

2024 Spring

(i) Write key principles of economy.

→ Key principles of economy.

(ii) Develop the alternatives.

→ The feasible alternatives need to be identified & then defined for subsequent analysis. A decision involves making a choice among two or more alternatives. If there is only one alternative no choice is required. Developing & defining alternatives for evaluation is important because of resulting impact on the quality of decision.

(iii) Focus on differences.

→ The expected differences in future outcomes among the alternatives are relevant to their comparison & should be considered in decision making.

(iv) Use a consistent viewpoint.

→ To determine prospective (future) outcomes of feasible alternatives, the viewpoint should be consistent & defined. It is important that the viewpoint for particular decision is defined, then consistently in the description, analysis & comparison of alternatives.

(v) Use a common unit of measure.

→ Common unit of measurement should follow to enumerate



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perspective of outcome of feasible alternative which will make easier analysis & comparison. For economic consequences, a monetary unit is the common measure.

(v) Consider all relevant criteria. (social & enviro aspect)
→ Selection of a preferred alternative requires the sum of all relevant criteria. In engineering economic analysis, the primary criterion relates to provide maximum monetary return to owners. But other objectives like social, cultural, environmental justice etc. should become the basis of for additional criteria in decision making process.

(vi) Make uncertainty explicit.
→ Uncertainty is inherent in projecting (estimating) magnitudes & impact of future outcome of feasible alternatives & should be recognized in their analysis & comparison.

(vii) Revisit your decision (self evaluation)
→ Improve decision results from an adaptive process due to this the projected outcome of selected alternative & actual results achieved should be subsequently compared.



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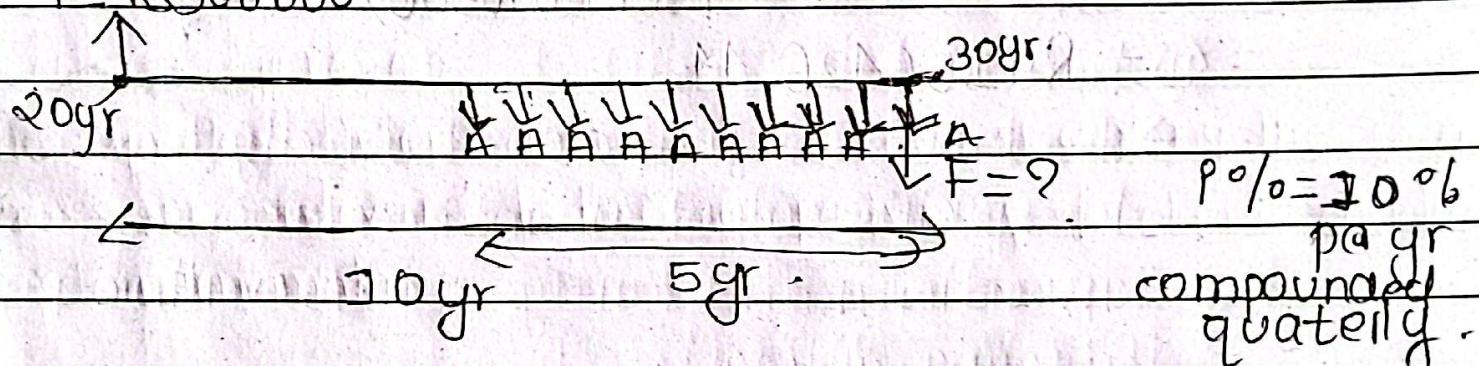
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A man aged 30 years now had borrowed Rs 500000 from a bank for his further studies at the age of 20 years. The bank was charged interest at 10% per year compounded yearly quarterly. He wishes to pay that loan from last 10 semiannual way with equal installment basis & now he has just cleared the loan. What amount did he pay in each installment?

