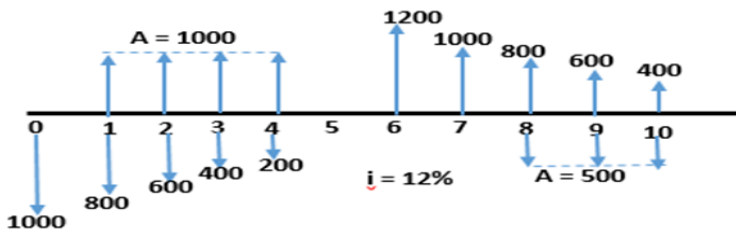


MID-TERM EXAMINATION

HUM 3021 – ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT

SCHEME OF VALUATION

Q1. For the cash flow diagram shown below, the equation to estimate the net present worth are given below,



- A)** $NPW = 1000 (P/A, 12\%, 4) + [1200 - 200 (A/G, 12\%, 5)] (F/A, 12\%, 5) (P/F, 12\%, 10) - [1000 - 200 (A/G, 12\%, 5)] (P/A, 12\%, 5) - 500 (F/A, 12\%, 3) (P/F, 12\%, 10)$
- B)** $NPW = -1000 + [200 + 200 (A/G, 12\%, 4)] (P/A, 12\%, 4) + [1200 - 200 (A/G, 12\%, 5)] (P/A, 12\%, 5) (P/F, 12\%, 5) - 500 (F/A, 12\%, 3) (P/F, 12\%, 10)$

Choose the correct option from below: **(1)**

1. ****Only B is correct**
2. Only A is correct
3. Both A and B are correct
4. None of them are correct

Q2. An engineer who is saving for her retirement plans to deposit \$500 every quarter, starting from next quarter onwards, into an investment account. If the account pays interest at 6% compounded quarterly, the total she will have at the end of 25 years is closest to (use formula): **(1)**

1. \$295,380
2. \$56,400
3. \$79,700
4. ****\$114,402**

$$I_{eff} = 1.5\% \text{ per quarter} \Rightarrow F = 500 [(1.015^{25} - 1) / 0.015] = 114,402$$

Q3. You are planning to make quarterly payment into an account which has an interest of 15% compounded semi-annually. The effective interest rate on the payment period is closest to: **(1)**

1. 7.5%
2. 15.56%
3. ****3.7%**
4. 3.75%

$$I_{eff} = (1 + r/m)^n - 1 = (1 + 0.075)^{0.5} - 1 = 0.037 = 3.7\% \text{ per Quarter}$$

Q4. Assume that you and your best friend each have \$1000 to invest. You invest your money in a fund that pays 10% per year compound interest. Your friend invests her money at a bank that pays 10% per year simple interest. At the end of 1 year, the difference in the total amount for each of you is: **(1)**

1. You have \$10 more than she does
2. You have \$100 more than she does
3. ****You both have the same amount of money**
4. She has \$10 more than you do

Q5. For the mutually exclusive alternatives shown, the one(s) that should be selected are: (1)

Alternative	NPW, \$	Alternative	NPW, \$
A	25,000	C	10,000
B	12,000	D	15,000

- a) Only C b) ****Only A** c) C and D d) Only D

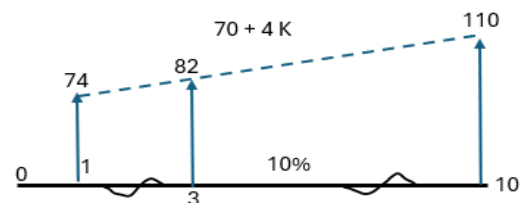
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Q6. GKX Industries expects sales of its hydraulic seals (in inch and metric sizes) to increase (from year 1 to year 10) according to the cash flow sequence $\$70 + 4k$, where k is in years. What is the amount of the cash flow in year 3? Determine future worth of the entire cash flow series in year 10 considering interest rate of 10% (2)

