UNIT – 3 CASH FLOW

Part – A

1. **State the limitations of present worth method. (N/D ’17)**

   The biggest disadvantage to the net present worth method is that it requires some guesswork about the firm's cost of capital. Assuming a cost of capital that is too low will result in making suboptimal investments. Assuming a cost of capital that is too high will result in forgoing too many good investments.

2. **What is the concept of future worth method of comparison? (A/M ’17) (A/M ’15)**

   In the future worth method of comparison of alternatives, the future worth of various alternatives will be computed. Then, the alternative with the maximum future worth of net revenue or with the minimum future worth of net cost will be selected as the best alternative for implementation.

3. **State the applications of rate of return method? (A/M ’17)**

   In most of the practical decision environments, executives will be forced to select the best alternative from a set of competing alternatives. Rate of return is one of the method for comparing the worthiness of the projects.

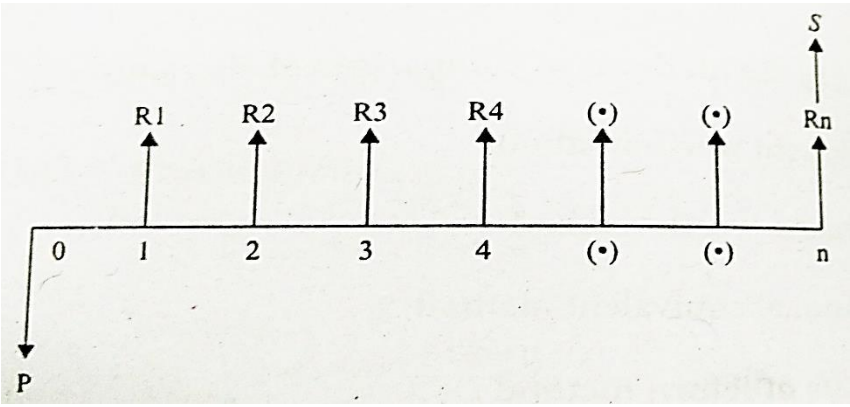
4. **What is rate of return method of evaluating projects? (A/M ’16) (A/M ’15) (M/J ’13)**

   The rate of return of a cash flow pattern is the interest rate at which the present worth of that cash flow pattern reduces to zero. In this method of comparison, the rate of return for each alternative is computed. Then the alternative which has the highest rate of return is selected as the best alternative.

5. **What is revenue dominated cash flow? (N/D ’16)**

   In a revenue/profit-dominated cash flow diagram, the profit, revenue, salvage value (all inflows to an organization) will be assigned with positive sign. The costs (outflows) will be assigned with negative sign.

   P represents an initial investment and *Rn* the net revenue at the end of the *n*th year. The interest rate is *i*, compounded annually. *S* is the salvage value at the end of the *n*th year.



   The alternative with the maximum amount should be selected as the best alternative.

6. **What are the methods of cash flow? (N/D ’15)**
   - Revenue dominated cash flow
   - Cost dominated cash flow

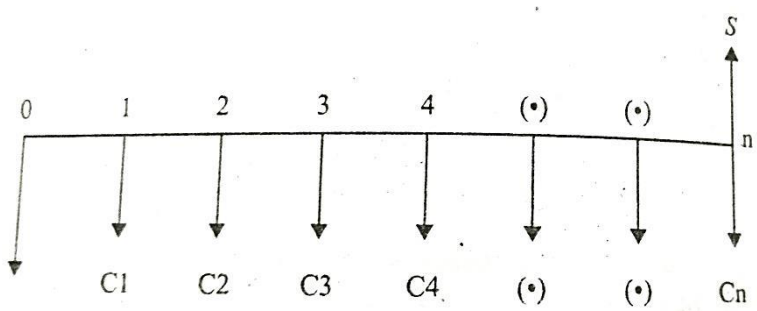
7. **What is annual equivalent method of comparing alternatives? (N/D ’15) (N/D ’13)**

In the annual equivalent method of comparison, first the annual equivalent cost or the revenue of each alternative will be computed. Then the alternative with the maximum annual equivalent revenue in the case of revenue-based comparison or with the minimum annual equivalent cost in the case of cost based comparison will be selected as the best alternative.