C.F.D:

$$P = \text{Rs} 500000$$



$$EDR(i\%) = \left(1 + \frac{r}{m}\right)^m - 1$$

$$\left(1 + 0.10\right)^4 - 1 = 0.1038 \text{ yr.}$$

$$F = 50000 (1 + 0.1038)^{10}$$

$$= \text{Rs} 1349375.14$$

Now,

$$A = F(A/F, i\%, N)$$



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$$\text{Semiannual} = (1 + \text{Interest})^{\frac{1}{m}} - 1$$

$$(1 + 0.1038)^{\frac{1}{2}} - 1$$

0.0506 | semiannual

$$A = F \left[\frac{(1 + i)^N - 1}{(1 + i)^N} \right]$$

1342375.74

$$= 1342375.74 \left[\frac{0.0506}{(1 + 0.0506)^{10} - 1} \right]$$

= RS 106426.44



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(a) Explain the manufacturing cost & non manufacturing cost.

→ All manufacturing cost

→ All the cost that are associated with the process of manufacturing are called manufacturing cost. Most companies divide into prime & overhead category.

(1) Prime / Direct cost.

→ Prime cost are related to given cost object & that can be traced into specific unit of product.

i) Direct material cost.

→ It is cost associated with those materials & components that can be directly & conveniently traced to a unit of final product like cast iron in furniture, steel in bridge etc.

ii) Direct labor cost.

→ It refers the cost of labour that can be directly & conveniently traced to unit of final product. Cost associated with salary of managers, machine operators, full time staffs, etc.

iii) Direct expenses.

→ If the product expense that can be directly & conveniently traced to a unit of final product are direct expenses.



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Special design & drawing, hire of special tools & equipment, manufacturing job, etc.

2. Overhead / Indirect cost.

(i) Indirect material cost.

→ The cost of materials that are ~~are~~ ^{could not} directly traceable & those extremely small in monetary value are called material cost. like cost of glue used to bind a book, dishwasher detergent in fast food restaurant.

(ii) Indirect labor cost.

→ The labor cost that are not directly traceable for specific output are indirect labor cost. cost associated with security guard, overtime pay, meeting allowance, etc.

(iii) Indirect expense

→ like Insurance, medicine, stationary, tax, depreciation, etc.

Non manufacturing cost

→ All cost that are not associated with process of manufacturing are called non manufacturing cost. it consists of



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- administrative cost
- advertising cost
- marketing cost
- R&D, etc.

1(c) Describe ecological footprint

→ The ecological footprint represents environmental cost associated with engineering projects & products processes, including resource consumption, energy use & waste generation. It helps engineers & decision makers evaluate the sustainability & long term economic impact of a project by factoring in not just financial costs but also depletion of natural resources & ecological damage, enabling more responsible planning & investment choices that balance economic benefit with environmental stewardship.

2(b) Star construction company planning to purchase from diff companies A & B Because it was based on estimation using coterminated 5 yr & 8 yr respectively

	Investment Rs	Revenue Rs	Expense Rs	Surplus value Rs
Plain A	35000000	13000000	1500000	3500000
Plain B	50000000	17500000	2500000	5000000



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3(a) Find both types of B/C ratios using P/W formular for a project having first investment cost of Rs 150000 project life of 10 yr; salvage value Rs 30000 annual benefit Rs 65000 annual O&M cost Rs 20000 & MARR = 12% per yr.

SOL:

Given,

Initial Investment = Rs 150000

useful life = 10 yr.

salvage value = Rs 65000 - 30000

Annual cost (O&M) = Rs 20000

Annual revenue = Rs 65000

MARR = 12% per yr.