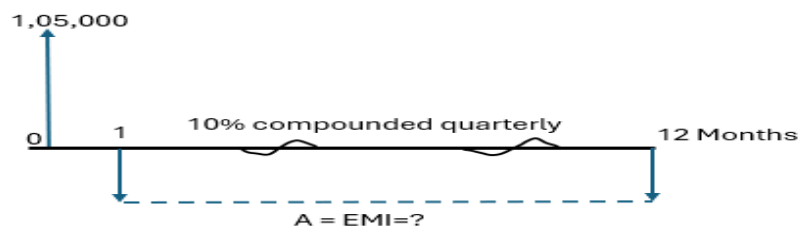
Cashflow at 3 = $70 + 4 \times 3 = 82$

$$FW = 74 (F/A, 10\%, 10) + 4 (A/G, 10\%, 10) (F/A, 10\%, 10)$$

$$= 74 (15.937) + 4 (3.725) (15.937) = \mathbf{\$1,416.8}$$



Q7. You have bought a smartphone worth ₹1,05,000 for which you have opted a equal monthly instalment (EMI) scheme on your credit card. The term period of this payment is next 12 months and the interest rate applicable for this loan is 10% compounded quarterly. Determine the EMI (use formula for calculations) (2)



$P = 1,05,000$ $n=12$ months $i=10\%$ compounded quarterly EMI=?

$$i_{\text{eff}} = (1 + r/m)^n - 1 = (1 + 0.10/4)^{(1/3)} - 1 = \mathbf{0.83\%}$$

$$EMI = P (A/P, i_{\text{eff}}, 12) = 1,05,000 [0.00826 (1.00826)^{12} / [(1.00826)^{12} - 1]]$$

$$= 1,05,000 [0.00912/0.10375] = 1,05,000 (0.0879) = \mathbf{9230 \text{ per month}}$$

Q8. You expect to invest an amount of X now and $2X$ at the end of 2nd year, ₹50,000 at the end of 4th year, into an account with an interest rate of 10%. From the account you are expecting to withdraw an amount of ₹2,00,000 at the end of 7th year. Find the value of X . (2)

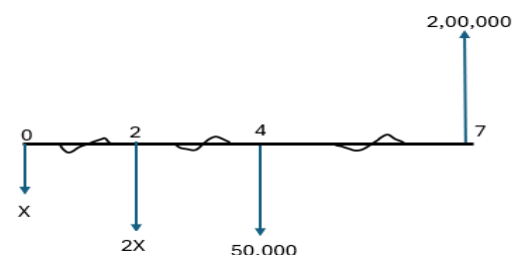
FV of Investment = FV Withdrawal

$$X (1 + i)^7 + 2X (1 + i)^5 + 50000 (1 + i)^3 = 2,00,000$$

$$X (1.949) + 2X (1.611) + 50,000 (1.331) \Rightarrow 1.949 X + 3.322$$

$$X + 66550 = 2,00,000$$

$$5.271 X = 133450 \Rightarrow \mathbf{X = 25,317.8}$$

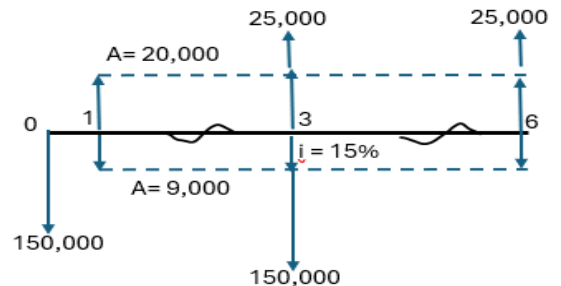


Q9. For the following information below, while comparing alternatives, I and J by the present worth method, determine the PW of Alternative I to be considered for comparison with J. (3)

