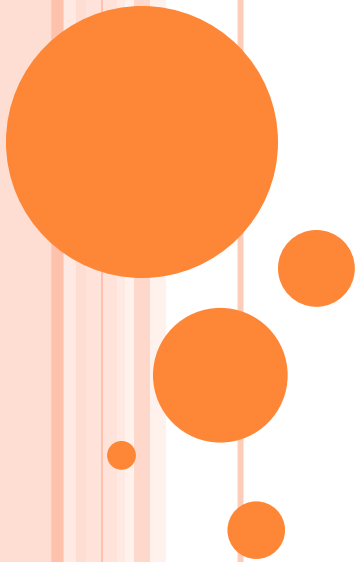


DEPRECIATION



- ▣ **Depreciation means a decrease in worth**
- ▣ **Reduction in the value of the physical asset with the passage of time is known as depreciation**



CAUSES OF DECLINING VALUE

- Assets depreciate in value for several reasons
- Assets decreasing worth may be attributed to **any** of the following reasons:

1. Physical depreciation:

□ Depreciation due to wear and tear:

- When any machinery performs work, **wear and tear** takes place, this can be **minimized through proper maintenance** but cannot be avoided
- The value of machine reduces due to wear and tear

□ Depreciation due to physical decay:

- Asset which gets **deteriorated due to atmospheric and climatic effects**, due to this the value decreases



❑ Accidental depreciation:

- ❑ Due to **rough operation** or some other reasons the machine may be damaged, due to these damages the value decreases

❑ Depreciation due to deferred maintenance:

- ❑ If the maintenance instructions are not properly followed then the assets value decreases

2. Functional depreciation

- **Depreciation due to inadequacy:**

- The equipment though it is in the **good condition** it has to be replaced by new one

e.g. There is a drilling machine to drill holes between 30mm and 50mm. There is a demand to drill holes beyond 50mm, though the present drilling machine is in good condition, it has to be replaced by new drilling machine



3. Technological depreciation

- ❑ **Depreciation due to obsolescence:**
- ❑ Because of **scientific advancement** of **new equipment** may come into the market which **reduces** the **cost of operation** and thereby the **cost of product manufacturing**, because of this reason the present equipment is to be replaced by the new equipment



4. Sudden failure:

- A **sudden or catastrophic loss** in value due to technological characteristics inherent in the asset
- Includes loss due to accident and misuse

e.g. Light bulbs burn out as a natural consequence of use and with little loss in operating efficiency up to the point of failure



5. Depletion:

- Consumption of an **exhaustible** natural resource to produce products or services

e.g. Removal of oil, timber, rock or minerals from a site decreases the value of the holding

- This decrease is compensated by a proportional reduction in earnings derived from the resource

□ 6. Monetary depreciation:

- A change in price levels is subtle but troublesome cause of decrease in the value of owned assets



Purpose of Charging Depreciation

- (1) To ascertain the true profit of the business
- (2) To show the true presentation of financial position
- (3) To provide funds for replacement of assets
- (4) To show the assets at its reasonable value in the balance sheet



Factors Affecting the Amount of Depreciation

Factors are to be considered while charging the amount of depreciation :

- (1) **The original cost of the asset**
- (2) **The useful life of the asset**
- (3) **Estimated scrap or residual value of the asset at the end of its life**
- (4) **Selecting an appropriate method of depreciation**



METHODS OF DEPRECIATION

Methods of accounting depreciation fund

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



Straight Line Method of Depreciation

- A **fixed sum** is charged as the **depreciation amount** throughout the lifetime of an asset
- The **accumulated sum** at the end of the life of the asset is **exactly equal to the purchase value** of the asset

Assumption: Inflation is absent

P = **First cost** of the asset

F = **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**



- The formulae for depreciation and book value are:

$$D_t = (P - F)/n$$

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



- ▣ e.g. 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

$$P = \text{Rs. } 1,00,000$$

$$F = \text{Rs. } 20,000$$

$$n = 8 \text{ years}$$

$$\begin{aligned} D_t &= (P - F)/n \\ &= (1,00,000 - 20,000)/8 \\ &= \text{Rs. } 10,000 \end{aligned}$$

- In this method of depreciation, the value of D_t is the same for all the years



D_t and B_t for different values of t

D_t and B_t Values under Straight line Method of Depreciation

<i>End of year (t)</i>	<i>Depreciation (D_t)</i>	<i>Book value (B_t = B_{t-1} - D_t)</i>
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



e.g.2 Using the data in **e.g. 1** compute the depreciation and the book value for period 5.

$$P = \text{Rs. } 1,00,000$$

$$F = \text{Rs. } 20,000$$

$$n = 8 \text{ years}$$

$$D_5 = (P - F)/n$$

$$= (1,00,000 - 20,000)/8$$

$$= \text{Rs. } 10,000 \text{ (This is independent of the time period)}$$

$$B_t = P - t(P - F)/n$$

$$B_5 = 1,00,000 - 5(1,00,000 - 20,000)/8$$

$$= \text{Rs. } 50,000$$



Declining Balance 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
- A **more realistic approach**, since the **depreciation charge decreases with the life** of the asset which matches with the earning potential of the asset