By conventional method

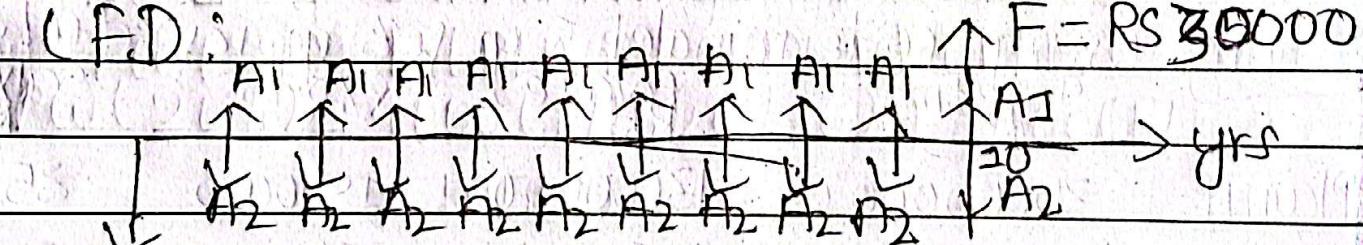
$$B/C \cdot R = Pw(B)$$

~~$$B/C = Pw(T) - Pw(S) + Pw(O\&M)$$~~

we have

$$Pw(B) =$$

C.F.D:



$$P = Rs 150000$$

$$F = Rs 30000$$

$$A_1 = Rs 65000$$

$$A_2 = Rs 20000$$

$$MARR = 12\%$$



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By conventional method.

B/C ratio - $PW(B)$

$$PW(T) - PW(S) + PW(0\&M)$$

we have

$$PW(B) = A_1 (P/A, 9\%, N)$$

$$= 65000 (P/A, 12\%, 10)$$

$$= 65000 * 5.6502$$

$$= \text{Rs } 36726.3$$

$$PW(T) = \text{Rs } 150000$$

$$PW(S) = F(P/F, 9\%, N)$$

$$= \cancel{F} 30000 * (P/F, 12\%, 10)$$

$$= 30000 * 0.3220$$

$$= \text{Rs } 9660$$

$$PW(0\&M) = A_2 (P/A, 9\%, N)$$

$$= 20000 (P/A, 12\%, 10)$$

$$= 20000 * 5.6502$$

$$= \text{Rs } 113004$$

Now,

$$\text{B/C ratio} = 36726.3$$

$$150000 - 9660 + 113004$$

$$= 1.94 > 1.0 \text{ accepted}$$

By modified method

$$\text{B/C ratio} = \frac{PW(B) - PW(0\&M)}{PW(T) - PW(S)}$$

$$= \frac{36726.3}{150000 - 9660 + 113004}$$



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$$367263 - 113004$$

$$150000 - 9660$$

$$= 1.81 > 1.0 \text{ accepted.}$$

3(b) Perform sensitivity analysis over project over the range of $\pm 30\%$ on (i) Initial Investment

(ii) annual revenue (iii) useful life

$$\text{Initial Investment} = 14500$$

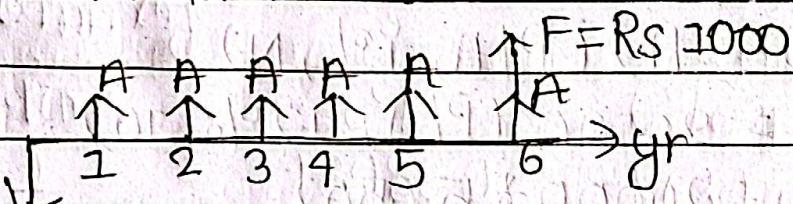
$$\text{annual revenue} = 4000$$

$$\text{salvage value} = 1000$$

$$\text{useful life} = 6 \text{ yr.}$$

$$\text{MARR} = 20\%$$

Soln



$$P = \text{Rs } 14500$$

$$A = \text{Rs } 4000$$

$$\text{MARR} = 10\%$$

Base eqn over a range of (0%)

$$P_w(0\%) = A(P/A, 0\%, N) + F(P/F, 0\%, N) - P_0$$

$$P_w(20\%) = 4000(P/A, 20\%, 6) + 1000(P/F, 20\%, 6) - 14500$$

$$= 13302 + 334.9 - 14500$$

$$= -1863.1$$

$$\text{base } P_w = -\text{Rs } 1863.1$$



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now over range of $\pm 30\%$

