DEPRECIATION AND CORPORATE INCOME TAXES 7

7.1 Concept and Terminology of Depreciation

- It is the decrease in the value of assets with the passage of time.
- Most assets lose their value with the passage of time and must be replaced at the end of useful life.

The amount of the annual depreciation depends upon following factors:

- Investment in the property.
- Date placed in service.
- Estimated useful life.
- Estimated salvage value.
- Method of depreciation used.
- Estimated expenditure for repair.

Common Terms Used in Depreciation

Initial Cost: It is the total cost of acquiring the asset.

Salvage Value: It represents estimated market value of the asset at the end of its useful life. It is the expected cash inflow that the owner of the asset will receive by disposing it at the end of useful life.

Book Value: It is the value of asset recorded on the accounting books of the firm at a given time period. It is generally calculated at the end of each year. Book value at the end of a given year equals the initial cost less the total depreciation amount till that year.

Useful Life: It represents the expected number of years the asset is useful in terms of generating revenue. The asset may still be in working condition after the useful life but it may not be economical. Useful life is also known as depreciable life. The asset is depreciated over its useful life.

7.2 Basic Methods of Depreciation

The commonly used depreciation methods are:

- Straight line depreciation method.

- Declining balance method.
- Sum of years-digits method.
- Sinking fund method.

7.2.1 Straight Line (SL) Depreciation Method

It is the simplest method of depreciation. In this method it is assumed that the book value of an asset will decrease by same amount every year over the useful life till its salvage value is reached. In other words the book value of the asset decreases at a linear rate with the time period.

The expression for annual depreciation in a given year 'm' is presented as follows:

$$D_m = \frac{P - SV}{n}$$

Where,

D_m = depreciation amount in year m. (m=1, 2, 3, 4..... n ie $1 \le m \le n$).

P = initial cost of the asset.

n = useful life or depreciable life (in years) over which the asset is depreciated.

In above equation, $\frac{1}{n}$ is the constant annual depreciation rate which is denoted by the term $\mathbf{d_m}$.

Since the depreciation amount is same every year, $D_1 = D_2 = D_3 = D_4 = \ldots\ldots\ldots = D_m$

The book value at the end of 1st year is equal to initial cost less the depreciation in the 1st year and is given by:

$BV_1 = P - D_m$

Book value at the end of 2nd year is equal to book value at the beginning of 2nd year (i.e. book value at the end of 1st year) less the depreciation in 2nd year and is expressed as follows:

$$BV_2 = BV_1 - D_m$$

As depreciation amount is same in every year.

Now putting the value of 'BV_1' in above equation.

$$BV_2 = (P - D_m) - D_m = P - 2D_m$$

Similarly the book value at the end of 3rd year is equal to book value at the beginning of 3rd year (i.e. book value at the end of 2nd year) less the depreciation in 3rd year and is given by;

$$BV_3 = BV_2 - D_m$$

$$BV_3 = (P - 2D_m) - D_m = P - 3D_m$$

In the same manner the generalized expression for book value at the end of any given year 'm ' can be written as follows:

$$BV_m = P - mD_m$$

$$D_m = \frac{P - BVm}{m}$$

Example 7.1

A machine is being purchased for Rs 5,00,000; it has an estimated useful life of 10 years and a salvage value of Rs 50,000 at that time. Determine the depreciation for the 5th year and the book value at the end of the 5th year by using straight line method.

Solution: We have given,

Initial cost (P) = 5,00,000
Salvage value (SV)) = 50,000
Useful life (n) = 10 years
Depreciation amount (D_5) =?
Book value (BV_5) =?
We know that,

$$D_m = \frac{P - SV}{n}$$

$$d_5 = \frac{(500,000 - 50,000)}{10} = \text{Rs } 45,000$$

Years	Book Value Before Depreciation	Depreciation	Book Value After Depreciation
1	5,00,000	45,000	4,55,000
2	4,55,000	45,000	4,10,000
3	4,10,000	45,000	3,65,000
4	3,65,000	45,000	3,20,000
5	3,20,000	45,000	2,75,000

7.2.2 Declining Balance (DB) Depreciation Method

- It is an accelerated depreciation method.
- In this method the annual depreciation is expressed as a fixed percentage of the book value at the beginning of the year.
- It is calculated by multiplying the book value at the beginning of each year with a fixed percentage.

- This method is also sometimes known as fixed percentage method of depreciation.
- The ratio of depreciation amount in a given year to the book value at the beginning of that year is constant for all the years of useful life of the asset.
- When this ratio is twice the straight-line depreciation rate i.e. $\frac{2}{n}$, the method is known as Double-Declining Balance (DDB) method.
- In other words the depreciation rate is 200% of the straight-line depreciation rate.
- Double-Declining Balance (DDB) method is the most commonly used declining balance method.
- In declining balance methods the depreciation during the early years is more as compared to that in later years of the asset's useful life.
- In case of declining balance method, for calculating annual depreciation amount, the salvage value is not subtracted from the initial cost.
- It is important to ensure that, the asset is not depreciated below the estimated salvage value.
- In declining-balance method the calculated book value of the asset at the end of useful life does not match with the salvage value.
- If the book value of the asset reaches its estimated salvage value before the end of useful life, then the asset is not depreciated further.

Expressions for Calculation of Annual Depreciation Amount and Book Value

a. Annual Depreciation

The depreciation in 1st year is calculated by multiplying the initial cost (i.e. book value at beginning) with the depreciation rate as given below.

$$D_1 = P \times d_m$$

$$D_2 = d_m (P - D_1) = d_m (P - P\, d_m) = P\, d_m (1 - d_m)$$

$$D_3 = d_m (P - D_1 - D_2) = d_m (P - P\, d_m - P\, d_m (1 - d_m) = P\, d_m (1 - d_m)^2$$

Similarly the generalized expression for depreciation at the end of any year '*m*' is given as follows;

$$\mathbf{D_m = P\, d_m (1 - d_m)^{m-1}} \quad \text{----------(1)}$$

$$BV_3 = (P - 2D_m) - D_m = P - 3D_m$$

In the same manner the generalized expression for book value at the end of any given year 'm ' can be written as follows:

$$BV_m = P - mD_m$$

$$D_m = \frac{P - BVm}{m}$$

Example 7.1

A machine is being purchased for Rs 5,00,000; it has an estimated useful life of 10 years and a salvage value of Rs 50,000 at that time. Determine the depreciation for the 5th year and the book value at the end of the 5th year by using straight line method.

Solution: We have given,

Initial cost (P) = 5,00,000
Salvage value (SV)) = 50,000
Useful life (n) = 10 years
Depreciation amount (D_5) =?
Book value (BV_5) =?
We know that,

$$D_m = \frac{P - SV}{n}$$

$$d_5 = \frac{(500,000 - 50,000)}{10} = \text{Rs } 45,000$$

Years	Book Value Before Depreciation	Depreciation	Book Value After Depreciation
1	5,00,000	45,000	4,55,000
2	4,55,000	45,000	4,10,000
3	4,10,000	45,000	3,65,000
4	3,65,000	45,000	3,20,000
5	3,20,000	45,000	2,75,000

7.2.2 Declining Balance (DB) Depreciation Method

- It is an accelerated depreciation method.
- In this method the annual depreciation is expressed as a fixed percentage of the book value at the beginning of the year.
- It is calculated by multiplying the book value at the beginning of each year with a fixed percentage.

