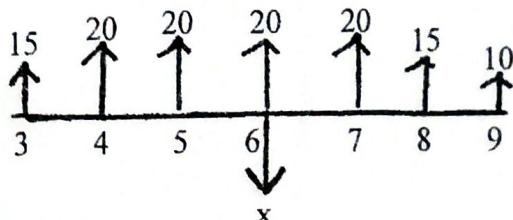
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1. a) List out the principles of engineering economy. [1]
- b) Explain the cash flow diagram. [3]
- c) First Cost = \$ 80000. SV = 10% of First Cost. The general inflation rate = 5%. [5]

EOY	1	2	3	4	5
Net Cash Flow in Actual Dollars	32000	35000	33000	29000	50000

Evaluate the PW by deflection method, if inflation free interest rate = 10%.

2. a) What will be the amount at the end of 10 years if you deposit Rs. 5000 per month for five years continuously if nominal interest rate is 10% compounded quarterly? [3]
- b) Find the value of X from the following figure. $i = 10\%$ [3]



3. Calculate both types of BCR using FW formulation when [8]
 - Initial investment is Rs. 50000;
 - Income is Rs. 10000 at the end of first year and increasing by 10% per year;
 - Annual expenditure is Rs. 2000 at the end of first year and increasing by Rs. 200 per year;
 - Useful life is 6 years
 - Salvage value is Rs. 20000
 - MARR - 15%
4. Use IRR method to select the best project. Use MARR = 12%. (Select the best combination if A, B and C are mutually exclusive.) [8+4]

	A	B	C	D
Initial Investment (Rs.)	10,000	15,000	27,000	20,000
Annual Income (Rs.)	5,000	7,000	12,000	9,000
Useful Life (yrs.)	4	4	4	4
Salvage Value (Rs.)	2,500	5,000	8,000	10,000
MARR (%)	15	15	15	15

5. Annual Equivalent Cost of defender and challenger are given below:

[8]

n	Defender	Challenger
1	5380	7700
2	5203	6184
3	5469	5756
4	5844	5625
5	6258	5631
6	6682	5721

Either the defender or challenger is required for next 8 years.

After the work, neither the defender nor the challenger will be retained.

What is the best replacement strategy?

6. What are the sources of risk in engineering projects in Nepal? Perform sensitivity analysis of the following project over a range of $\pm 30\%$ in (a) Initial investment, (b) Net Annual Revenue and (c) Useful Life. Draw also the sensitivity diagram. Use PW formulation.

[8]

Initial Investment (Rs.)	5,50,000
Net Annual Revenue (Rs.)	1,50,000
Salvage Value (Rs.)	80,000
Useful Life (years)	6
MARR	10%

7. a) Compute the Book Value at the end of 3 Years (BV3) by all the methods of depreciation except MACRS method. Cost basis of a machine is Rs. 10,000. SV = 0. Useful Life = 5 years. MARR = 10%.

[4]

- b) Evaluate after tax PW. The cost basis for a machine is Rs. 10,000. The machine is 5-year MACRS property. Over 6 years, it is estimated to save Rs. 4,500 per year in maintenance costs with annual operating cost being Rs. 1000. It will be depreciated by MACRS method. SV = 0. Tax rate = 30%. MARR = 15%.

[8]

8.

	Machine A	Machine B
Initial Investment	Rs. 50000	Rs. 35000
Annual Benefits	Rs. 20000	Rs. 15000
O & M Cost	Rs. 10000	Rs. 2000
Salvage Value	Rs. 15000	Rs. 10000
Useful Live	4 years	3 years
MARR		12%

- a) Select the best machine by ERR method. Required study period is 5 years. Take $\epsilon = 10\%$.

[8]

- b) Evaluate also by capitalized worth method.

[4]

9. A machine has a Fixed Cost of Rs. 40,00,000. It has variable cost Rs. 45,000 per unit. Find BEP both in volume and value if selling price per unit is Rs. 60,000. What would be the effect on profit/loss when fixed cost increase by 10% and selling price decreases by 5%.

[5]

OR

Explain the Decision Tree Analysis.

