Meaning and Methods of Accounting Depreciation

Introduction

- Any equipment which is purchased today will not work for ever. This may be due to wear and tear of the equipment or obsolescence of technology.

- Hence, it is to be replaced at the proper time for continuance of any business. The replacement of the equipment at the end of its life involves money.

- The recovery of money from the earnings of an equipment for its replacement purpose is called depreciation fund since we make an assumption that the value of the equipment decreases with the passage of time.

- Thus, the word "depreciation" means decrease in value of any physical asset with the passage of time.

Meaning:

- Depreciation is the decrease in the value of physical properties with the passage of time and use.

- It can be defined in three senses:
  - Physical Depreciation: caused due to physical decay
  - Economic Depreciation: Loss of value of an asset due to outdated technology
  - Accounting Depreciation: Estimated value of fall in the worth of an asset

Methods of Accounting Depreciation

1. Straight line method of depreciation
2. Declining balance method of depreciation
3. Sum of the years-digits method of depreciation
4. Sinking-fund method of depreciation
5. Service output method of depreciation

Straight Line Method of Depreciation

- In this method of depreciation, a fixed sum is charged as the depreciation amount throughout the lifetime of an asset such that the accumulated sum at the end of the life of the asset is exactly equal to the purchase value of the asset.

Straight Line Method of Depreciation

- **Notations:**

P = Purchase Price or First Cost of the Asset

F (or S) = Salvage Value of the asset

n = Life of the asset

B_t = Book Value of the asset at the end of the period t.

D_t = Depreciation amount for the period t.

- **Formula:**

$D_t = (P-F)/n$

$B_t = B_{t-1} - D_t = P - t[(P-F)/n]$

Example-1

- A company has purchased an equipment whose first cost is Rs. 1,00,000 with an estimated life of eight years. The estimated salvage value of the equipment at the end of its lifetime is Rs. 20,000. Determine the depreciation charge and book value at the end of various years using the straight line method of depreciation.

Solution-1

P = Rs. 1,00,000 / F = Rs. 20,000 / n = 8 years

- $D_t = (P - F)/n = (1,00,000 - 20,000)/8 = Rs. 10,000$
- The value of D_t is the same for all the years. The calculations pertaining to B_t for different values of t

End of year (t)	Depreciation (D_t)	Book value ($B_t = B_{t-1} - D_t$)
0		1,00,000
1	10,000	90,000
2	10,000	80,000
3	10,000	70,000
4	10,000	60,000
5	10,000	50,000
6	10,000	40,000
7	10,000	30,000
8	10,000	20,000

Example-2

- Consider Example 9.1 and compute the depreciation and the book value for period 5.

Declining Balance Method of Depreciation

- In this method of depreciation, a constant percentage of the book value of the previous period of the asset will be charged as the depreciation amount for the current period.

- **Notations:**

P = Purchase Price or First Cost of the Asset

F (or S) = Salvage Value of the asset

n = Life of the asset

B_t = Book Value of the asset at the end of the period t.

K = a fixed percentage

D_t = Depreciation amount for the period t.

Declining Balance Method of Depreciation

● **Formula:**

$D_t = K \times B_{t-1}$

$B_t = B_{t-1} - D_t = B_{t-1} - K \times B_{t-1} = (1\text{-}K) \times B_{t-1}$

The Formula for depreciation and book value in terms of P are as follows:

$D_t = K(1\text{-}K)^{t-1} \times P$

$B_t = (1\text{-}K)^t \times P$

Example -1

- A Company has purchased an equipment whose first cost is Rs. 100000 with an estimated life of eight years. The estimated salvage value of the equipment at the end of its lifetime is Rs. 20000. Demonstrate the calculations of the Declining Balance Method of Depreciation by assuming 0.2 for K.

Solution-1

- $P = Rs.\ 1,00,000\ /\ F = Rs.\ 20,000\ /\ n = 8\ years\ /\ K = 0.2$
- $D_t = K \times B_{t-1}$
- $B_t = B_{t-1} - D_t$

End of year (n)	Depreciation (D_t)	Book value (B_t)
0		1,00,000.00
1	20,000.00	80,000.00
2	16,000.00	64,000.00
3	12,800.00	51,200.00
4	10,240.00	40,960.00
5	8,192.00	32,768.00
6	6,553.60	26,214.40
7	5,242.88	20,971.52
8	4,194.30	16,777.22

Example 1.1

- Consider Example 9.1 and calculate the depreciation and the book value for period 5 using the declining balance method of depreciation by assuming 0.2 for K.