- This method is also sometimes known as fixed percentage method of depreciation.
- The ratio of depreciation amount in a given year to the book value at the beginning of that year is constant for all the years of useful life of the asset.
- When this ratio is twice the straight-line depreciation rate i.e. $\frac{2}{n}$, the method is known as Double-Declining Balance (DDB) method.
- In other words the depreciation rate is 200% of the straight-line depreciation rate.
- Double-Declining Balance (DDB) method is the most commonly used declining balance method.
- In declining balance methods the depreciation during the early years is more as compared to that in later years of the asset's useful life.
- In case of declining balance method, for calculating annual depreciation amount, the salvage value is not subtracted from the initial cost.
- It is important to ensure that, the asset is not depreciated below the estimated salvage value.
- In declining-balance method the calculated book value of the asset at the end of useful life does not match with the salvage value.
- If the book value of the asset reaches its estimated salvage value before the end of useful life, then the asset is not depreciated further.

Expressions for Calculation of Annual Depreciation Amount and Book Value

a. Annual Depreciation

The depreciation in 1st year is calculated by multiplying the initial cost (i.e. book value at beginning) with the depreciation rate as given below.

$$D_1 = P \times d_m$$

$$D_2 = d_m (P - D_1) = d_m (P - P\, d_m) = P\, d_m (1 - d_m)$$

$$D_3 = d_m (P - D_1 - D_2) = d_m (P - P\, d_m - P\, d_m (1 - d_m) = P\, d_m (1 - d_m)^2$$

Similarly the generalized expression for depreciation at the end of any year '*m*' is given as follows;

$$D_m = P\, d_m (1 - d_m)^{m-1} \quad \text{----------(1)}$$

Where,

$D_1, D_2, D_3 \ldots D_m$ = depreciation amount in 1st, 2nd, 3rd and m^{th} year.

P = initial cost of asset.

d_m = constant annual depreciation rate = $\frac{1}{N}$

b. Book Value

Book value at the end of 1st year is calculated by subtracting 1st year depreciation from initial cost

$BV_1 = P - D_1 = P - P\,d_m = P(1 - d_m)$

$BV_2 = BV_1 - D_2 = P(1 - d_m) - P\,d_m(1 - d_m) = P(1 - d_m)^2$

$BV_3 = BV_2 - D_3 = P(1 - d_m)^2 - P\,d_m(1 - d_m)^2 = P(1 - d_m)^3$

Similarly, the generalized expression for book value at the end of any year 'm' is given as follows

$BV_m = P(1 - d_m)^m$

The book value at the end of useful life i.e. at the end of '*n*' years is given by;

$$\mathbf{BV_n = P(1 - d_m)^n} \text{----------(2)}$$

Where,

$BV_1, BV_2, BV_3 \ldots\ldots\ldots BV_m, BV_n$= book value at the end of 1st, 2nd 3rd ……m^{th} and n^{th} year.

The book value at the end of useful life is theoretically equal to the salvage value of the asset. Thus equating the salvage value (SV) of the asset to its book value (BV_n) at the end of useful life.

$$\mathbf{SV = BV_n = P(1 - d_m)^n} \text{----------(3)}$$

Thus for calculating the depreciation of an asset using declining balance method, equation (3)can be used to find out the constant annual depreciation rate, if it is not stated for the asset.

From equation (3), the expression for constant annual depreciation rate 'd_m' from known values of initial cost 'P' and salvage value (SV > 0) is obtained as follows:

$SV = P(1 - d_m)^n$ Or, $\frac{Sv}{P}(1 - d_m)^n$

$$\text{Or, } d_m = 1 - \left(\frac{SV}{P}\right)^{\frac{1}{n}} \text{----------(4)}$$

Switching Between Different Depreciation Methods

- Switching is carried out from one depreciation method to another to accelerate the depreciation of book value of the asset and thus to have income tax benefits.
- Switching takes place when depreciation amount of an asset for a given year in the present depreciation method is less than that in the new depreciation method.
- The most commonly used switching is from double-declining balance (DDB) method to straight-line (SL) method.
- In double-declining balance method, the book value as calculated never reaches zero.
- In addition the calculated book value at the end of useful life does not match with the salvage value.
- Switching from double-declining balance method to straight-line method ensures that the book value does not fall below the estimated salvage value of the asset.

Case I: When $BV_n > SV$

- It indicates that full cost of the asset has not been depreciated.
- In this situation to reduce the book value of asset to salvage value switching is done from decline balance of depreciation (DB) to straight line of depreciation (SL).
- Switching takes place from DB to SL when DB≤SL for remaining depreciable life of the project.
- For straight-line (SL) method the depreciation amount for a given year 'm' is calculated by using the following expression.

$$\mathbf{D_m = \frac{BV_{m-1} - SV}{(n - m + 1)}} \text{----------(5)}$$

Where, D_m= depreciation amount for a given year m.
n= useful life.
SV=salvage value.

Case II: When $BV_n < SV$

- In this case we must readjust the analysis because tax law doesn't permit to depreciate the assent below salvage value.
- Switching from declining balance method to straight-line method is done at any period when BVn < SV.
- At this period adjustment is done in such a way that $BV_n = SV$.

Example 7.2

The initial cost of equipment is Rs.35,00,000. It has useful life of 10 years. The estimated salvage value of the equipment at the end of useful life is Rs.5,00,000. Calculate the annual depreciation and book value of the equipment using double-declining balance method.

Solution: We have given,

Initial cost of the construction equipment = P = Rs.35,00,000

Estimated salvage value = SV = Rs.5,00,000

Useful life = n = 10 years

a. Calculation of Annual Depreciation

The constant annual depreciation rate 'd_m' is given by;

$$d_m = \frac{2}{n} = \frac{2}{10} = 0.2$$

The depreciation amount for a given year is calculated using equation $D_m = P\, d_m\, (1-d_m)^{m-1}$

Depreciation for 1st year = $D_1 = 35,00,000 \times (1-0.2)^{1-1} \times 0.2$

= Rs 7,00,000

Depreciation for 2nd year = $D_2 = 35,00,000 \times (1-0.2)^{2-1} \times 0.2$

= Rs 5,60,000

b. Calculation of Book Value

The book value at the end of a given year is calculated by subtracting the annual depreciation amount from previous year's book value.