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE, BEL, BEX, 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. Explain why the subject of engineering economics is important to Civil Engineer. [4]

2. What is difference between nominal and effective interest rate?

You deposit Rs. 1000 in your bank account. If the bank pays 4% simple interest, how much will you accumulate in your account after 10 years? What if the bank pays compound interest? How much of your earnings will be interest on interest? [2+4]

3. a) Calculate IRR from the following cash flow and draw investment balance diagram. [6]

Year	0	1	2	3	4	5
Cash Flow	-800	250	300	400	-150	600

b) Calculate both types of BCR of a project with following details. MARR = 12% [6]

Initial Investment	Annual Income	Annual Cost	Useful Life	Salvage Value
Rs. 100000	Rs. 20000 at the end of first year and increase by 5% per year	Rs. 3000 at the end of first year and increase by Rs. 500 per year	12 years	25000

4. a) Select the best project by ERR method. Take MARR = 10% and $\epsilon = 20\%$ [6]

EOY →	0	1	2	3	4	5	6
PROJECT A	-64,000	26,200	29,000	30,200	31,000	31,000	26,000
PROJECT B	-68,000	-4,000	39,200	38,000	38,000	38,000	38,000
PROJECT C	-75,500	20,500	40,600	40,000	39,000	39,000	32,400

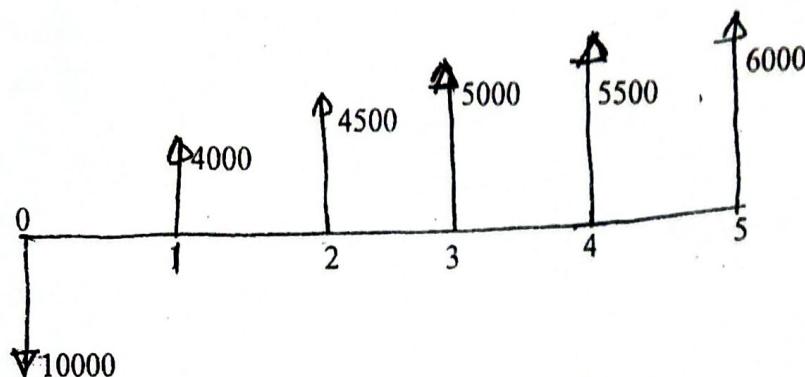
b) Co-terminating both project at 5 years and select the best project by modified BCR (using AW formulation). Take Salvage Value of each project = 10% of First Cost, MARR = 15% [6]

PROJECT	First Cost	Annual Benefits	Annual O & M Costs	Useful Life
A	Rs. 4,00,000	Rs. 175,000	Rs. 25,000	6 years
B	Rs. 7,00,000	Rs. 250,000	Rs. 35,000	8 years

5. a) An existing machine has market value of Rs. 10000 and decreases by Rs. 2000 per year. Its operating cost is Rs. 2500 in year 1 and increases by 20% each year for 4 years. New machine costs Rs. 20000 now and its market value will decreases by Rs. 20% per year for 4 years. Operating cost is Rs. 1500 in first year and increase by 30% each year. Calculate equivalent uniform annual cost of both existing and new machines. MARR = 15%. Formulate the best replacement strategy if we need the machine for four years only. [4+4+4]

b) Define mutually exclusive project, independent project and contingent project with proper combinations. [4]

6. a) A company produces an electronics timing switch that is used in consumer and commercial products made by several other manufacturing firms. The fixed cost and total cost are Rs. 40,000 and Rs. 85,000 respectively. The total sales are Rs. 1,05,000 and sales volume is 15,000 for this situation. [4]
- Find the breakeven points in terms of number of units
 - What should be the output if the profit desired is Rs. 50,000?
- b) Draw sensitivity chart using PW formulation of the following cash inflows. It is desired to evaluate the sensitivity of PW to $\pm 30\%$ changes on: [8]
- Interest
 - Investment



7. a) Explain the general procedure for after tax economic analysis with suitable example. [4]
- b) Considering the following information, compute the annual depreciation and book value of each year by (i) SL method (ii) DB method (iii) SOYD method and (iv) Sinking fund method. [1+2+3+2]