Limitation

- The book value at the end of the life of the asset **may not be exactly equal to the salvage value** of the asset



Declining Balance Method of Depreciation

Let

P = first cost of the asset

F = 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 at the end of the period t



depreciation and book value

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

$$\begin{aligned} B_t &= B_{t-1} - D_t = B_{t-1} - K \times B_{t-1} \\ &= (1 - K) \times B_{t-1} \end{aligned}$$

depreciation and book value in terms of P

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

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



- While availing **income-tax exemption** for the depreciation amount paid in each year, the **rate K** is limited to at the most **$2/n$**
- If rate equal to **$2/n$** is used, then the corresponding approach is called the **double declining balance method (DDB) of depreciation**



e.g. 3

Using the data in **e.g.1** demonstrate the calculations of the declining balance method of depreciation by assuming 0.2 for K.



Solution

- P = Rs. 1,00,000
- F = Rs. 20,000
- n = 8 years
- K = 0.2

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

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

D_t and *B_t* according to Declining Balance Method of Depreciation

<i>End of year</i> (<i>n</i>)	<i>Depreciation</i> (<i>D_t</i>)	<i>Book value</i> (<i>B_t</i>)
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



e.g. 4

- Using the data in **e.g.1** calculate the depreciation and the book value for period 5 using the declining balance method of depreciation by assuming 0.2 for K.



Solution

- $P = \text{Rs. } 1,00,000$
- $F = \text{Rs. } 20,000$
- $n = 8 \text{ years}$
- $K = 0.2$
- $T = 5^{\text{th}} \text{ year}$

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

$$\begin{aligned} D_5 &= 0.2(1 - 0.2)^4 \times 1,00,000 \\ &= \text{Rs. } 8,192 \end{aligned}$$

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

$$\begin{aligned} B_5 &= (1 - 0.2)^5 \times 1,00,000 \\ &= \text{Rs. } 32,768 \end{aligned}$$



Sum-of-the-Years-Digits(SOYD) Method of Depreciation

- Here, it is **assumed** that the **book value** of the asset **decreases at a decreasing rate**

e.g. If the asset has a life of **eight** years, the sum of the years is

$$\begin{aligned}\text{Sum of the years} &= 1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 \\ &= 36 = n(n + 1)/2\end{aligned}$$



- **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, are:**

Year 1= $8/36$

Year 2= $7/36$

Year 3= $6/36$

Year 4= $5/36$

Year 5= $4/36$

Year 6= $3/36$

Year 7= $2/36$

Year 8= $1/36$



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

$$D_t = \text{Rate} \times (P - F)$$

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

D_t and B_t for a specific year t are

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

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



e.g.: 5

Using data from e.g. 1 demonstrate the calculations of the sum-of-the-years-digits method of depreciation.



Solution

- $P = \text{Rs. } 1,00,000$
- $F = \text{Rs. } 20,000$
- $n = 8 \text{ years}$

$$\text{Sum} = n(n + 1)/2 = 8 \times 9/2 = 36$$

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

$$D_t = \text{Rate} \times (P - F)$$

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



D_t and B_t under Sum-of-the-years-digits Method of Depreciation

<i>End of year</i> (n)	<i>Depreciation</i> (D_t)	<i>Book value</i> (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



e.g. 6:

Using data from **e.g. 1**, find the depreciation and book value for the 5th year using the sum-of-the-years-digits method of depreciation



Solution

$P = \text{Rs. } 1,00,000$

$F = \text{Rs. } 20,000$

$n = 8 \text{ years}$

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

$$\begin{aligned} D_5 &= \frac{8 - 5 + 1}{8(8 + 1)/2} (1,00,000 - 20,000) \\ &= \text{Rs. } 8,888.88 \end{aligned}$$

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

$$\begin{aligned} B_5 &= (1,00,000 - 20,000) \frac{8 - 5}{8} \frac{8 - 5 + 1}{8 + 1} + 20,000 \\ &= 80,000 \times (3/8) \times (4/9) + 20,000 \\ &= \text{Rs. } 33,333.33 \end{aligned}$$



Service Output Method of Depreciation

- In some situations, **it may not be realistic** to compute depreciation based on time Period
- In such cases, the **depreciation is computed based on service rendered** by an asset



Let

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

$$= \frac{P - F}{X}(x)$$



e.g.: 9 The first cost 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

$$P = \text{Rs. } 80,00,000$$

$$F = \text{Rs. } 50,000$$

$$X = 75,000 \text{ km}$$

$$x = 2,000 \text{ km}$$

$$\text{Depreciation for } x \text{ units of service in a period} = \frac{P - F}{X} x$$

$$\begin{aligned} \text{Depreciation for year 3} &= \frac{(80,00,000 - 50,000)}{75,000} \times 2,000 \\ &= \text{Rs. } 2,12,000 \end{aligned}$$



Sinking Fund Method of Depreciation

- Here, the **book value decreases at increasing rates** with respect to the life of the asset

Let

P = first cost of the asset

F = 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 at the end of the period t**



- The loss in value of the asset ($P - F$) is made available in 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.