Book value at the end of 1st year = $BV_1 = 35,00,000 - 7,00,000$

= Rs 28,00,000

Book value atr the end of 2nd year = $BV_2 = 28,00,000 - 5,60,000$

= Rs 22,40,000

Alternatively

The book value at the end of different years can also be calculated by using formula

$BV_n = P\,(1-d_m)^n$

$BV_1 = P\,(1-d_1)^1 = 35,00,000\,(1-0.2)^1 = Rs\ 2,80,0000$

The book value and annual depreciation are presented in the table below.

Table 7.1: Depreciation and Book Value of the Equipment.

Year	Annual Depreciation (D_m) Rs $=P\, d_m\, (1-d_m)^{m-1}$	Book Value (BV_m) Rs $BV_n = P\,(1-d_m)^n$
0	-	35,00,000
1	7,00,000	28,00,000
2	5,60,000	22,40,000
3	4,48,000	17,92,000
4	3,58,400	14,33,600
5	2,86,720	11,46,880
6	2,29,376	9,17,504
7	1,83,500.80	7,34,003.20
8	1,46,800.64	5,87,202.56
9	1,17,440.51	4,69,762.05
10	93,952.41	3,75,809.64

Example 7.3

The initial cost of an asset is Rs.10,00,000. It has useful life of 9 years. The estimated salvage value of the asset at the end of useful life is zero. Calculate the annual depreciation and book value using double-declining balance method and find out the year in which the switching is done from double-declining balance method to straight-line method.

Solution: We have given,

Initial cost of the asset = P = Rs.10,00,000

Useful life = n = 9 years

Salvage value = SV = 0

For double-declining balance (DDB) method, the constant annual depreciation rate 'd_m' is given by;

$$d_m = \frac{2}{n} = \frac{2}{9} = 0.222$$

The annual depreciation and the book value at the end different years are calculated and are presented in Table 7.2.

Example 7.2

The initial cost of equipment is Rs.35,00,000. It has useful life of 10 years. The estimated salvage value of the equipment at the end of useful life is Rs.5,00,000. Calculate the annual depreciation and book value of the equipment using double-declining balance method.

Solution: We have given,

Initial cost of the construction equipment = P = Rs.35,00,000

Estimated salvage value = SV = Rs.5,00,000

Useful life = n = 10 years

a. Calculation of Annual Depreciation

The constant annual depreciation rate 'd_m' is given by;

$$d_m = \frac{2}{n} = \frac{2}{10} = 0.2$$

The depreciation amount for a given year is calculated using equation $D_m = P\, d_m\, (1-d_m)^{m-1}$

Depreciation for 1st year = $D_1 = 35,00,000 \times (1-0.2)^{1-1} \times 0.2$

= Rs 7,00,000

Depreciation for 2nd year = $D_2 = 35,00,000 \times (1-0.2)^{2-1} \times 0.2$

= Rs 5,60,000

b. Calculation of Book Value

The book value at the end of a given year is calculated by subtracting the annual depreciation amount from previous year's book value.

Book value at the end of 1st year = $BV_1 = 35,00,000 - 7,00,000$

= Rs 28,00,000

Book value atr the end of 2nd year = $BV_2 = 28,00,000 - 5,60,000$

= Rs 22,40,000

Alternatively

The book value at the end of different years can also be calculated by using formula

$BV_n = P\,(1-d_m)^n$

$BV_1 = P\,(1-d_1)^1 = 35,00,000\,(1-0.2)^1 = Rs\ 2,80,0000$

The book value and annual depreciation are presented in the table below.

Table 7.1: Depreciation and Book Value of the Equipment.

Year	Annual Depreciation (D_m) Rs $=P\, d_m\, (1-d_m)^{m-1}$	Book Value (BV_m) Rs $BV_n = P\,(1-d_m)^n$
0	-	35,00,000
1	7,00,000	28,00,000
2	5,60,000	22,40,000
3	4,48,000	17,92,000
4	3,58,400	14,33,600
5	2,86,720	11,46,880
6	2,29,376	9,17,504
7	1,83,500.80	7,34,003.20
8	1,46,800.64	5,87,202.56
9	1,17,440.51	4,69,762.05
10	93,952.41	3,75,809.64

Example 7.3

The initial cost of an asset is Rs.10,00,000. It has useful life of 9 years. The estimated salvage value of the asset at the end of useful life is zero. Calculate the annual depreciation and book value using double-declining balance method and find out the year in which the switching is done from double-declining balance method to straight-line method.

Solution: We have given,

Initial cost of the asset = P = Rs.10,00,000

Useful life = n = 9 years

Salvage value = SV = 0

For double-declining balance (DDB) method, the constant annual depreciation rate 'd_m' is given by;

$$d_m = \frac{2}{n} = \frac{2}{9} = 0.222$$

The annual depreciation and the book value at the end different years are calculated and are presented in Table 7.2.

Table 7.2: Depreciation and Book Value from DDB Method.

Year	Annual Depreciation (D_m) Rs $D_m = P\, d_m (1-d_m)^{m-1}$	Book Value (BV_m) Rs $BV_n = P(1-d_m)^n$
0	0	10,00,000
1	2,22,000	7,78,000
2	1,72,716	6,05,284
3	1,34,373.05	4,70,910.95
4	1,04,542.23	3,66,368.72
5	81,333.86	2,85,034.86
6	63,277.74	2,21,757.12
7	49,230.08	1,72,527.04
8	38,301	1,34,226.04
9	29,798.18`	1,04,427.86

- From the above table it is observed that the book value at the end of useful life is Rs.1,04,427.86, which is more than the estimated salvage value i.e. 0.
- The asset is not completely depreciated. Thus switching is carried out from double-declining balance method to straight-line method and is shown in Table 7.3.

Depreciation by Straight Line (SL) Method

$$D_m = \frac{(BV_{m-1} - SV)}{(n-m+1)} = \frac{(BV_{m-1} - 0)}{(9-m+1)}$$

Table 7.3: DDB Method and Switching to Straight-line Method

Year	Dep. (Rs) DDB Method		Dep. (Rs) SL Method $D_m = \frac{(BV_{m-1})}{(10-m)}$	Selected Dep. Amount (Rs)	Book Value (Rs)	Decision
0	0		0	0	10,00,000	
1	2,22,000	>	11,111.11	2,22,000	7,78,000	Don't switch
2	1,72,716	>	`97,250	1,72,716	6,05,284	Don't switch
3	1,34,373.05	>	86,469.14	134,373.05	4,70,910.95	Don't switch
4	1,04,542.23	>	78,485.15	104,542.23	3,66,368.72	Don't switch
5	81,333.86	>	73,273.74	81,333.86	2,85,034.86	Don't switch
6	63,277.74	<	71,258.71	71,258.71	2,13,776.15	Switch to SL
7	49,230.08	<	71,258.71	71,258.71	1,42,517.44	
8	38,301	<	71,258.71	71,258.71	71,258.73	
9	29,798.18`	<	71,258.71	71,258.71	0	

Example 7.4

A machine is being purchased for Rs 5,00,000; it has an estimated useful life of 10 years and a salvage value of Rs 50,000 at that time. Determine the depreciation allowance for the 5th year and the book value at the end of the 5th year using declining balance depreciation.