(i) Initial Investment

$(+30\%)$

$$PW(20\%) = 4000(P/A, 20\%, 6) + 1000(P/F, 20\%, 6) \\ + (14500 * 0.70) \\ = -5213.07$$

(-30%)

$$PW(20\%) = 4000(P/A, 20\%, 6) + 1000(P/F, 20\%, 6) \\ - (14500 * 0.70) \\ = +3486.09$$

(ii) annual revenue

at $+30\%$

$$PW(20\%) = 4000 * 1.30(P/A, 20\%, 6) + 1000(P/F, 10\%, 6) \\ - 14500 \\ = RS +3,197.9$$

(-30%)

$$PW(20\%) = 4000 * 0.70(P/A, 20\%, 6) + 1000(P/F, 10\%, 6) \\ - 14500 \\ = RS - 4854.1$$

(iii) useful life

at $+30\%$

$$PW(20\%) = 4000(P/A, 20\%, 6 * 1.30) + 1000(P/A, 20\%, 6 * 1.30) \\ - 14500$$



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16598.29
15348.63

8.4.

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$$\begin{aligned} & \text{4000} \\ & = 4000 \left[\frac{(1+0.2)^{7.08} - 1}{(1+0.2)^{7.08} (0.2)} \right] + 1000 \left[\frac{1}{(1+0.2)^{7.08}} \right] - 14500 \\ & = \text{RS } 15175.90 + 241.20 - 14500 \\ & = 917.104 \\ & \text{PVA}(90\%) = 4000(\text{P/A}, 20\%, 6 * 0.7) + 1000(\text{P/F}, 20\%, 6 * 0.7) \\ & = 19500 \\ & = 11165.28 - 14500 \\ & = -3334.72 \end{aligned}$$

Summary

Details	-30%	0%	30%
P.I	+3986.9	-863.1	-5213.1
Annual revenue	+4854.1	-863.1	+3127.9
Useful life	-3334.72	-863.1	+917.104



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4(a) Compute discounting payback period & B/C ratio from following data.

initial investment = Rs 400000

annual revenue = Rs 150000

annual cost = Rs 30000

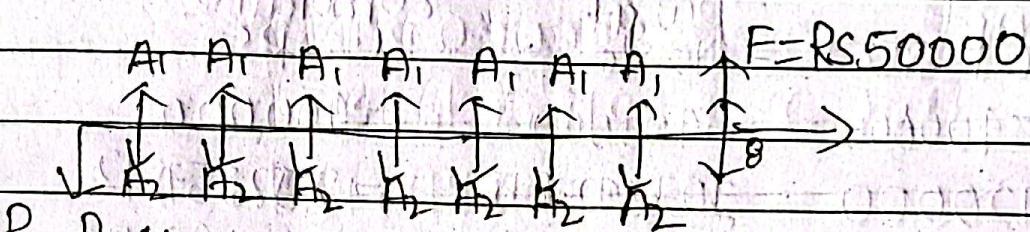
salvage value = Rs 50000

useful life = 8

MARR = 12%

SOLⁿ

CED:



$$A_1 = \text{Rs } 150000$$

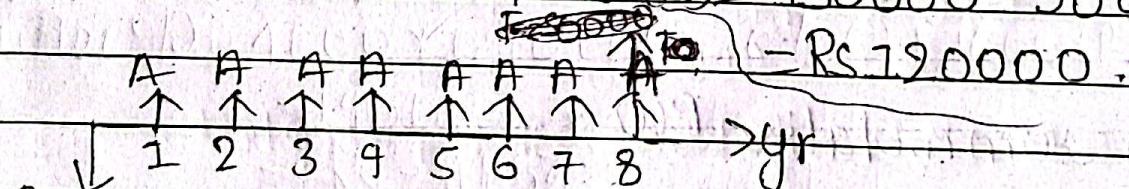
$$A_2 = \text{Rs } 30000$$

$$\text{MARR} = 12\%$$

Discounting

PayBack period:

$$\text{annual net cash flow } (A) = 150000 - 30000$$



$$\text{MARR} = 12\%$$

& PV of each year

$$P_1 = F_1 (1 + i)^{-N} = 120000 (1 + 0.12)^{-1} = \text{Rs } 107142$$

• 85



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$$x+a = 05676$$

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$$P_2 = F_2 \cdot (1+9)^{-N} = 120000(1+0.12)^{-2} = \text{Rs } 95663.26$$