Cost basis	Salvage Value	Useful Life	MARR
\$ 7,000	\$ 2,000	5 years	10%

8. Choose the best project from the following alternatives. [6]

Project	Machine	Machine
	X	Y
First Cost	15,00000	20,00000
Life	7 years	7 years
Salvage Value	200000	300000
Annual operating and maintenance cost	300000	250000

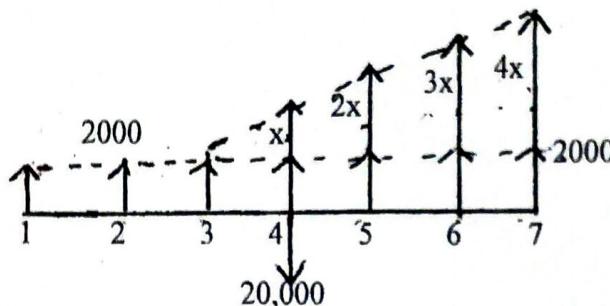
Assume an average inflation of 5% for the next five years and interest rate is 15% / year.

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCE, BEL, BEX, 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. Explain any three principles of engineering economic analysis. [1+4]
2. a) Define nominal and effective interest rates. If you deposit Rs 2000 per month for two years, what will be the amount at the end of five years if bank interest rate 3% in every six month? [1+3]
- b) Find the value of X if $i = 10\%$ [4]



3. a) What is MARR? Explain the factors affecting its determination. [3]
- b) Cash flows of a project are as follows: Take MARR = 10%

EOY →	0	1	2	3	4	5
Cash inflow	0	500,000	560,000	620,000	680,000	740,000
Cash outflow	-1000,000	100,000	200,000	300,000	400,000	500,000

- i) Evaluate both type of payback period (Standard payback period = 3 years). [1+2]
- ii) Evaluate IRR (PW formulation) using linear interpolation and prepare UIB both in table & diagram. [3+2+2]

- c. Explain the financial and economic analysis. [3]

4. a) Choose the best project among these alternatives using IRR, if MARR = 12% and study period 10 years. [6]

Project	A	B	D	E
First Cost Rs.	2000	1500	4000	3000
Annual Revenue Rs.	390	276	925	500

- b) Determine both types of B/C ratio for the given project if interest rate is 11%. [7]
 - Investment = 10000
 - Annual benefit = 4600
 - Annual cost = 3000
 - Salvage value = 2500
 - Life of project = 8 years

5. a) Explain the required assumption and decision framework for replacement analysis when required service life is long. [4]
- b) An old machine can sell it now for \$5,000. If repaired now, can be used for another 6 years. It will require an immediate \$1,200 for overhaul to restore it to operable condition. Future market values are expected to decline by 25% each year over the previous year's value. Operating costs are estimated at \$2,000 during the first year and these are expected to increase by \$1,500 per year thereafter. Determine economic service life of this machine. [8]
6. Perform sensitivity analysis by IRR using FW formulation (with increment of 10%) over a range of $\pm 30\%$ in (a) useful life and (b) MARR. Take MARR = 10%. [8]
- | PROJECT | First Cost | Annual Benefits | Annual Expenses | Salvage Value | Useful Life |
|---------|--------------|-----------------|-----------------|-------------------|-------------|
| A | Rs. 3,00,000 | Rs. 1,50,000 | Rs. 25,000 | 10% of First Cost | 10 years |
7. a) What are the purpose of depreciation calculation? 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 1,00,000, Useful life = 5 years, Salvage Value = 20,000. [1+5]
- b) A machine is expected to cost Rs. 5,00,000 and will generate revenue of Rs 1,50,000 per year for five years. Its salvage value is Rs 2,00,000. Calculate after tax cash flow and corresponding NPV if tax rate is 30% and depreciation is on sum of year digit method. MARR = 15% [6]
8. Explain any two reasons for inflation and compute the equivalent present worth using deflation method. [2+4]

EOY →	0	1	2	3	4	5
Cash inflow	-	5,00,000	5,60,000	6,20,000	6,80,000	7,40,000
Cash outflow	-10,00,000	1,00,000	2,00,000	3,00,000	4,00,000	5,00,000

Given cash flow are in Actual Dollars. Take $f = 5\%$ and $i = 10\%$

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE, BEL, BEX, 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 10th 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]
- 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 1st year and increases by 15% thereafter