8. **What is cost dominated cash flow diagram? (M/J ’13)**

In a cost dominated cash flow diagram, the costs (outflows) will be assigned with positive sign and the profit, revenue, salvage value (all inflows), etc. will be assigned with negative sign.

P represents an initial investment, *Cn* the net cost of operation and maintenance at the end of the *n*th year, and *S* the salvage value at the end of the *n*th year.



The alternative with the minimum amount should be selected as the best alternative.

9. **What is the concept of present worth method of comparison? (N/D ’13)**

In present worth method of comparison, the cash flows of each alternative will be reduced to time zero by assuming an interest rate *i*. Then, depending on the type of decision, the best alternative will be selected by comparing the present worth amounts of the alternatives.

In case the decision is to select the alternative with the minimum cost, then the alternative with the least present worth amount will be selected. On the other hand, if the decision is to select the alternative with the maximum profit, then the alternative with the maximum present worth will be selected.

Part – B

1. **Compare and contrast the present worth method with future worth method? (16 marks) (N/D ’17) (A/M ’17)**

Present worth method

In present worth method of comparison, the cash flows of each alternative will be reduced to time zero by assuming an interest rate *i*. Then, depending on the type of decision, the best alternative will be selected by comparing the present worth amounts of the alternatives.

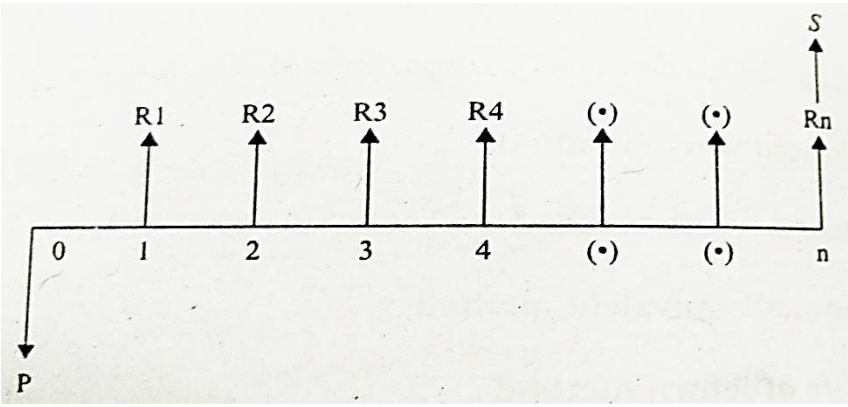
In case the decision is to select the alternative with the minimum cost, then the alternative with the least present worth amount will be selected. On the other hand, if

the decision is to select the alternative with the maximum profit, then the alternative with the maximum present worth will be selected.

Revenue dominated cash flow

In a revenue/profit-dominated cash flow diagram, the profit, revenue, salvage value (all inflows to an organization) will be assigned with positive sign. The costs (outflows) will be assigned with negative sign.

P represents an initial investment and *Rn* the net revenue at the end of the *n*th year. The interest rate is *i*, compounded annually. *S* is the salvage value at the end of the *n*th year.



To find the present worth of the above cash flow diagram for a given interest rate, the formula is

$PW(i) = -P + R1[1/(1 + i)1] + R2[1/(1 + i)2] + ... + Rj[1/(1 + i)\ j] + Rn[1/(1 + i)n] + S[1/(1 + i)n]$

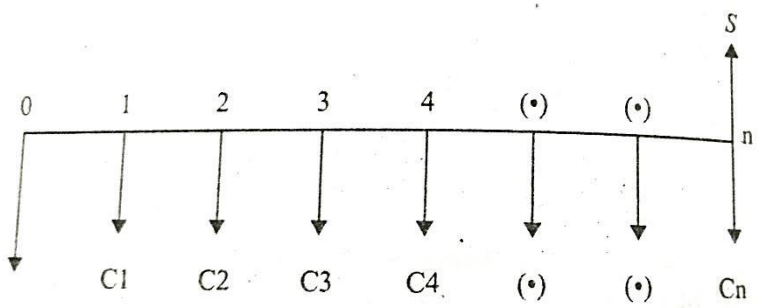
In this formula, expenditure is assigned a negative sign and revenues are assigned a positive sign.