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

The actual depreciation amount will be in the increasing manner with respect to the time period

The book value at the end of period t is

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



e.g.7 Using data from **e.g. 1** make the calculations regarding the **sinking fund** method of depreciation with an interest rate of **12%**, compounded annually

Solution

$$P = \text{Rs. } 1,00,000$$

$$F = \text{Rs. } 20,000$$

$$n = 8 \text{ years}$$

$$i = 12\%$$

$$\begin{aligned} A &= (P - F_{(\text{salvage value})}) [A/F_{(\text{future amount}), 12\%, 8}] \\ &= (1,00,000 - 20,000) (0.0813) \\ &= \text{Rs. } 6,504 \end{aligned}$$

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
- Depreciation amount at the **end of year 1** (D_1) = **Rs. 6,504**
- Depreciation at the **end of year 2** (D_2) = $6,504 + (6,504 \times 0.12) =$
Rs. 7,284.48
- Depreciation at the **end of year 3** (D_3) = $6,504 + (6,504 + 7,284.48)$
 $\times 0.12 =$ **Rs. 8,158.62**
- Depreciation at the **end of year 4** (D_4) = $6,504 + (6,504 + 7,284.48$
 $+ 8,158.62) \times 0.12 =$ **Rs. 9,137.65**



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

D_t and B_t according to Sinking Fund Method of Depreciation

<i>End of year</i> <i>t</i>	<i>Fixed</i> <i>depreciation</i> (Rs.)	<i>Net depreciation</i> D_t (Rs.)	<i>Book value</i> 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



- **e.g. 8** Using data from **e.g.1**, compute D_5 and B_7 using the sinking fund method of depreciation with an interest rate of 12%, compounded annually



Solution

$$P = \text{Rs. } 1,00,000$$

$$F = \text{Rs. } 20,000$$

$$n = 8 \text{ years}$$

$$i = 12\%$$

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

$$\begin{aligned} D_5 &= (P - F) (A/F, 12\%, 8) (F/P, 12\%, 4) \\ &= (1,00,000 - 20,000) \mathbf{X} 0.0813 \mathbf{X} 1.574 \\ &= \text{Rs. } 10,237.30 \end{aligned}$$

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

$$\begin{aligned} B_7 &= P - (P - F) (A/F, 12\%, 8) (F/A, 12\%, 7) \\ &= 1,00,000 - (1,00,000 - 20,000) \mathbf{X} 0.0813 \mathbf{X} 10.089 \\ &= 34,381.10 \end{aligned}$$



Sinking Fund Method Of Depreciation

Advantages

- i. A sum of money is made available for the replacement of asset by maintaining separate provision
- ii. Helps to strengthen financial position of a concern

Disadvantages

- i. The burden on profit and loss account goes on increasing as years pass by since the amount of depreciation every year remains same but the amount spent on repairs goes on increasing as the asset become old
- ii. Creates complication due to frequent investment



The initial cost of a piece of construction equipment is Rs.3500000. It has useful life of 10 years. The estimated salvage value of the equipment at the end of useful life is Rs.500000. Calculate the annual depreciation and book value of the construction equipment using **straight-line method, double-declining balance method, SOYD** and **sinking fund method**. ($i = 8$ percent). Assume $k=2/n$



Solution:

Initial cost of the construction equipment = $P = \text{Rs.}3500000$

Estimated salvage value = $\text{Rs.}500000$

Useful life = $n = 10$ years

$K=2/n$



Depreciation and book value of the construction equipment using straight-line method and double-declining balance method

Year	Straight-line method		Double-declining balance method	
	Depreciation (Rs.) D_m	Book value (Rs.) BV_m	Depreciation (Rs.) D_m	Book value (Rs.) BV_m
0	-	3500000	-	3500000
1	300000	3200000	700000	2800000
2	300000	2900000	560000	2240000
3	300000	2600000	448000	1792000
4	300000	2300000	358400	1433600
5	300000	2000000	286720	1146880
6	300000	1700000	229376	917504
7	300000	1400000	183500.80	734003.20
8	300000	1100000	146800.64	587202.56
9	300000	800000	117440.51	469762.05
10	300000	500000	93952.41	375809.64

Depreciation and book value of the construction equipment using sum-of-years-digits method and sinking fund method

Year	Sum-of-years-digits method		Sinking fund method	
	Depreciation (Rs.) D_m	Book value (Rs.) BV_m	Depreciation (Rs.) D_m	Book value (Rs.) BV_m
0	-	3500000	-	3500000
1	545454.55	2954545.45	207088.47	3292911.53
2	490909.09	2463636.36	223655.55	3069255.98
3	436363.64	2027272.73	241547.99	2827707.99
4	381818.18	1645454.55	260871.83	2566836.16
5	327272.73	1318181.82	281741.58	2285094.58
6	272727.27	1045454.55	304280.90	1980813.68
7	218181.82	827272.73	328623.38	1652190.30
8	163636.36	663636.36	354913.25	1297277.06
9	109090.91	554545.45	383306.31	913970.75
10	54545.45	500000	413970.81	499999.94* = 500000

Book Value from different depreciation methods