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

Useful life = 8 years

MARR = 15%

Ch. 11
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 6th 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]

Exam,	New Back	Full Marks	80
Level	BE		
Programme	BCE, BEL, BEX, 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.
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1. "Knowledge of engineering economics helps in decision making process". Justify it by the principles of engineering economics. [4]
2. A person invest a sum of 50,000 in bank at a nominal interest rate of 18% for 15 years. The compounding is monthly. Find maturity amount of the deposit after 15 years. Also briefly explain the importance of time value of money. [3+3]
3. Initial investment of a project is Rs. 1,00,000 having useful life is equal to 5 years with no salvage value. Annual operation and maintenance cost is Rs. 25,000. Annual revenue at the end of first year is Rs. 70,000 and decreases by Rs. 5,000 each year for the remaining years. [6+5+5]
 - i) Draw U/B diagram
 - ii) Evaluate modified BCR using PW formulation. Take salvage value Rs. 10,000
 - iii) Evaluate discounted payback period. Take standard (cut off) payback period 3 years.
4. a) Select the best proposed using ERR (Take $\epsilon=25\%$ and MARR = 20%) [4+4]

EOY	0	1	2	3	4	5	6
Proposal A	-6000	2400	2800	2900	3000	3000	2450
Proposal B	-7000	1900	3800	3700	3600	3600	3300

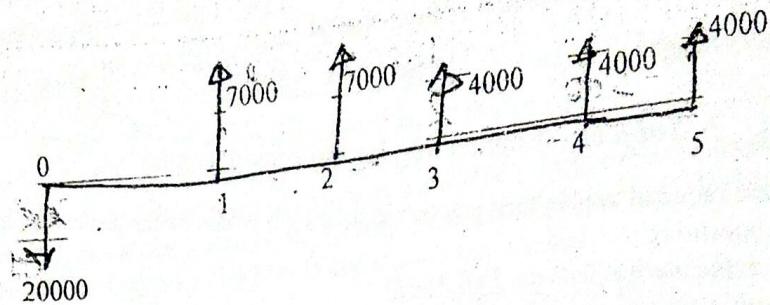
- b) What do you mean by mutually exclusive, contingent and independent project? Compute the following projects by using repeatability assumption when MARR is 10%. [2+6]

Project	A	B
Initial Investment (Rs)	1,00,000	1,50,000
Annual Revenue (Rs)	15,000	20,000
Annual Cost (Rs)	3,000	4,000
Useful life (Years)	6	8
Salvage value (Rs)	5,000	10,000

5. Define sunk cost and economic life of an assets. What are the reasons for replacement of asset. The Annual Equivalent cost of defender and challenger are given in table below. What is the best replacement strategies? Use MARR = 12% and planning horizon of the project is 8 years. [1+1+2+8]

End of Years (n)	1	2	3	4	5	6
(AEC) (Rs)	5300	5100	5400	5600	6000	6500
(AECC) (Rs)	7500	6000	3600	3240	3050	3860

6. a) Consider the following cash flow diagram. Plot changes in present worth to $\pm 20\%$ and $\pm 30\%$ for the project life. Let MARR = 10%. Assume salvage value = 0 [8]



[4]

- b) A small hydro project has given following information

Initial investment = Rs. 10,00,000

Energy Generated per year = 200 MW

Annual operating cost = Rs. 6,00,000

Market price of energy = Rs. 4/KWhr

Salvage value = Rs. 1,00,000

MARR = 10%

Find its break even point of time

7. a) If a machine has following information, compute the depreciation and book value of each year by [4+4]

i) SOYD method

ii) Sinking fund method

Cost basis	Salvage value	life	MARR
\$ 8000	\$2000	10 years	10%

- b) Explain about the method of "MACRS" depreciation. [3]

8. 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+1]

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE, BEL, BEX, 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.
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- ✓ Assume suitable data if necessary.

1. Define term Engineering economy. Explain principles of engineering economy. [1+3]
2. 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

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCE, BEL, BEX, 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 5th 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 1st year and decreases by Rs. 10,000 thereafter

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

Salvage value = Rs. 1,00,000

Life year = 8

MARR = 9% per year

- 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 1st 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]