Solution: We have given,

Investment = P = Rs 5,00,000
Salvage value = SV = Rs 50,000
Useful life = n = 10 years

a. Depreciation allowance and book value at the end of 5th year = ?
We know,

$$d_m = 1 - (SV/P)^{1/n}$$
$$= 1 - (50,000/5,00,000)^{1/10} = 20.567\%$$

Depreciation allowance at the end of 5th year is calculated by using following expression

$$D_m = P\, d_m (1-d_m)^{m-1}$$
$$D_5 = 5,00,000 \times 0.20567 (1-0.20567)^{5-1}$$
$$= 40,939.7 \text{ Ans}$$

Again book value at the end of 5th year is calculated by using following expression

$$BV_n = P(1-d_m)^n$$
$$BV_5 = 5,00,000(1.0 - 0.205672)^5$$
$$= 1,58,113.65 \text{ Ans}$$

7.2.3 Sum-of-years-digits (SOYD) Depreciation Method

- It is also an accelerated depreciation method.
- This method ensures that the full capital invested in a project is recovered at the end of project's life.
- In this method the annual depreciation rate for any year is calculated by dividing the number of years left in the useful life of the asset by the sum of years over the useful life.

The depreciation rate 'd_m' for any year 'm' is given by:

$$d_m = \frac{n-m+1}{SOYD}$$

The depreciation each year is calculated by using the following expression

$$D_m = d_m (P - SV) \text{----------(1)}$$

Where,
SOYD = sum of years' digits over the useful life = $1+2+3+\text{--------}+n$
$= \frac{n(n+1)}{2}$
n= useful life.
d_m= depreciation rate for any year 'm'.
D_m= depreciation for any year 'm'.
SV = salvage value.

7.2.4 Sinking Fund (SF) Depreciation Method

- In this method it is assumed that the full capital invested in a project is recovered at the end of project's useful life.
- For this purpose, first the uniform depreciation amount i.e. fixed amount deposited in sinking fund at the end of each year is calculated by multiplying the total depreciation amount i.e. initial cost less salvage value over the useful life by sinking fund factor.
- After that the interest earned on the accumulated amount is calculated.
- The first component of depreciation i.e. uniform depreciation amount 'A' at the end of each year is given by;

Expression for Annual Depreciation

Depreciation amount for 1st year is equal to only 'A' as this is the amount set aside every year from the revenue generated to be deposited in sinking fund at the end of 1st year and hence there is no interest accumulated on this amount.
Therefore,
$D_1 = A = A(1+i)^0$
$D_2 = A + D_1 \times i = A + A \times i = A(1+i)$
$D_3 = A + (D_1 + D_2) \times i = A + \{A(1+i)\} \times i = A(1+i)^2$

Now the generalized expression for depreciation in any given year '*m*' **can be written as follows**

$$\mathbf{D_m = A(1+i)^{m-1}} \text{----------(1)}$$

$$A = (P-SV) \times (A/F, i, n) = (P-SV) \times \frac{i}{(1+i)^n - 1} \text{----------(2)}$$

Substituting the value of 'A' in equation (1) the expression for depreciation results

$$\mathbf{D_m = (P-SV) \times i/\{(1+i)^n - 1\} \times (1+i)^{m-1}} \text{----------(3)}$$
Or, $D_m = (P-SV)(A/F, i, n) \times (F/P, i, m-1)$

Where, P=initial cost of asset.
SV= salvage value.
i = interest rate per year.
n = life of asset.
A = annual equivalent amount of depreciation charge.

Expression for Book Value

Now book value at the end of 1st year is given by;
$BV_1 = P - D_1 = P - A(1+i)^0$
$BV_2 = BV_1 - D_1 = P - A(1+i)^0 - A(1+i) = P - A\{(1+i)^0 + (1+i)^1\}$
$BV_3 = BV_2 - D_2 = P - A\{(1+i)^0 + (1+i)^1\} - A(1+i)^2$
$= P - A\{(1+i)^0 + (1+i)^1 + (1+i)^2\}$

Similarly, the generalized expression for book value at the end of any year '*m*' is given by
$BV_m = P - A\{(1+i)^0 + (1+i)^1 + (1+i)^2 + 1+i)^2 + \ldots + (1+i)^{m-2} + (1+i)^{m-1}\}$

$$\mathbf{BV_m = P - A(F/A, i, m)} \text{----------(2)}$$

Substituting the value of 'A ' and the expression for uniform series compound factor in equation (2) results the following generalized expression for book value at the end of any year 'm' ($1 \le m \le n$).

$$\mathbf{BV_m = P - (P-SV)(A/F, i, n) \times (F/A, i, m)} \text{.....(3)}$$

$$\text{Or, } BV_m = P - (P-SV) \times \frac{i}{(1+i)^n - 1} \times \frac{(1+i)^m - 1}{i}$$

$$= P - (P-SV) \times \frac{(1+i)^n - 1}{(1+i)^n - 1}$$

In this method, the depreciation during later years is more as compared to that in early years of the asset's useful life.

Example 7.5

The initial cost of equipment is Rs.35,00,000. It has useful life of 10 years. The estimated salvage value of the equipment at the end of useful life is Rs.5,00,000. Calculate the annual depreciation and book value of the construction equipment using sum-of-years-digits method and sinking fund method. The interest rate is 8% per year.

Solution: We have given,

P = Rs.35,00,000

SV = Rs.5,00,000

n = 10 years

Sum of Years Digits Method

SOYD = sum of years' digits over the useful life $= \frac{n(n+1)}{2} = \frac{10(10+1)}{2}$

$= 55$

Depreciation for 1st year

$$D_1 = \frac{n-m+1}{SOYD} \times (P - SV) = \frac{10-1+1}{55} \times (35,00,000 - 5,00,000)$$

= Rs 5,45,454.55

Book value at the end of 1st year

$BV_1 = P - D_1 = 35,00,000 - 5,45,454.55$

= Rs 2,95,45,545.45

Similarly, the annual depreciation and book value at the end of other years for the construction equipment have been calculated and are presented in Table 7.4

Sinking Fund Method

The interest rate per year = i = 8%

Depreciation amount for 1st year

$$D_1 = (35,00,000 - 5,00,000) \times \frac{0.08}{(1+0.08)^{10} - 1} \times (1 + 0.08)^{1-1}$$

= Rs 2,07,088.47

Book Value at the end of 1st year

$BV_1 = 35,00,000 - 2,07,088.47$

= Rs 32,92,911.53

Depreciation amount at the end of 2nd year

$$D_2 = (35,00,000 - 5,00,000) \times \frac{0.08}{(1+0.08)^{10} - 1} \times (1 + 0.08)^{2-1}$$

= Rs 2,23,655.55

Book value at the end of 2nd year

$BV_2 = 32,92,911.53 - 2,23,655.55$

= Rs 30,69,255.98

Similarly, the annual depreciation and book value at the end of other years are calculated in the same manner and are given in Table 7.4.