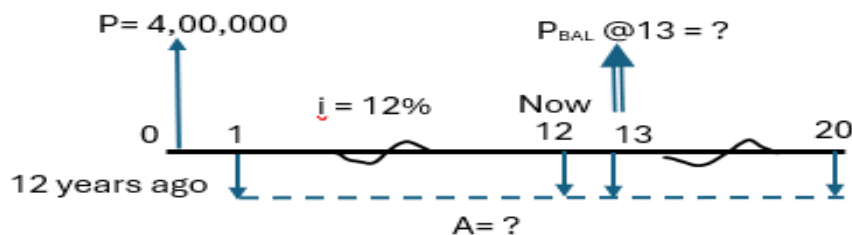
	Alternative I	Alternative J
Initial cost, \$	-150,000	-250,000
Annual income, \$ per year	20,000	40,000
Annual expenses, \$ per year	-9,000	-14,000
Salvage value, \$	25,000	35,000
Life, years	3	6

The interest rate is 15% per year.

$$\begin{aligned}
 \text{PW (I)} &= -150,000 - 125,000 (P/F, i=15\%, 3) + 25,000 (P/F, 15\%, 6) + 11,000 (P/A, 15\%, 6) \\
 &= -150,000 - 125,000 (0.6575) + 25,000 (0.4323) + 11,000 (3.784) \\
 &= -179,756
 \end{aligned}$$



Q10. A company 12 years ago borrowed Rs.4,00,000 to pay for a new machine tool, agreeing to repay the loan in 20 yearly equal payments at an annual interest rate of 12%. The company now wants to pay off completely the remaining loan amount, which will be paid during the next instalment period. How much would this payment be, assuming no penalty costs for early payout? (3)

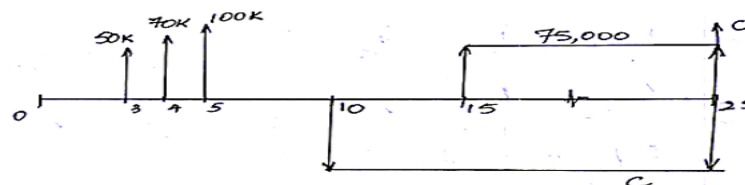


$$\text{Annual Installments} = A = 4,00,000 (A/P, i=12\%, 20\text{yrs}) = 4,00,000 (0.1339) = 53,560$$

$$P_{\text{BAL now}} = 53560 (P/A, 12\%, 8) = 53560 (4.968) = 2,66,086.1$$

$$P_{\text{BAL @13 to be Paid}} = 2,66,086 (1.12) = 2,98,016.41$$

Q11. Find the value of C for the cashflow diagram given below considering interest rate of 15% (K = 1000). (3)



$$50,000 (1.15)^{22} + 70,000 (1.15)^{21} + 100,000 (1.15)^{20} + 75,000 (F/A, 15\%, 11) + C = C (F/A, 15\%, 16)$$

$$= 50,000 (21.645) + 70,000 (18.822) + 100,000 (16.367) + 75,000 (24.349) + C = C (55.717)$$

$$5,862,665 = C (55.717 - 1) = 54.717 C$$

$$C = 1,07,145.2$$

Q12. A report by the Government Accountability Office (GAO) shows that the GAO expects the U.S. Postal Service to lose a record \$7 billion at the end of this year, and if the business model is not changed, the total future value of losses will total \$241 billion by the end of year 10. If the losses increase uniformly over the 10-year period, you are required to answer the following:

- a) The expected increase in loss value in \$ each year if interest rate is 8%
b) The equivalent uniform worth of the losses at an interest of 8% per year **(3)**