- Solution:-

- $D_t = K(1-K)^{t-1} \times P$

- $B_t = (1-K)^t \times P$

$D_t = K(1 - K)^{t-1} \times P$

$D_5 = 0.2(1 - 0.2)^4 \times 1,00,000$

$\quad = \text{Rs. } 8,192$

$B_t = (1 - K)^t \times P$

$B_5 = (1 - 0.2)^5 \times 1,00,000$

$\quad = \text{Rs. } 32,768$

Sum-of-the-Years-Digits Method of Depreciation

- In this method of depreciation also, it is assumed that the book value of the asset decreases at a decreasing rate. If the asset has a life of eight years, first the sum of the years is computed as

- Sum of the years = $1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 = 36$ $= n(n + 1)/2$

- The rate of depreciation charge for the first year is assumed as the highest and then it decreases. The rates of depreciation for the years 1–8, respectively are as follows: 8/36, 7/36, 6/36, 5/36, 4/36, 3/36, 2/36, and 1/36.

Formula:-

- For any year, the depreciation is calculated by multiplying the corresponding rate of depreciation with (P – F).

- D_t = Rate (P – F)

- $B_t = B_{t-1} - D_t$

- The formulae for D_t and B_t for a specific year t are as follows:

$$D_t = \frac{n - t + 1}{n(n + 1)/2} (P - F)$$

$$B_t = (P - F) \frac{(n - t)}{n} \frac{(n - t + 1)}{(n + 1)} + F$$

Example :- 1.1

- A Company has purchased an equipment whose first cost is Rs. 100000 with an estimated life of eight years. The estimated salvage value of the equipment at the end of its lifetime is Rs. 20000. Demonstrate the calculations of the Sum-of-the-years-digits Method of Depreciation.

Solution:-

P = Rs. 1,00,000 / F = Rs. 20,000 / n = 8 years

- Sum = $n(n + 1)/2 = 8$ _x0002_ $9/2 = 36$

The rates for years 1–8, are respectively 8/36, 7/36, 6/36, 5/36, 4/36, 3/36, 2/36 and 1/36.

- The calculations of D_t and B_t for different values of t are summarized in

$D_t = \text{Rate} (P - F)$ / $B_t = B_{t-1} - D_t$

End of year (n)	Depreciation (D_t)	Book value (B_t)
0		1,00,000.00
1	17,777.77	82,222.23
2	15,555.55	66,666.68
3	13,333.33	53,333.35
4	11,111.11	42,222.24
5	8,888.88	33,333.36
6	6,666.66	26,666.70
7	4,444.44	22,222.26
8	2,222.22	20,000.04

Example 1.2

From the Example 1.1; find the depreciation and book value for the 5th year using the sum-of-the-years-digits method of depreciation.

$$D_t = \frac{n - t + 1}{n(n + 1)/2} (P - F)$$

$$D_5 = \frac{8 - 5 + 1}{8(8 + 1)/2} (1,00,000 - 20,000)$$

$$= \text{Rs. } 8,888.88$$

$$B_t = (P - F) \frac{n - t}{n} \frac{n - t + 1}{n + 1} + F$$

$$B_5 = (1,00,000 - 20,000) \frac{8 - 5}{8} \frac{8 - 5 + 1}{8 + 1} + 20,000$$

$$= 80,000 \times (3/8) \times (4/9) + 20,000$$

$$= \text{Rs. } 33,333.33$$

Sinking Fund Method of Depreciation

- In this method of depreciation, the book value decreases at increasing rates with respect to the life of the asset.
- The loss in value of the asset (P – F) is made available an the form of cumulative depreciation amount at the end of the life of the asset by setting up an equal depreciation amount (A) at the end of each period during the lifetime of the asset.
- A = (P – F) [A/F, i, n]
- The fixed sum depreciated at the end of every time period earns an interest at the rate of i% compounded annually, and hence the actual depreciation amount will be in the increasing manner with respect to the time period.
- D_t = (P – F) (A/F, i, n) (F/P, i, t – 1)

Formula:-

- **Notations:**

P = Purchase Price or First Cost of the Asset

F (or S) = Salvage Value of the asset

n = Life of the asset

i = Rate of return compounded annually

A = Annual Equivalent Amount

B_t = Book Value of the asset at the end of the period t.