Table 7.4: Depreciation and Book Value of the Construction Equipment Using Sum-of-years-digits Method and Sinking Fund Method.

Year	Sum of year digit method		Sinking fund method	
	Dep. (D_m) Rs	Book Value (BV_m) Rs	Dep. (D_m) Rs	Book Value (BV_m) Rs
0	-	35,00,000	-	35,00,000
1	5,45,454.55	29,54,545.45	2,07,088.47	32,92,911.53
2	4,90,909.09	24,63,636.36	2,23,655.55	30,69,255.98
3	4,36,363.64	20,27,272.73	2,41,547.99	28,27,707.99
4	3,81,818.18	16,45,454.55	2,60,871.83	25,66,836.16
5	3,27,272.73	13,18,181.82	2,81,741.58	22,85,094.58
6	2,72,727.27	10,45,454.55	3,04,280.90	19,80,813.68
7	2,18,181.82	8,27,272.73	3,28,623.38	16,52,190.30
8	1,63,636.36	6,63,636.36	3,54,913.25	12,97,277.06
9	1,09,090.91	5,54,545.45	3,83,306.31	9,13,970.75
10	54,545.45	5,00,000	4,13,970.81	5,00,000

7.2.5 MACRS Method of Depreciation

- MACRS is the only depreciation method approved for use in the U.S. for income tax purposes.
- It was created in 1986 and prescribed by the IRS.
- MACRS is the most commonly used depreciation method for computing income tax liability.
- MACRS is now the principal method for computing depreciation.
- It calculates depreciation for tax purposes.
- It ignores residual value.
- MACRS assigns a class (tax life) to various kinds of property. (Useful life estimates are no longer relevant)
- MACRS gives percentage depreciation for each year.
- Depreciation in the first year (for personal property) is based on the assumption that the asset was purchased halfway through the year.
- The depreciation amount is the percentage times the initial cost.
- MACRS gives organizations the choice of two depreciation **systems as:**
  - General depreciation system (GDS)
  - Alternative depreciation system (ADS).

- GDS is more accelerated and thus most often preferred.
- The GDS percentages are computed with a declining balance method using a switch point.
- Double rate for 3, 5, 7 and 10year classes.
- 1.5 rates for 15 and 20year classes.
- **Straight line method is used for:**
  - Rental property (27.5 year life)
  - Nonresidential real property (31.5 year life).

Table 7.5: MARS Property Classification

Recovery Period	ADR Midpoint Class	Applicable Property
3-year	ADR ≤ 4	Special tools for manufacture of plastic products, fabricated metal products, and motor vehicles.
5-year	4 < ADR ≤ 10	Automobiles, light trucks, high-tech equipment, equipment used for R&D, computerized telephone switching systems.
7-year	10 < ADR ≤ 16	Manufacturing equipment, office furniture, fixtures.
10-year	16 < ADR ≤ 20	Vessels, barges, tugs, railroad cars.
15-year	20 < ADR ≤ 25	Waste-water plants, telephone-distribution plants, or similar utility property.
20-year	25 ≤ ADR	Municipal sewers, electrical power plant.
27.5-year		Residential rental property.
39-year		Nonresidential real property including elevators and escalators.

Table 7.6: MRCS Depreciation Rates.

Year	3 year	5 year	7 year	10 year	15 year	20 year
1	33.33	20.00	14.29	10.00	5.00	3.750
2	44.45	32.00	24.29	18.00	9.50	7.219
3	**14.81**	19.20	17.49	14.40	8.55	6.677
4	7.41	**11.52**	12.49	11.52	7.70	6.177
5		11.52	**8.93**	9.22	6.93	5.713
6		5.76	8.92	7.37	6.23	5.285
7			8.93	**6.55**	**5.90**	4.888
8			4.46	6.55	5.90	4.522
9				6.56	5.91	**4.462**
10				6.55	5.90	4.461
11				3.28	5.90	4.462
12					5.91	4.461
13					5.90	4.462
14					5.91	4.461
15					5.90	4.462
16					2.95	4.461
17						4.462
18						4.461
19						4.462
20						4.461
21						2.231

Example 7.6

A piece of construction equipment has initial cost and estimated salvage value of Rs.15,00,000 and Rs.2,00,000 respectively. The useful life of equipment is 10 years. Find out the year in which the switching from double-declining balance method to straight-line method takes place.

Solution: We have given,

Initial cost of the asset = P = Rs.15,00,000
Salvage value = SV = Rs.2,00,000
Useful life = n = 10 years

The constant annual depreciation rate d_m for double-declining balance (DDB) method is calculated as follows;

$$d_m = \frac{2}{n} = \frac{2}{10} = 0.2$$

Table 7.7: Depreciation and Book Value Using Double-declinin Balance Method.

Year	Depreciation (Rs) $D_m = P\, d_m(1-d_m)^{m-1}$	Book Value (Rs) $BV_m = BV_{m-1} - D_m$
0	-	15,00,000
1	3,00,000	12,00,000
2	2,40,000	9,60,000
3	1,92,000	7,68,000
4	1,53,600	6,14,400
5	1,22,880	4,91,520
6	98,304	3,93,216
7	78,643.2	3,14,572.8
8	62,914.56	2,51,658.24
9	50,331.65	2,01,326.59
10	40,265.32	1,61,061.27

From the above table it is noted that the book value at the end of useful life i.e. 10th year is Rs.1,61,061.27, which is less than the estimated salvage value i.e. Rs.2,00,000. Thus the total depreciation amount over the useful life is more than the desired. Hence switching from double-declining balance method to straight-line method is carried out.

Table 7.8: Double-declining Balance Method with Switching to Straight-line Method.

Year	Dep. (Rs) DDB Method		Dep. (Rs) SL Method $D_m = (BV_{m-1} - SV)/(n-m+1)$	Selected Dep. Amount (Rs)	Book Value (Rs)	Decision
0			0	0	15,00,000	
1	3,00,000	>	1,30,000	3,00,000	12,00,000	Don't switch
2	2,40,000	>	1,11,111.11	2,40,000	9,60,000	Don't switch
3	1,92,000	>	95,000	1,92,000	7,68,000	Don't switch
4	1,53,600	>	81,142.86	1,53,600	6,14,400	Don't switch
5	1,22,880	>	69,066.67	1,22,880	4,91,520	Don't switch
6	98,304	>	58,304	98,304	3,93,216	Don't switch
7	78,643.2	>	48,304	78,643.2	3,14,572.8	Don't switch
8	62,914.56	>	38,190.93	62,914.56	2,51,658.24	Don't switch
9	50,331.65	>	25,829.12	50,331.65	2,01,326.59	Don't switch
10	40,265.32		1,326.59	1,326.59	2,00,000	Switch to SL

7.3 Introduction to Corporate Income Tax

- Income tax imposed on corporations is known as corporate income tax.