$$P_3 = 120000(1+0.12)^{-3} = 85913.62$$

$$P_4 = 120000(1+0.12)^{-4} = 76262.16$$

$$P_5 = 120000(1+0.12)^{-5} = 68091.22$$

$$P_6 = 120000(1+0.12)^{-6} = 60795.73$$

$$P_7 = 120000(1+0.12)^{-7} = 54281.90$$

$$P_8 = 120000(1+0.12)^{-8} = 48465.98$$

	net C.F(RS)	PW at 12%	cumulative PW RS
0	-400000	-400000	= 400000
1	120000	107147.85	-292857.12
2	120000	95663.26	-197193.89
3	120000	85913.62	-111780.27
4	120000		-4368.05
5			17106.68
6			71388.58
7			11985.56
8			

for cumulative PW



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year cumulative PW (Rs)

1 107148

2 202872

3 288240

4 369512

5 432600

② at end of year 4 cumulative PW = Rs 369512

③ at end of year 5 cumulative PW = Rs 432600

(< 400000)

so payback occurs during year 5



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Benefit cost ratio.

modified PW method

$$B/C R = \frac{PW(B) - PW(0\%)}{PW(P) - PW(S)}$$

where

$$\begin{aligned} PW(B) &= A_1(P/A, 9\%, 8) \\ &= 750000 (P/A, 12\%, 8) \\ &= \text{Rs } 745140 \end{aligned}$$

$$PW(P) = \text{Rs } 400000$$

$$\begin{aligned} PW(S) &= F(P/F, 9\%, 8) \\ &= 50000 (P/F, 12\%, 8) \\ &= \text{Rs } 20195 \end{aligned}$$

$$\begin{aligned} PW(0\%) &= A_2(P/A, 9\%, 8) \\ &= 30000 (P/A, 12\%, 8) \\ &= \text{Rs } 149028 \end{aligned}$$

Now

$$\begin{aligned} B/C R &= \frac{745140 - 149028}{400000 - 20195} \\ &= 1.056 > 1.0 \text{ accepted} \end{aligned}$$



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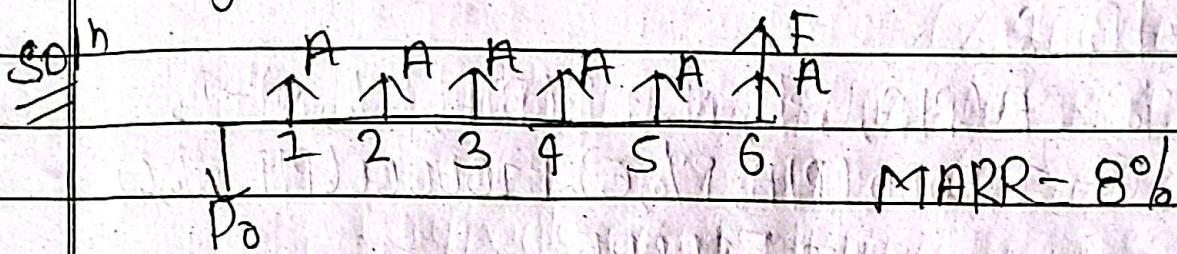
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4(b) Select the best project by using IRR method where
MARR is 8%.

Items	Project A	Project B
Initial invest	300000	500000
annual revenue	90000	175000
life year	6	6
salvage value	10000	100000



For project A

$$\begin{aligned}
 PW(9\%) &= A(P/A, 9\%, 6) + F(P/F, 9\%, 6) - P_0 \\
 &= 90000(P/A, 9\%, 6) + 10000(P/F, 9\%, 6) - \\
 &\quad 300000
 \end{aligned}$$

$$\text{assume } i\% = 10\%.$$

$$\begin{aligned}
 PW(10\%) &= 90000 * 4.3553 + 10000 * 0.5645 - 300000 \\
 &= 97622
 \end{aligned}$$

$$\text{assume } i\% = 20\%.$$

$$\begin{aligned}
 PW(20\%) &= 90000 * 3.3255 + 10000 * 0.3399 - 300000 \\
 &= +2644
 \end{aligned}$$

$$\text{assume } i\% = 25\%.$$

$$\begin{aligned}
 PW(25\%) &= 90000 * 2.9514 + 10000 * 0.2621 - 300000 \\
 &= -31753
 \end{aligned}$$