D_t = Depreciation amount for the period t.

- **Formula:**

$D_t = (P-F) \times (A/F, i, n) \times (F/P, i, t-1)$

$B_t = P - (P-F) \times (A/F, i, n) \times (F/A, i, t)$

Where $(A/F, i, n) = \dfrac{i}{(1+i)^n - 1}$,

$(F/A, i, t) = \dfrac{(1+i)^t - 1}{i}$ and

$(F/P, i, t-1) = (1+i)^{t-1}$

Example 1.1

● A Company has purchased an equipment whose first cost is Rs. 100000 with an estimated life of eight years. The estimated salvage value of the equipment at the end of its lifetime is Rs. 20000. Give the calculations regarding the sinking fund method of depreciation with an interest rate of 12%, compounded annually.

● Solution 1.1 :-

P = Rs. 1,00,000   / F = Rs. 20,000   / n = 8 years / i = 12%

$A = (P - F)\dfrac{i}{(1 + i)^n - 1}$ = (1,00,000 – 20,000) 0.0813 = Rs. 6,504

 a fixed amount of Rs. 6,504 will be depreciated at the end of every year from the earning of the asset. The depreciated amount will earn interest for the remaining period of life of the asset at an interest rate of 12%, compounded annually.

● Solution 1.1 :-

Depreciation at the end of year 1 (D1) = Rs. 6,504.

Depreciation at the end of year 2 (D2) = 6,504 + 6,504 x 0.12 = Rs. 7,284.48

Depreciation at the end of the year 3 (D3)

= 6,504 + (6,504 + 7,284.48) x 0.12 = Rs. 8,158.62

Depreciation at the end of year 4 (D4)

= 6,504 + (6,504 + 7,284.48 + 8,158.62) x 0.12 = Rs. 9,137.65

End of year t	Fixed depreciation (Rs.)	Net depreciation D_t (Rs.)	Book value B_t (Rs.)
0	6,504	–	1,00,000.00
1	6,504	6,504.00	93,496.00
2	6,504	7,284.48	86,211.52
3	6,504	8,158.62	78,052.90
4	6,504	9,137.65	68,915.25
5	6,504	10,234.17	58,681.08
6	6,504	11,462.27	47,218.81
7	6,504	12,837.74	34,381.07
8	6,504	14,378.27	20,002.80

Example 1.2

Consider Example 1.1; compute D5 and B7 using the sinking fund method of depreciation with an interest rate of 12%, compounded annually.

$D_t = (P - F) \dfrac{i}{(1 + i)^n - 1} (1 + i)^{t-1}$

$D_5 = (1,00,000 - 20,000) \times 0.0813 \times 1.574 = Rs. 10,237.30$

$B_t = P - (P - F) \times \dfrac{i}{(1 + i)^n - 1} \times \dfrac{(1 + i)^t - 1}{i}$

$B_7 = 1,00,000 - (1,00,000 - 20,000) \times 0.0813 \times 10.089$

$= 34,381.10$

Service Output Method of Depreciation

The depreciation is computed based on service rendered by an asset.

P = first cost of the asset

F = salvage value of the asset

X = maximum capacity of service of the asset during its lifetime

x = quantity of service rendered in a period.

Then, the depreciation is defined per unit of service rendered:

Depreciation/unit of service = (P – F)/X

Depreciation for x units of service in a period = ((P - F)/X)* (x)

Example 1:

The first coat of a road laying machine is Rs. 80,00,000. Its salvage value after five years is Rs. 50,000. The length of road that can be laid by the machine during its lifetime is 75,000 km. In its third year of operation, the length of road laid is 2,000 km. Find the depreciation of the equipment for that year.
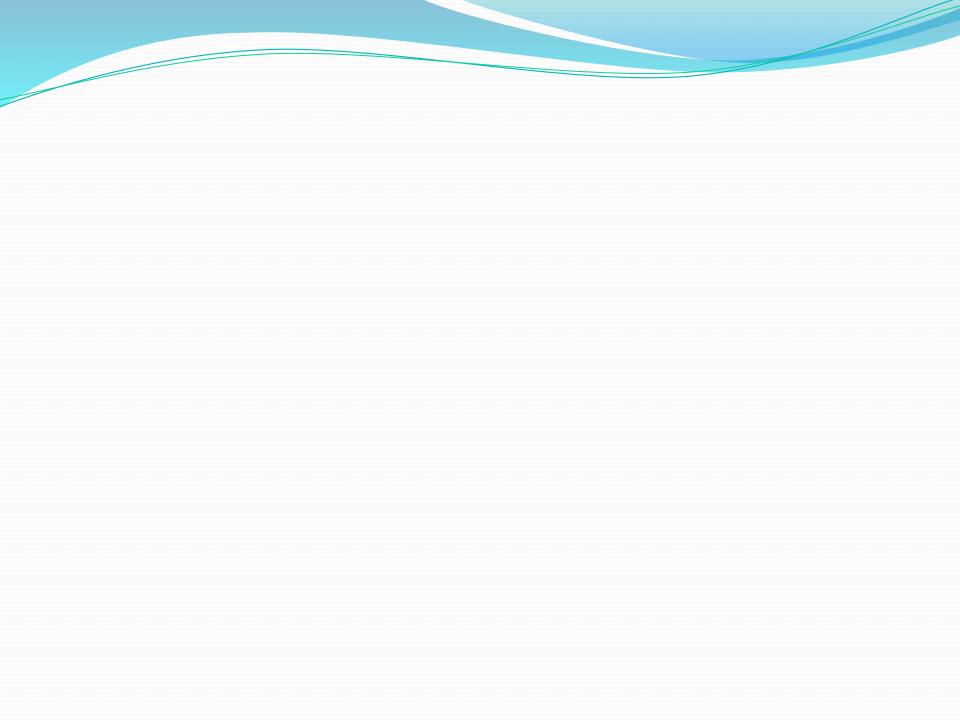
Solution :

P = Rs. 80,00,000

F = Rs. 50,000

X = 75,000 km

x = 2,000 km

Depreciation for x units of service in a period

= $((P - F)/X) * (x)$

Depreciation for year 3

= $((80,00,000 - 50,000)/75,000) * 2,000$ = Rs. 2,12,000

Example Practie

- The Alpha Drug Company has just purchased a capsulating machine for Rs. 20,00,000. The plant engineer estimates that the machine has a useful life of five years and a salvage value of Rs. 25,000 at the end of its useful life. Compute the depreciation schedule for the machine by each of the following depreciation methods:
- (a) Straight line method of depreciation
- (b) Sum-of-the-years digits method of depreciation
- (c) Double declining balance method of depreciation

Question 1.1

- To maintain the fitness culture, your University has purchased an equipment and installed in the indoor gym. The cost of the equipment is `5000000 and has a useful life of 6 years. The salvage value of the equipment is 10% of the purchase cost using Sinking Fund method and 12% interest rate calculate

- (i)the fixed depreciation.

- (ii)the net depreciation and book value at the end of each year.

Question 2.1

- A melting machine in a steel plant cost $400000. The salvage value of the machine is 12.5% of the purchase cost. The machine will provide service for 8 years.

- (i)Prepare a depreciation schedule for the tax purposes (Annual depreciation and Book value) by Declining Balance method. Use a depreciation rate of (200/N) percentage.

- (ii)Is the salvage value of the machine maintained in the record?

Question 2.2

- The cost of an equipment is Rs.300000. The salvage value of the asset at the end of 8 years is 10% of the purchase cost.

- (i)Calculate the net depreciation charge and book value of the asset at the end of each year by Sinking Fund Method. Use an interest rate of 12% compounded annually.

- (ii)Is the salvage value maintained in the record?

Question 3.1

- The cost of a machine is $400000. The machine can be used for 6 years. The Salvage value of the machine is 25% of the cost of the machine. Tabulate the net depreciation and book value of the machine for each year by sinking fund method. The interest rate is 12% compounded annually.

Question 4.1

- The cost of a machine is Rs.25,00,000. The salvage value of the machine at the end of its useful life of 8 years is 10% of the purchase value. Tabulate the annual depreciation and Book value of the asset for each year by Declining Balance method at the depreciation rate of 2/N (N is the life of the asset).