- The tax is imposed on taxable income.
- Income and capital gains by corporations are taxed at a flat rate of 25%.
- Income-generating expenses and operating expenses are deductible when computing for the taxable income. (For detail refer chapter 12 of this book)

7.4 After Tax Cash Flow Estimate

After tax cash flow is the amount remaining after deduction of income tax, mortgage interest, maintenance cost, etc from gross income of an investment property.

Cash Flow Estimate

Example 7.7

A construction equipment has initial cost and annual saving per year are of Rs.40,000 and Rs.20,000 respectively with annual operation and maintenance cost of Rs 7,000. It will depreciate by MACRS method and will have no salvage value. The useful life of equipment is 5 years. Estimate before and after tax cash flow. The company pays income tax @ 40%.

Solution: We have given,

Initial cost of the asset = P = Rs.40,000
Annual saving = R = Rs.20,000
O & M Costs = E = 7,000
Useful life = n = 5 years

Table 7.9: After Tax Cash Flow Estimates.

Year	1 Before Tax Cash Flow	2 MARCS Rate	3 Dep. Amount = (40000 × MARCS Rate)	4 Net Taxable Income 1-3	5 Tax Amount 4×40%	6 After Tax Cash Flow 1−5
0	− 40,000	-	-	-	-	-40,000
1	R − E = 20,000−7,000 =13,000	20	8,000	5,000	2000	11,000
2	13,000	32	12,800	200	80	12,920
3	13,000	19.2	7,680	5320	2,128	10,872
4	13,000	11.52	4,608	8392	3,357	4,608
5	13,000	11.52	4,608	8392	3,357	4,608
6	13,000	5.76	2,304	10696	4,279	8,721

7.5 General Procedure for Making After Tax Economic Analysis

- After tax economic analysis is the analysis of after tax cash flow estimate.

Procedure

1. Calculate before tax cash flow in year n.
   Before Tax Cash Flow ($BTCF_n$) = $R_n - E_n$
   Where, R_n = revenue from the project during year n.
   E_n = expenses of the project during year n.
2. Calculate taxable income.
   Taxable Income (TI) = $R_n - E_n - D_n$
   Where, D_n = depreciation amount of the project during year n.
3. Calculate income tax amount during year n.
   $T_n = t_r (R_n - E_n - D_n)$
   Where, T_n = income tax amount during year n.
   t_r = income tax rate
4. Calculate after tax cash flow in year n.
   After Tax Cash Flow ($ATCF_n$) = $BTCF_n - T_n$
   $= R_n - E_n - t_r (R_n - E_n - D_n) = (1 - t_r)(R_n - E_n) + t_r D_n$

Example 7.8

From the $ATCF_n$ calculation in example 7.7, determine economic analysis when MARR is 10% use present worth method.

Solution:

PW= – 40,000 + 11,000 (P/F 10% 1) + 12,920 (P/F 10% 2)
+ 10,872 (P/F 10% 3) + 4,608 (P/F 10% 4) + 4,608 (P/F 10% 5)
+ 8,721 (P/F 10% 6)
= – 40,000 + 11,000 (0.9091) + 12,920 (0.8264) + 10,872 (0.7513)
+ 4,608 (0.6830) + 4,608 (0.6209) + 8,721 (0.5645)
= – Rs 223.30 **Ans.**

Additional Solved Examples

Example 7.1

Considering the following information, compute the annual depreciation and book value of each by

i. SL method

ii. DB method
iii. SOYD method and
iv. Sinking fund method

TU-2072

Cost Basis	Salvage Value	Useful Life	MARR
7,000	2,000	5 years	10%

Solution: We have given,

P = 7,000
SV = 2,000
n = 5 years

Decline Balance Method

The constant annual depreciation rate d_m for double-declining balance (DDB) method is calculated as follows;

$$d_m = \frac{2}{n} = \frac{2}{5} = 0.4$$

Table 7.10: Depreciation and Book Value Using Double-declining Balance Method.

Year	Decline Balance Method Dep. (D_m) $=7{,}000 \times 0.4(1\text{-}0.4)^{m-1}$	Book Value	SL Method Dep. (D_m) $= \frac{BVm-1-SV}{5-m+1}$	Book Value (BV_m)
0	-	7,000	-	7,000
1	2,800	4,200	1,000	6,000
2	1,680	2,520	1,000	5,000
3	1,008	1,512	1,000	4,000
4	604.8	907.2	1,000	3,000
5	59.2	848	1,000	2,000

Sum of Years Digits Method

SOYD = sum of years' digits over the useful life

$$= \frac{n(n+1)}{2} = \frac{5(5+1)}{2} = 15$$

Depreciation for 1st year

$$d_m = \frac{n-m+1}{SOYD} \times (P - SV) = \frac{5-1+1}{15} \times (7{,}000 - 2{,}000)$$
$$= 1{,}666.67$$

Book value at the end of 1st year

$BV_1 = P - d_1 = 7{,}000 - 1{,}666.67 = 5{,}333.33$

Similarly, the annual depreciation and book value at the end of other years for the construction equipment have been calculated and are presented in Table 7.11

Sinking Fund Method

The interest rate per year = i = 10%

Depreciation amount for 1st year

$$D_1 = (7,000 - 2,000) \times \left\{\frac{0.1}{(1+0.1)^5 - 1}\right\} \times (1+0.1)^{1-1}$$

$$= 818.98$$

Book Value at the end of 1st year

$BV_1 = 7,000 - 818.98$

$= 6,181.01$

Depreciation amount at the end of 2nd year

$$D_2 = (7,000 - 2,000) \times \frac{0.1}{(1+0.1)^5 - 1} \times (1+0.1)^{2-1} = 900.88$$

Book value at the end of 2nd year

$BV_2 = 6,181.01 - 900.88 = 5,280.14$

Similarly, the annual depreciation and book value at the end of other years are calculated in the same manner and are given in Table 7.11.

Table 7.11: Depreciation and Book Value of the Construction Equipment Using Sum-of-years-digits Method and Sinking Fund Method.

Year	Sum of year digit method		Sinking fund method	
	Dep. (D_m) = $\frac{n-m+1}{SOYD} \times 5000$	Book Value (BV_m)	Dep. (D_m) $5000 \times \left\{\frac{0.1}{(1+0.1)^5-1}\right\} \times (1+0.1)^{n-1}$	Book Value (BV_m)
0	-	7,000	-	7,000
1	1,666.67	5,333.33	818.98	6,181.02
2	1,333.33	4,000	900.88	5,280.14
3	1,000	3,000	990.97	4,289.17
4	666.67	2,333.33	1,090.07	3,199.10
5	333.33	2,000	1,199.08	2,000.02

Example 7.2

Compute the annual depreciation allowance and the resulting book value using the double decline balance method with switch over to straight line method. Cost of the asset =Rs 1, 00,000, Useful life = 5 years, salvage value = 20,000. **TU-2072**

Solution: We have given,

Initial cost of the asset = P = Rs.1, 00,000
Salvage value = SV = Rs.20, 000
Useful life = n = 5 years

The constant annual depreciation rate d_m for double-declining balance (DDB) method is calculated as follows;

$$d_m = \frac{2}{n} = \frac{2}{5} = 0.4$$

$$D_m = P\, d_m(1-d_m)^{m-1} = 1,00,000 \times 0.4\,(1-0.4)^{m-1} = 40,000 \times 0.6^{m-1}$$

Table 7.12: Depreciation and Book Value Using Double-declining Balance Method.