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$$\begin{aligned}
 DRR(\%) &= \frac{P_w \text{ of LR}}{\text{Interest}} + \frac{P_w \text{ of HR}}{P_w \text{ of LR} - P_w \text{ of HR}} (\text{HR}-\text{LR}) \\
 &= 20\% + \frac{2644}{2644 - (-31753)} (25 - 20) \\
 &= 20.38\% > \text{MARR accepted.}
 \end{aligned}$$

Project B %

$$\begin{aligned}
 PW(i\%) &= A(P/A, i\%, N) + F(P/F, i\%, N) - P_0 \\
 &= 175000(P/A, i\%, 5) + 100000(P/F, i\%, 6) - 500000
 \end{aligned}$$

assume $i\% = 10\%$

$$\begin{aligned}
 PW(10\%) &= 175000 * 4.3553 + 100000 * 0.5645 \\
 &- 500000 \\
 &= +318627.5
 \end{aligned}$$

assume $i\% = 30\%$

$$\begin{aligned}
 PW(30\%) &= 175000 * 2.773 + 100000 * 0.262 - 500000 \\
 &= +11475
 \end{aligned}$$

assume $i\% = 35\%$

$$\begin{aligned}
 PW(35\%) &= 175000 * 2.3852 + 100000 * 0.1652 - 500000 \\
 &= -66070
 \end{aligned}$$

Now

$$\begin{aligned}
 DRR &= 30 + \frac{11475}{11475 - (-66070)} (35 - 30) \\
 &= 30 + \frac{11475}{18082} * 5 \\
 &\approx 30 + 3.1 \\
 &\approx 33.1\%
 \end{aligned}$$



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~~- 30.73 % MARR acceptable.~~

Q3 Project B is best opt^h because it has highest PRR & is well above the MARR of 8%.

5(a) ~~(a)~~ (b) short notes.

(b) Nominal rate of interest

→ If a financial institution uses a unit of time less than one year in length such as month, quarter, etc the institution usually quotes the interest rate on annual basis. In this situation the basic annual rate of interest is known as nominal interest rate & it is represented by 'i'. Hence nominal interest rate may be stated for any time less than one year such as 6 month (semianual), quarter, month, week, day etc.
For eg:

A financial institute charges 1% interest rate per month on car loan. then

$$\begin{aligned} \text{NPR/APR} &= 1\% * 12 \\ &= 12\% \text{ per yr.} \end{aligned}$$

(c) Demand & Supply.

Law of demand

→ Everybody knows that demand depends upon price. law



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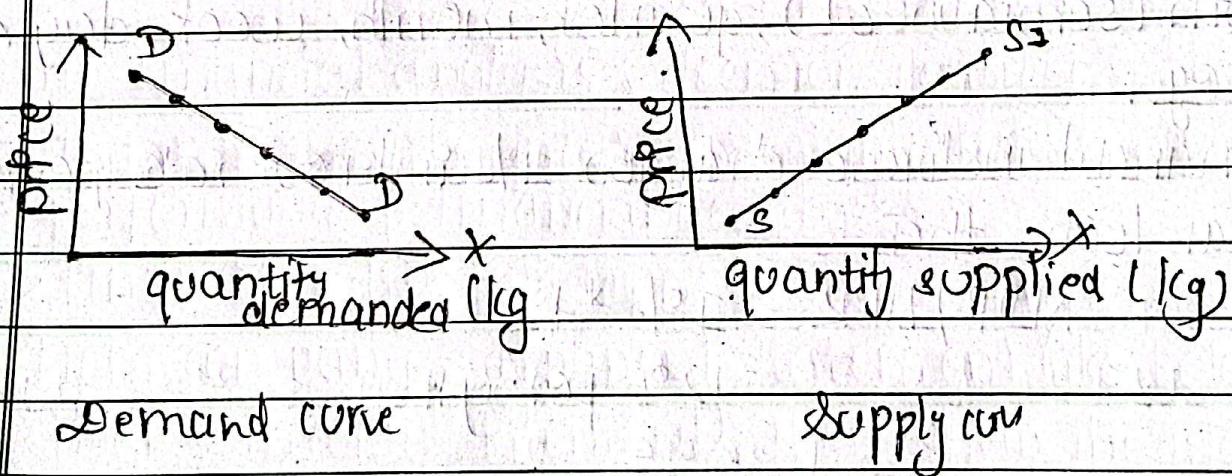
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law of demand states the relationship between quantity demanded & price of commodity. Although there are many other factors (income, taste, weather, population size, etc) to influence on demand, price is most imp determinant of demand in short-run as well as long-run. Law of demand explains the inverse relation b/w price & quantity demanded.