If we have some more alternatives which are to be compared with this alternative, then the corresponding present worth amounts are to be computed and compared. Finally, the alternative with the maximum present worth amount should be selected as the best alternative.

Cost dominated cash flow diagram

In a cost dominated cash flow diagram, the costs (outflows) will be assigned with positive sign and the profit, revenue, salvage value (all inflows), etc. will be assigned with negative sign.

P represents an initial investment, *Cn* the net cost of operation and maintenance at the end of the *n*th year, and *S* the salvage value at the end of the *n*th year.



To compute the present worth amount of the above cash flow diagram for a given interest rate *i*, we have the formula

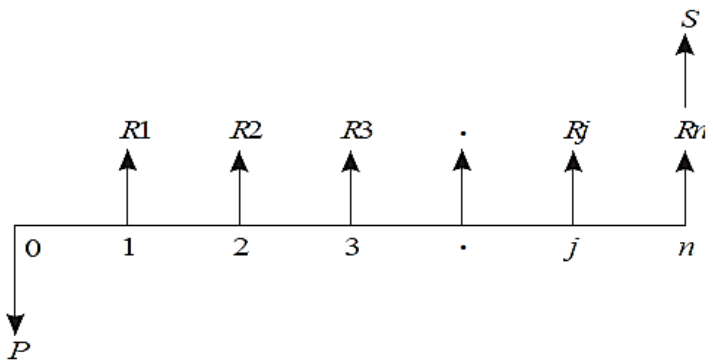
$PW(i) = P + C1[1/(1 + i)1] + C2[1/(1 + i)2] + ... + Cj[1/(1 + i)\ j] + Cn[1/(1 + i)n] – S[1/(1 + i)n]$

In the above formula, the expenditure is assigned a positive sign and the revenue a negative sign. If we have some more alternatives which are to be compared with this alternative, then the corresponding present worth amounts are to be computed and compared. Finally, the alternative with the minimum present worth amount should be selected as the best alternative.

Future worth method of comparison

In the future worth method of comparison of alternatives, the future worth of various alternatives will be computed. Then, the alternative with the maximum future worth of net revenue or with the minimum future worth of net cost will be selected as the best alternative for implementation.

A generalized revenue-dominated cash flow diagram to demonstrate the future worth method of comparison is presented in Fig.



In Fig., *P* represents an initial investment, *Rj* the net-revenue at the end of the *j*th year, and *S* the salvage value at the end of the *n*th year.

The formula for the future worth of the above cash flow diagram for a given interest rate, *i* is

$FW(i) = –P(1 + i)n + R1(1 + i)n–1 + R2(1 + \mathrm{i})n–2 + ... + Rj(1 + i)n–j + ... + Rn + S$

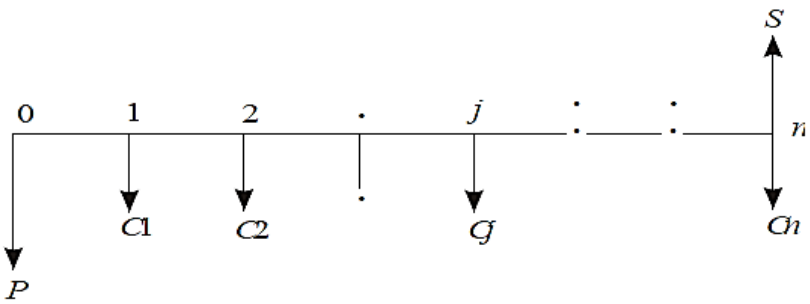
In the above formula, the expenditure is assigned with negative sign and the revenues are assigned with positive sign.