Year	Depreciation (Rs) $D_m = 40000 \times 0.6^{m-1}$	Book Value (Rs) $BV_m = BV_{m-1} - D_m$
0	-	1,00,000
1	40,000	60,000
2	24,000	36,000
3	14,400	21,600
4	8,640	12,960
5	5,184	7,780

- From the above table it is noted that the book value at the end of useful life i.e. 5th year is Rs.7,780, which is less than the estimated salvage value i.e. Rs.20,000.
- Thus the total depreciation amount over the useful life is more than the desired.
- Hence switching from double-declining balance method to straight-line method is carried out.

Depreciation Straight Line Method

$$D_m = \frac{BV_{m-1} - S.V}{(n-m+1)} = \frac{(BV_{m-1} - 20,000)}{(5-m+1)}$$

Table 7.13: Double-declining Balance Method with Switching to Straight-line Method.

Year	Dep. (Rs) DDB Method D_m		Dep. (Rs) SL Method $D_m = \frac{(BV_{m-1} - 20,000)}{(6-m)}$	Selected Dep. Amount (Rs)	Book Value BV_m (Rs)	Decision
0			0	0	1,00,000	
1	40,000	>	16,000	40000	60,000	Don't switch
2	24,000	>	10,000	24000	36,000	Don't switch
3	14,400	>	5,333.33	14400	21,600	Don't switch
4	8,640	>	800	800	20,800	Switch
5	5,184		6,480	800	20,000	Switch

Examples 7.3

A machine is expected to cost Rs 5, 00,000 and will generate revenue of Rs 1,50,000 per years for five years. Its salvage value is Rs 2, 00,000. Calculate after tax cash flow and corresponding NPV if tax rate is 40% and depreciation is on sum of year digit method. MARR=15% **TU-2072**

Solution: We have given,

Initial Cost = P = Rs 5,00,000
Salvage value = SV = Rs 2,00,000
Revenue generated per year = R = Rs 1,50,000
Useful life = n= 5 years
MARR = 15%

Sum of Years Digits Method

SOYD = sum of years' digits over the useful life = $\frac{n(n+1)}{2} = \frac{5(5+1)}{2}$

=15

Depreciation for 1st year

$d_m = \frac{n-m+1}{SOYD} \times (P - SV) = \frac{5-1+1}{15} \times (5,00,000 - 2,00,000) = 1,00,000$

Book value at the end of 1st year

$BV_1 = P - D_1 = 5,00,000 - 1,00,000 =$ Rs 4,00,000

Similarly, the annual depreciation and book value at the end of other years for the construction equipment have been calculated and are presented in table below.

Table 7.14: After Tax Cash Flow Estimates of Machine Using Sum-of-years-digits Method.

Year	1 Before Tax Cash Flow	2 Dep. Amount $(D_m) = \frac{5-m+1}{15} \times 3,00,000$	3 Net Taxable Income 1-2	4 Tax Amount 3×40%	5 After Tax Cash Flow 1 – 4
0	-5,00,000	-	-	-	-5,00,000
1	1,50,000	1,00,000	50,000	20,000	1,30,000
2	1,50,000	80,000	70,000	28,000	1,22,000
3	1,50,000	60,000	90,000	36,000	1,14,000
4	1,50,000	40,000	1,10,000	44,000	1,06,000
5	3,50,000	20,000	3,30,000	1,32,000	1,98,000

$$NPW = \frac{A_0}{(1+i)^0} + \frac{A_1}{(1+i)^1} + \frac{A_2}{(1+i)^2} + \ldots + \frac{A_n}{(1+i)^n}$$

$$NPW = -\frac{5,00,000}{(1+0.15)^0} + \frac{1,30,000}{(1+0.15)^1} + \frac{1,22,000}{(1+0.15)^2} + \frac{1,14,000}{(1+0.15)^3} + \frac{1,06,000}{(1+0.15)^4} + \frac{1,98,000}{(1+0.15)^5}$$

$= -$ Rs 60,703.30 **Ans.**

Examples 7.4

An asset has installed value of 45,000. Salvage value=0. It is classed as a 5 years property. Determine approximate MACRS depreciation schedule. Over 6 years it is estimated to generate revenue of Rs 23,000 per year with annual operating cost Rs7,300 required rate of return is 15% after tax. Tax rate =40%. Evaluate after tax with annual worth method. **TU-2070**

Solution: We have given,

Installed value = P= Rs 45,000
Salvage value = SV = Rs 0
Revenue generated per year = R = Rs 23,000
Operating Cost = E = Rs 23,000

According to MACRS Assumption

- MACRS deduction percentages begin with the first taxable year and ending with the 6th year.

- Under MACRS salvage value = 0
- One half year of depreciation is allowed in the year of purchase regardless of the purchase date (some exceptions).
- The percentages rates of depreciation are computed as under:

SL rate = $\frac{1}{n} = \frac{1}{5} = 0.2 = 20\%$

DDB rate = $\frac{2}{5} = 0.4 = 40\%$

Year	Calculations	DDB Dep. %		SL Dep. %	MARCS %	Dep. Amount (Rs) MRCS % × P
1	$\frac{1}{2}$ year DDB dep. = 0.5 × 0.4	20				9,000
2	DDB = 0.4 × (100 – 20) SL Dep. = $\frac{1}{4.5}$ × (100 – 20)	32	>	17.78	32	14,400
3	DDB Dep. = 0.4 × (100 – 52) SL Dep.= $\frac{1}{3.5}$ × (100 – 52)	19.2	>	13.71	19.2	8,640
4	DDB Dep. = 0.4 × (100 – 52) SL Dep.= $\frac{1}{2.5}$ × (100 – 71.2)	11.5	=	11.52	11.52	5,184
5	SL Dep.= $\frac{1}{1.5}$ × (100 – 82.72)			11.52	11.52	5,184
6	SL Dep.= $\frac{1}{2}$ × 11.52			5.76	5.76	2,592

After Tax Cash Flow Estimates

Year	1 Before Tax Cash Flow	2 MARCS Rate	3 Dep. Amount 1×2	4 Net Taxable Income 1-3	5 Tax Amount 4×40%	6 After Tax Cash Flow 1–5
0	-45,000	-	-	-	-	-45,000
1	R – E = 23,000 – 7,300 =15,700	20	9,000	6,700	2,680	13,020
2	15,700	32	14,400	1,300	520	15,180
3	15,700	19.2	8,640	7,060	2,824	12,876
4	15,700	11.52	5,184	10,516	4,206.40	11,493.60
5	15,700	11.52	5,184	10,516	4,206.40	11,493.60
6	15,700	5.76	2,592	13,108	5,243.20	10,456.80