Law of Supply.

→ The relationship b/w price & quantity supplied is known as law of supply. Supply varies directly & positively w/ price. It can be defined as "Other things remaining the same as price of commodity rise its supply is extended & as price fall its supply is contracted".



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5(a) After passing civil engineering course suppose you are going to start housing construction work. If you started it describe the project funding mechanism.

How many funding mechanism are there please explain

→ To start a housing construction business I must figure out where the money will come from to pay for buying land, materials (cement, steel, bricks, etc), labor wages, equipment & machinery, overhead expense (perm. insurance, utilities), marketing & sales. This funding mechanism needs to be applied.

Funding mechanism means the way we get money to finance our project. There is no single way, different project & companies use diff method or combination.

Different funding mechanism:

1. Self financing Government budget.

→ Most of development & public utility projects (like road, water supply, electricity) are established & run by government funding through government budget.

2. Public Private partnership (PPP)

→ A collaboration between government & private sector.

Private Investors build/operate & get paid overtime (through tolls, availability payment). Common in large projects (expressways, metro rail, govt housing schemes).



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3. Private Investment:

- Fully funded by private developers or companies
 Profit motive is primary driver. Typically in most commercial real estate & private housing
- self financing
 - bank loans / term loans.
 - Project finance / construction loan
 - joint venture / partnership

4. To start housing construction work, different combination of private investment funding mechanism will be included to reduce risk & maintain cash flow.

5(b) What are financial ratios & why are they used in financial analysis & decision making? How do financial ratios provide insights into company's performance & financial health.

→ Financial ratios are numerical comparison derived from company's financial statement (like balance sheet & income statement). They show the relationship between diff. financial variable like profit, assets, debt & equity. common ratios:

Liquidity ratio



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profitability ratios

solvency ratios

efficiency ratios

Financial ratios help in

- Analyzing performance over time
- Comparing with competitors or industry benchmarks
- Understanding financial strength & weakness
- Making investment or lending decisions
- Identifying risk & areas for improvement

So they are important in Financial analysis & decision making

Financial ratios provide insights into company's performance & financial health. Let's take example:

- Liquidity ratios show if a company can pay its short term bills. If current ratio < 1 , company may face cash dischar shortage.
- Profitability ratios measures how well company turn sales into profit. A low net profit margin may mean high cost or poor pricing issues.
- Solvency ratios assess long term financial stability. A high debt to equity ratio shows reliance on borrowed money - risky in long run.
- Efficiency ratio shows how effectively resource are used. High inventory turnover - good sales; low = stock not moving.