If we have some more alternatives which are to be compared with this alternative, then the corresponding future worth amounts are to be computed and compared. Finally, the alternative with the maximum future worth amount should be selected as the best alternative.

Cost-dominated cash flow diagram

A generalized cost-dominated cash flow diagram to demonstrate the future worth method of comparison is given in Fig.

In Fig, *P* represents an initial investment, *Cj* the net cost of operation and maintenance at the end of the *j*th year, and *S* the salvage value at the end of the *n*th year.



The formula for the future worth of the above cash flow diagram for a given interest rate, *i* is

$FW(i) = P(1 + i)n + C1(1 + i)n–1 + C2(1 + i)n–2 + ... + Cj(1 + i)n–j + ... + Cn – S$

In this formula, the expenditures are assigned with positive sign and revenues with negative sign. If we have some more alternatives which are to be compared with this alternative, then the corresponding future worth amounts are to be computed and compared. Finally, the alternative with the minimum future worth amount should be selected as the best alternative.

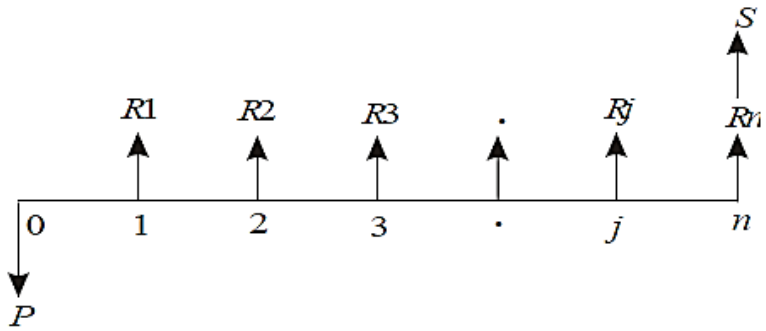
2. With suitable example compare the Annual Equivalent Method with rate of return method. (16 marks) (N/D ’17)

Annual equivalent method

In the annual equivalent method of comparison, first the annual equivalent cost or the revenue of each alternative will be computed. Then the alternative with the maximum annual equivalent revenue in the case of revenue-based comparison or with the minimum annual equivalent cost in the case of cost based comparison will be selected as the best alternative.

Revenue-dominated cash flow diagram

A generalized revenue-dominated cash flow diagram to demonstrate the annual equivalent method of comparison is presented in Fig.



In Fig., P represents an initial investment, Rj the net revenue at the end of the *j*th year, and S the salvage value at the end of the nth year. The first step is to find the net present worth of the cash flow diagram using the following expression for a given interest rate, i:

PW(i) = –P + R1/(1 + i)1 + R2/(1 + i)2 + ... + Rj/(1 + i) j + ... + Rn/(1 + i)n + S/(1 + i)n

In the above formula, the expenditure is assigned with a negative sign and the revenues are assigned with a positive sign.

In the second step, the annual equivalent revenue is computed using the following formula:

$$A = PW(i)\ \frac{i(1+i)^n}{(1+i)^n - 1}$$

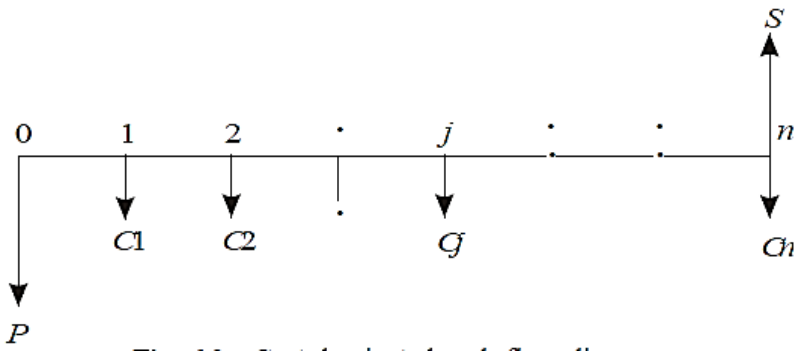
= PW(i) (A/P, i, n)

where (A/P, i, n) is called equal payment series capital recovery factor.