Examples 7.5

If a machine costing of Rs 1,50,000 is purposed by expecting salvage value Rs 40,000 at the end of 6th year. Calculate depreciation amount for each years by, (i) SOYD (ii) Declining balance **TU-2070**

Solution: We have given,

P = Rs.1,50,000, SV = Rs.40,000. n = 6 years

a. Sum of Years Digits Method

SOYD = sum of years' digits over the useful life = $\frac{n(n+1)}{2} = \frac{6(6+1)}{2} = 21$

Depreciation for 1st year

$d_m = \frac{n-m+1}{SOYD} \times (P - SV) = \frac{6-1+1}{21} \times (1,50,000 - 40,000)$ = Rs. 20,952.38

Similarly, the annual depreciation at the end of other years have been calculated and are presented in Table 7.15.

b. Declining Balance Method

The constant annual depreciation rate 'd_m' is given by;

$$d_m = 1 - \left(\frac{S_V}{P}\right)^{V_n} = 0.198$$

The depreciation amount for a given year is calculated using equation $D_m = P\, d_m\, (1 - d_m)^{m-1}$

Depreciation for 1st year = $D_1 = 1,50,000 \times (1 - 0.198)^{1-1} \times 0.198$

= Rs 29,700

Table7.15: Depreciation and Book Value of the Construction Equipment Using Sum-of-years-digits Method and Sinking Fund Method.

Year	Sum of Year Digit Method Dep. (D_m) Rs $D_m = \frac{n-m+1}{SOY} \times (P - SV)$ $= \frac{6-m+1}{21} \times 1,10,000$	DDB Method Dep. (D_m) Rs $D_m = 1,50,000 \times 0.802^{m-1} \times 0.198$
0	-	-
1	31,428.57	29,700
2	26,190.47	23,819.40
3	20,952.38	19,103.20
4	15,714.28	15,320.73
5	10,476.19	12,287.23
6	5,238.095	9,854.36

Examples 7.6

A machine costs Rs 1,50,000. Its useful life is 5 years and salvage value is Rs900. Compute the annual depreciation allowance and resulting book values using double declining balance depreciation methods.

TU - 2070

Solution: We have given,

Initial cost of the asset = P = Rs.1,50,000

Salvage value = SV = Rs.900, Useful life = n = 5 years

The constant annual depreciation rate d_m for double-declining balance (DDB) method is calculated as follows;

$$d_m = \frac{2}{5} = 0.4$$

Table 7.16 Depreciation and Book Value Using Double-declining Balance Method.

Year	Depreciation (Rs) $D_m = P\, d_m(1-d_m)^{m-1}$	Book Value (Rs) $BV_m = BV_{m-1} - D_m$
0	-	1,50,000
1	60,000	90,000
2	36,000	54,000
3	21,600	32,400
4	12,960	19,440
5	7,776	11,664

Here, Book value of the end of 5th year is greater than salvage value. So switching of SL method is required.

Year	DDB depreciation (Rs)	SL depreciation (Rs)	Book value (Rs)	Remarks
0	-	-	1,50,000	
1	60,000	$\frac{1,50,000-900}{5}$ = 29,820	90,000	do not switch
2	36,000	$\frac{90,000}{4}$ = 22,275	54,000	do not switch
3	21,600	$\frac{54,000-900}{3}$ = 17,700	32,400	do not switch
4	12,960	$\frac{32,400-200}{2}$ 15,750	16,650	Switch
5	11,664	15,750	900	Ok

Questions

1. A machine purchased for Rs 50,000 by expecting useful life of 10 years. Calculate its depreciation amount for each year by using declining balance method when rate of depreciation is 20% per year.
2. We are considering the purchase of motorcycle at a cost of Rs 1,10,000 with an estimated salvage value of Rs 2,000 and a project useful life of 5 years interest is 10% determine:
   a. Sum of years digits depreciation.
   b. Double decline balance with conversion to straight line depreciation.
3. If a machine costing of Rs 6,00,000 is estimated to have useful life 10 years and Rs 10,000 salvage value. Find depreciation amount for each year by using straight line, sum of the year digit and sinking fund method if i =10%.
4. If a machine costing Rs4,00,000 is estimated to have useful life 10 years and Rs 50,000 salvage value. Find depreciation amount for each year by using straight line and sum of the year digit depreciation.
5. A machine cost Rs 15,000. Its useful life is 5 years and salvage value is Rs 900. Compute the annual depreciation allowances and resulting book vales using double rate declining balance depreciation method.
6. If a machine costing of Rs 4,00,000 is estimated to have useful life 10 years and Rs 50,000 salvage value. Find depreciation amount for each year by using straight line and sum of the year digit depreciation.
7. A machine was brought for a manufacturing plant is Rs 4,000 having 10 years depreciation deduction, book value and cumulative depreciation cost at the end of the eight year using 150% declining balance method and sum of the years digits method.
8. We are considering the purchase of second hand computer at a cost of Rs 10,500 with an estimate salvage value of Rs500 and a projected useful life of four years. Interest is 10%. Determine: a. sum of year digit depreciation. b. Double declining balance with conversion to straight line depreciation.

9. We are considering the purchase of second hand computer at a cost of Rs 16,000 with an estimated salvage value of zero and a project useful life of five year. Interest is 10%

   Determine:

   a. Sum of years digits depreciation
   b. Sinking depreciation balance with conversion to straight line depreciation.
   c. Double balance with conversion to straight line depreciation.

10. The ABC Company purchases a new bus for Rs 95,000. If the company use the bus for 10 years and sold it in Rs 500, find depreciation and book value of each year using straight line and double rate declining balance method.

11. A company has purchased equipment whose first cost is Rs 1,00,000 with estimated life of eight years. The estimated salvage of the equipment at the end of its life time is Rs 20,000. Determine the depreciation charge and book value at the 4 an d5 years using the double decline method of depreciation.

12. A machine was brought for manufacturing plant in Rs 1,00,000 having year's depreciable life. The estimated salvage value of the machine is zero. Find annual depreciation and cumulative depreciation cost at the end of each year using 150% declining balance method and sum of the year's digit method.

13. A company has purchased equipment whose first cost is 'Rs 1,00,000 with estimated life of eight years. The estimated salvage of the equipment at the end of its life time is Rs 20,000. Determine the depreciation charge and book value at the 4 and 5 years using the double decline method of depreciation.

14. What do you mean by depreciation and what are its causes?

15. What do you understand by depreciation? Explain different methods used in calculation of depreciation.

16. What are the purposes of depreciation calculation?

17. Explain the general procedure for after tax economic analysis with suitable example.

18. State the factor affecting to the amount of depreciation.

19. Define depreciation and list out important methods of calculating depreciation deduction.