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~~6(a) A company equipment has initial cost & annual saving per year are of Rs 40000 & Rs 2000 respectively with annual O&M cost of 7000. It will depreciate by MACRS method & will have no salvage value. The useful life of equipment is 5 years. Estimate before & after cash flow. The company pays income tax @ 40%. Evaluate tax by FW method.~~

Solution

Given.

useful life - 5 years

initial cost = Rs 40000

annual saving / benefit = Rs 20000

annual O&M cost = Rs 7000

salvage value = 0

tax rate = 40%

$$\text{Before Tax cash flow BCF} = 20000 - 7000 \\ = \text{Rs } 13000$$

$$\text{S.L : dep rate (R)} = \frac{1}{N} \times BV$$

$$\text{DDB dep rate} = \frac{2}{N} = \frac{2}{5} = 0.40$$



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Year	Calculation of MACRS (%)	Selected Marg. Bas.	Dep. amo unt
1.	$\frac{1}{9}$ yr, DDB = $\frac{1}{9} * 0.40 \times 100\% = 20\%$. $\frac{1}{2}$ yr, SL = $0.5 * 0.40 \times 100\% = 10\%$.	20% 40000	8000
2.	DDB = $0.40(100\% - 20\%) = 32\%$. SL = $\frac{1}{4.5}(100\% - 20\%) = 17.28\%$.	32% 40000	12800
3.	DDB = $0.40(100\% - 20\% - 32\%) = 19.20\%$. SL = $\frac{1}{3.5}(100\% - 52\%) = 13.70\%$.	19.20% 40000	7680
4.	DDB = $0.40(100\% - 52\% - 19.20\%) = 11.52\%$. SL = $\frac{1}{2.5}(100\% - 71.20\%) = 11.52\%$.	11.52% 40000	4608
5.	DDB = $(0.40)(17.28\%) = 6.9\%$. SL = $(\frac{1}{1.5})(17.28\%) = 11.52\%$.	11.52% 40000	4608
6.	$(\frac{1}{2})(0.40)(5.76\%) = 1.15\%$. $(\frac{1}{2})(0.40 + 0.5) \cdot (5.76\%) = 5.76\%$	5.76% 40000	2304

We know BTCF = Rs 13000 per yr.

Now For taxable income.



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year	Depreciation Taxable amount	taxable income	Tax amount (10%)	ATCF = BTCF - Tax	
1	8000	5000	2000	11,000	
2	12800	900	80	12,920	
3	7680	5320	2128	10,872	
4	4608	8392	3356.8	9,643.2	
5	4608	8392	3356.8	9,643.2	
6	9304	30596	4978.4	8721.6	

since it's a half year convention.

Taxable income = BTCF - depreciation
 $= 13000 - \text{depreciation}$

Tax amount = Taxable income $\times 40\%$.

• Before tax cash flow: Rs 13000 per year
 After tax cash flow: shown in above table.

ATCF by FW method.

$$FWI = ATCF \left(A/F, i\%, n \right)^{5-t}$$

year
1
2
3
4
5



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Year	ATCF	$FV = ATCF (A/F, 7\%, 5-t)$
1	11000	17322.8
2	12920	18163
3	10,872	13645
4	9643.2	10,807
5	9643.2	9,643
6	8797.6	69,579.8

~~E~~:- \therefore Future worth of after tax cash flow =
 Rs 69579.8
 \approx Rs 69575

5(b) Describe the Taxation law and what do you understand about corporate income tax.

→ Taxation law is the body of rules & regulations that govern how tax are imposed, calculated, collected & managed by government. These law define what types of income, property or ~~tax~~ transaction are taxable who must pay tax & what rates apply, & the procedure for filling tax returns & paying tax. The purpose of taxation law is to ensure gov can raise revenue to fund public services & development while also maintaining fairness & compliance among tax payers.

Types of tax:

(1) Direct tax.



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(a) personal tax

↳ property tax

↳ Income tax

[single (500000)

[couple (100000)

(b) corporate tax.

2 Indirect tax (eg VAT)

Corporate Income Tax

→ Corporate ^{income} tax is a tax levied on the profit earned by companies or corporation. Unlike individual income tax which applies to a person's salary or wages, corporate tax applies to the net income of a business after deducting expenses like salaries, operating cost, depreciation & interest. Corporation are required to calculate their taxable income each year, apply the tax rate set by the law, & pay that amount to the government.

Example:

If a company earns Rs 10,000,000 in net profit in a year & the corporate tax rate is 25% it must pay 250,000 in corporate income tax.



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