If we have some more alternatives which are to be compared with this alternative, then the corresponding annual equivalent revenues are to be computed and compared. Finally, the alternative with the maximum annual equivalent revenue should be selected as the best alternative.

Cost-dominated cash flow diagram

A generalized cost-dominated cash flow diagram to demonstrate the annual equivalent method of comparison is illustrated in Fig.



In Fig., P represents an initial investment, Cj the net cost of operation and maintenance at the end of the jth year, and S the salvage value at the end of the *n*th year.

The first step is to find the net present worth of the cash flow diagram using the following relation for a given interest rate, i.

$PW(i) = P + C1/(1 + i)1 + C2/(1 + i)2 + ... + Cj/(1 + i)\ j + ... + Cn/(1 + i)^n – S/(1 + i)^n$

In the above formula, each expenditure is assigned with positive sign and the salvage value with negative sign. Then, in the second step, the annual equivalent cost is computed using the following equation:

$$A = PW(i)\ \frac{i(1+i)^n}{(1+i)^n - 1}$$

= PW(i) (A/P, i, n)

where (A/P, i, n) is called as equal-payment series capital recovery factor.

As in the previous case, if we have some more alternatives which are to be compared with this alternative, then the corresponding annual equivalent costs are to be computed and compared. Finally, the alternative with the minimum annual equivalent cost should be selected as the best alternative.

If we have some non-standard cash flow diagram, then we will have to follow the general procedure for converting each and every transaction to time zero and then convert the net present worth into an annual equivalent cost/revenue depending on the

type of the cash flow diagram. Such procedure is to be applied to all the alternatives and finally, the best alternative is to be selected.

Rate of return method

The rate of return of a cash flow pattern is the interest rate at which the present worth of that cash flow pattern reduces to zero. In this method of comparison, the rate of return for each alternative is computed. Then the alternative which has the highest rate of return is selected as the best alternative.

In this type of analysis, the expenditures are always assigned with a negative sign and the revenues/inflows are assigned with a positive sign. A generalized cash flow diagram to demonstrate the rate of return method of comparison is presented in Fig.

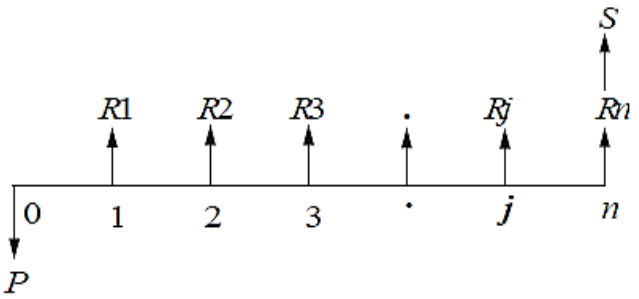


Fig. 7.1 Generalized cash flow diagram.

In the above cash flow diagram, P represents an initial investment, Rj the net revenue at the end of the *j*th year, and S the salvage value at the end of the *n*th year.

The first step is to find the net present worth of the cash flow diagram using the following expression at a given interest rate, *i*.

PW(i) = – P + R1/(1 + i)1 + R2/(1 + i)2 + ... + Rj/(1 + i) j + ... + Rn/(1 + i)n + S/(1 + i)n

Now, the above function is to be evaluated for different values of *i* until the present worth function reduces to zero, as shown in Fig.

In the figure, the present worth goes on decreasing when the interest rate is increased. The value of i at which the present worth curve cuts the X-axis is the rate of return of the given proposal/project. It will be very difficult to find the exact value of i at which the present worth function reduces to zero.