$A_1 = 7 \text{ Billion}$; $FW (@10) = 241 \text{ Billion}$; $G = ?$; $A = ?$

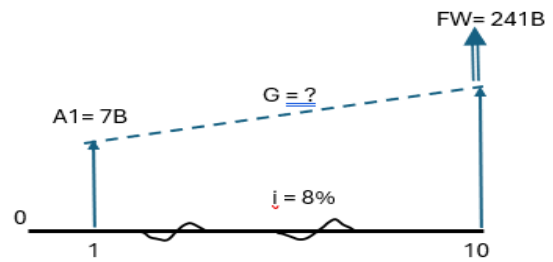
$$FW = [A_1 + G (A/G, 8\%, 10)] (F/A, 8\%, 10)$$

$$241 = [7 + G (3.871)] (14.487) \Rightarrow (241/14.487) - 7 = G (3.871)$$

$$G = 9.636/3.871 = \mathbf{2.49 \text{ Billion}}$$

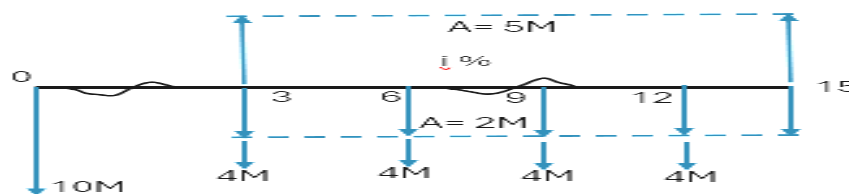
$$\mathbf{\text{Equivalent Annual Value } A = A_1 + G (A/G, 8\%, 10) = 7 + 2.49 (A/G, 8\%, 10)}$$

$$= 7 + 2.49 (3.871) = \mathbf{16.64 \text{ Billion}}$$



Q13. A new plant to produce tractor gears requires an initial investment of \$10 million. It is expected that an additional investment of \$4 million will be needed every 3 years to upgrade the plant. The plant is expected to start producing gears 2 years after the initial investment is made (at the start of the third year). Annual costs of production are expected to be \$2 million per year. Revenues of \$5 million per year are expected to begin to flow at the start of the fourth year. The plant has a 15-year life.

- a) Draw the cash flow diagram.
b) Write the equation to determine the Present Worth **(3)**



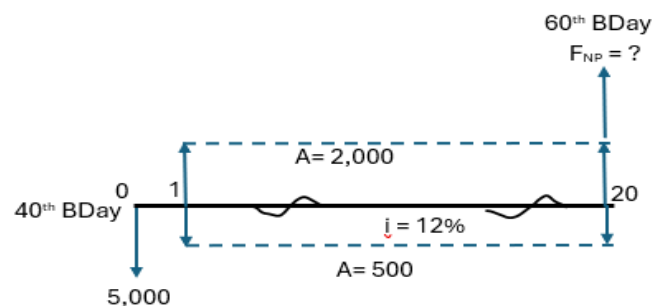
$$\mathbf{PW = -10M - 4M (P/F, i, 3) - 4M (P/F, i, 6) - 4M (P/F, i, 9) - 4M (P/F, i, 12) + (5M - 2M) (P/A, i, 13) (P/F, i, 2)}$$

Q14. An engineer is thinking of starting a part-time consulting business on his 40th birthday. He expects the business will require an initial cost of \$5000, to come from his savings, and will cost \$500 per year to operate; the business ought to generate \$2000 per year in cash receipts. During the 20 years that he expects to operate the business, he plans to deposit the annual net proceeds in a bank each year, at an interest rate of 12% per year, compounded annually. When he retires, on his 60th birthday, the engineer expects to invest whatever proceeds plus interest he then has from the business in a long-term savings plan that pays 15% per year, compounded annually. What is the maximum amount he could withdraw from the savings plan each year during his retirement and still have the funds last 15 years **(4)**

$$F_{NP} = -5000 (1 + i)^{20} + 1500 (F/A, i=12\%, 20)$$

$$= -5000 (9.646) + 1500 (72.052)$$

$$= \mathbf{59,848}$$



Withdrawal amount for 15 years retirement $A = ?$, $i = 15\%$

$$A = F_{NP} (A/P, i=15\%, 15) = 59,848 (0.1710) = \mathbf{10,234}$$