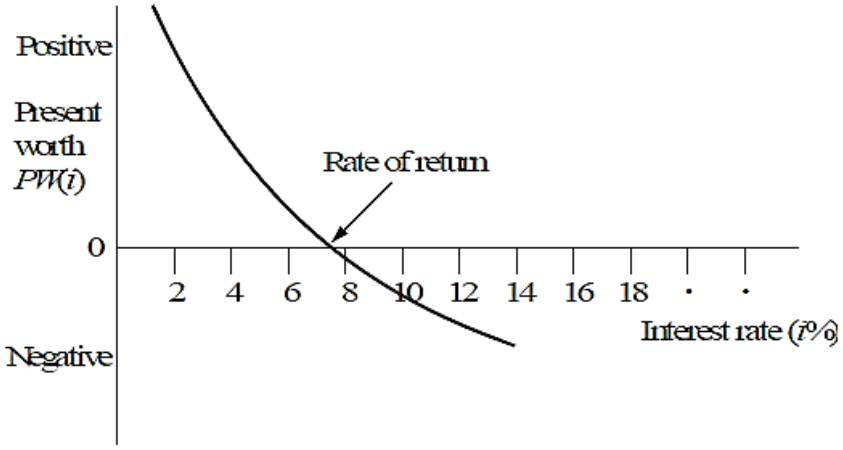


Fig. 7.2 Present worth function graph.

So, one has to start with an intuitive value of i and check whether the present worth function is positive. If so, increase the value of i until PW(*i*) becomes negative. Then, the rate of return is determined by interpolation method in the range of values of *i* for which the sign of the present worth function changes from positive to negative.

3. **Data on two mutually exclusive investment options are as follows:**
Cash flow in lakhs of rupees at the end of year

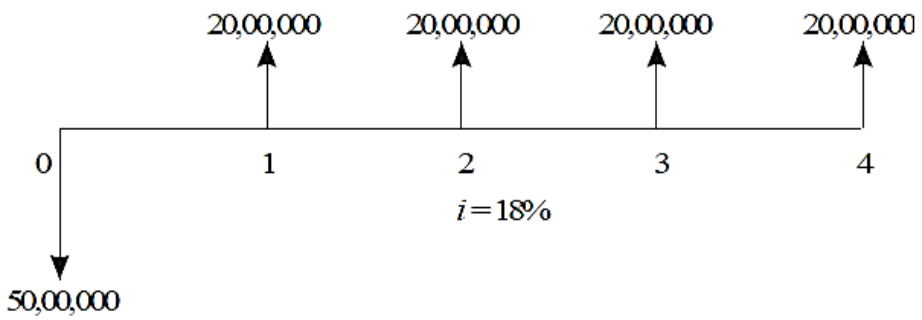
Alternative	0	1	2	3	4
A	-50	20	20	20	20
B	-45	18	18	18	18

Find the best option taking 18% interest by future worth method. (10 marks) (A/M '17)

Solution

Alternative A

Initial investment, P = Rs. 50,00,000
Annual equivalent revenue, A = Rs. 20,00,000
Interest rate, i = 18%, compounded annually
Life of alternative A = 4 years
The cash flow diagram of alternative A is shown in Fig.

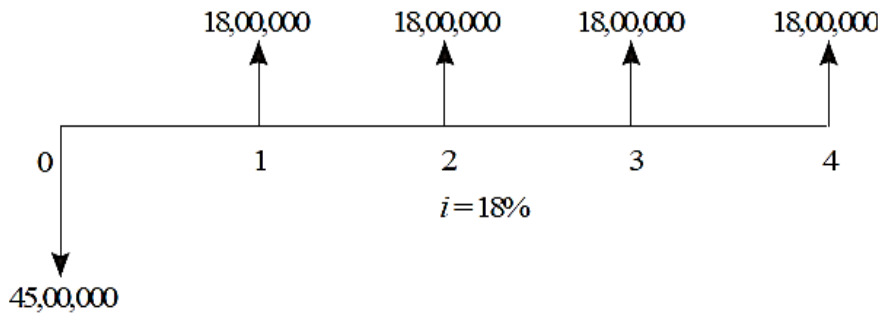


The future worth amount of alternative B is computed as

FWA(18%) = –50,00,000(F/P, 18%, 4) + 20,00,000(F/A, 18%, 4)
= –50,00,000(1.939) + 20,00,000(5.215)
= Rs. 7,35,000

Alternative B

The cash flow diagram of alternative B is illustrated in Fig.



Initial investment, P = Rs. 45,00,000
Annual equivalent revenue, A = Rs. 18,00,000
Interest rate, i = 18%, compounded annually
Life of alternative B = 4 years

The future worth amount of alternative B is computed as

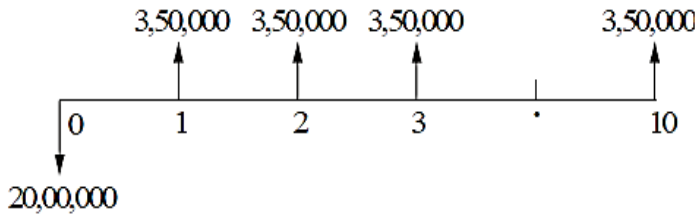
FWB(18%) = – 45,00,000(F/P, 18%, 4) + 18,00,000 (F/A, 18%, 4)
= –45,00,000(1.939) + 18,00,000(5.215)
= Rs. 6,61,500

The future worth of alternative A is greater than that of alternative B. Thus, alternative A should be selected.

4. **A firm is diversifying into a new business. The life of the business is 10 years without any salvage value at the end of the life. The initial outlay required is Rs. 20,00,000/- and the annual net profit estimated is Rs. 3,50,000/-. Find the rate of return for the new business. Check whether the business is worth for a cost of capital of 12%. (16 marks) (A/M '17)**

Solution
Life of the product line (n) = 10 years
Initial outlay = Rs. 20,00,000
Annual net profit = Rs. 3,50,000
Scrap value after 10 years = 0

The cash flow diagram for this situation is shown in Fig.



The formula for the net present worth function of the situation is

$PW(i) = -20,00,000 + 3,50,000(P/A, i, 10)$

When i = 10%,

$PW(10\%) = -20,00,000 + 3,50,000(P/A, 10\%, 10)$
$= -20,00,000 + 3,50,000(6.1446)$
= Rs. 1,50,610.

When i = 12%,

$PW(12\%) = -20,00,000 + 3,50,000(P/A, 12\%, 10)$
$= -20,00,000 + 3,50,000(5.6502)$
= Rs. –22,430.

$$i = 10\% + \frac{1,50,610 - 0}{1,50,610 - (-22,430)} \times (2\%)$$

= 11.74 %

Therefore, the rate of return of the new product line is 11.74%

5. **Alpha Industry is planning to expand its production operation. It has identified three different technologies for meeting the goal. The initial outlay and annual revenues with respect to each of the technologies are summarized in Table. Suggest the best technology which is to be implemented based on the present worth method of comparison assuming 20% interest rate, compounded annually. (16 marks) (A/M '16)**

	***Initial outlay* (Rs.)**	***Annual revenue (*Rs.)**	***Life* (years)**
Technology 1	**12,00,000**	**4,00,000**	**10**
Technology 2	**20,00,000**	**6,00,000**	**10**
Technology 3	**18,00,000**	**5,00,000**	**10**

Solution

In all the technologies, the initial outlay is assigned a negative sign and the annual revenues are assigned a positive sign.

TECHNOLOGY 1

Initial outlay, P = Rs. 12,00,000
Annual revenue, A = Rs. 4,00,000
Interest rate, i = 20%, compounded annually
Life of this technology, n = 10 years
The cash flow diagram of this technology is as shown in Fig.

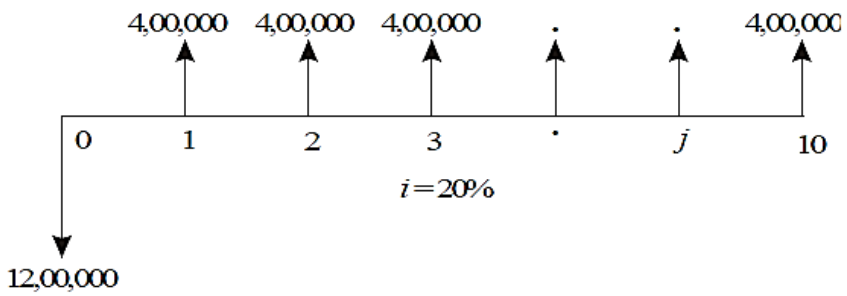


Fig. 4.3 Cash flow diagram for technology 1.

The present worth expression for this technology is

$PW(20\%)_1$ = –12,00,000 + 4,00,000 x (P/A, 20%, 10)
= –12,00,000 + 4,00,000 x (4.1925)
= –12,00,000 + 16,77,000
= Rs. 4,77,000

TECHNOLOGY 2

Initial outlay, P = Rs. 20,00,000
Annual revenue, A = Rs. 6,00,000
Interest rate, i = 20%, compounded annually
Life of this technology, n = 10 years
The cash flow diagram of this technology is shown in Fig.

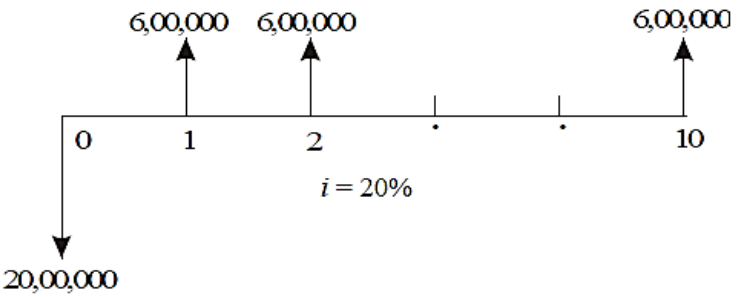


Fig. 4.4 Cash flow diagram for technology 2.

The present worth expression for this technology is

$PW(20\%)_2$ = – 20,00,000 + 6,00,000 x(P/A, 20%, 10)
= – 20,00,000 + 6,00,000 x(4.1925)
= – 20,00,000 + 25,15,500
= Rs. 5,15,500

TECHNOLOGY 3

Initial outlay, P = Rs. 18,00,000
Annual revenue, A = Rs. 5,00,000
Interest rate, i = 20%, compounded annually
Life of this technology, n = 10 years
The cash flow diagram of this technology is shown in Fig.

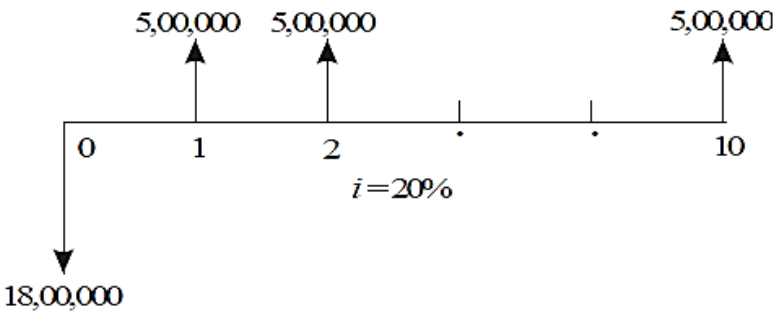


Fig. 4.5 Cash flow diagram for technology 3.

The present worth expression for this technology is

$PW(20\%)_3$ = –18,00,000 + 5,00,000 x (P/A, 20%, 10)
= –18,00,000 + 5,00,000 x (4.1925)
= –18,00,000 + 20,96,250
= Rs. 2,96,250

From the above calculations, it is clear that the present worth of technology 2 is the highest among all the technologies. Therefore, technology 2 is suggested for implementation to expand the production.