UNIT V DEPRECIATION

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DEPRECIATION

Definition :

Carter defines : Depreciation is the gradual and permanent decrease in the value of an asset from any cause

Accounting point of view : Depreciation is an annual charge reflecting the decline in value of an asset due to causes such as wear and tear action of elements obsolescence.

CAUSES OF DEPRECIATION

- **Wear and tear** : Results from friction, resistance and chemical reaction.
- **Depletion** : Decrease in the value of the assets such as oils wells, mines, forests
- **Obsolescence** : The assets getting out of use due to new invention and loss of demand due to change in technology.
- **Lapse of time** : The value of the asset goes down whether utilized or not.

METHODS OF DEPRECIATION

- Straight line method of depreciation
- Declining balance method
- Sum of years digits method
- Sinking fund method
- Service output method

STRAIGHT LINE MEHTOD OF DEPRECIATION

- In this method of depreciation a fixed sum is charged as depreciation amount throughout the life time.
- At the end of the life of an asset the accumulated sum of the asset is exactly equal to the purchase value of the asset.
- Assumption : Inflation is absent

STRAIGHT LINE MEHTOD OF DEPRECIATION

- 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_i
- D_t = Depreciation amount for the time period t

$$D_t = \frac{[P - F]}{n}$$

$$B_t = B_{i-1} - D_t = P - t[\frac{P - F}{n}]$$

PROBLEM 1

- A company purchased a machinery for Rs 8000, the useful life of the machinery is 10 years and the estimated salvage value of the machinery at the end of the lifetime is Rs800. Determine the depreciation charge and book value at the end of the various years using the straight line method of depreciation.

SOLUTION

- P = Rs 8000
- F = Rs 400
- D_t = (P-F)/n = (8000 – 800)/10 = 720
- Rate of Deprecation = D_t / P * 100
  = (720/8000)*100
  = 9%

SOLUTION

End of Year	Depreciation (D_t)	Book Value $B_t = B_{t-1} - D_t$
0	-	8000
1	720	7280
2	720	5660
3	720	5840
4	720	5120
5	720	4400
6	720	3680
7	720	2960
8	720	2240
9	720	1520
10	720	800

PROBLEM 2

- A machine costing Rs 24,000 was purchased on 1st December 1985. The installation and erection charges were Rs 1000 and its useful life is expected to be 10 years. The scrap value of the machine at the end of the useful life is Rs 5000. Compute the depreciation and the book value for the period 6

SOLUTION

- P = Rs 24,000 + Rs 1000 = 25000
- F = Rs 5000/-
- n = 10 years
- **D_t = (P-F)/n = (25000-5000)/10 = 2000**
- $$B_t = B_{i-1} - D_t = P - t[\frac{P-F}{n}]$$

- B_t = 25,000 – 6 × (25000-5000)/10
- **B_t = Rs.13,000/-**

DECLINING BALANCE METHOD

- A constant % of book value of the previous period of the asset will be charged as the independent amount for the current period.
- The book value at the end of the life of the asset may not be exactly equal to the salvage value of the asset.
- 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”

FORMULA FOR DECLINING BALANCE METHOD

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

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

$$B_t = (1 - K)B_{t-1}$$

FORMULA FOR DECLINING BALANCE METHOD

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

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

$$B_t = (1-K))B_{t-1}$$

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

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

- **If k = 2/n then it is called as double declining balance method**

PROBLEM 1

- Glaxo company has purchased a machine for Rs 1,50,000. The plant engineer estimates that the machine has a useful life of 10 years and a salvage value of Rs 25,000 at the end of the useful life. Demonstrate the calculations of the declining balance method of depreciation by assuming 0.2 for K
- P = Rs 1,50,000.
- F = Rs 25,000
- n= 10 years
- K = 0.2

Using the formula

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

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

SOLUTION

End of year (n)	Depreciation (D_t)	Book Value (B_t)
0	-	1,50,000.00
1	30,000.00	1,20,000.00
2	24,000.00	96,000.00
3	19,200.00	76,800.00
4	15,360.00	61,440.00
5	12,288.00	49,152.00
6	9830.40	39,321.60
7	7864.32	31,457.28
8	6291.45	25,165.83
9	5033.16	20,132.67
10	4026.53	16,106.14

PROBLEM 2

- Calculate the depreciation and book value for the period 5 using the declining balance method of depreciation by assuming 0.2 for K and Rs 1,20,000 for P and salvage value Rs 10,000. The useful life of the machinery is 10 years.
- P = Rs 1,20,000
- F = Rs 10,000
- n= 10 years
- K = 0.2

SOLUTION

- **Using the formula**

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

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

- **D_t = 0.2 (1-0.2)$^{(5-1)}$ × 1,20,000 = Rs 98,430.40/-**
- **B_t = (1-0.2)^5 × 1,20,000 = Rs 39,321.60**

SUM OF YEARS DIGITS METHOD

- The scrap value of the asset is deducted from its original cost and it is assumed that the book value of the asset decreases at a decreasing rate.
- Sum of the years = n (n+1)/2
- D_t = Rate × (P-F)
- $B_t = B_{t-1} - D_t$
- The formula for D_t and B_t for a specific year "t" are as follows

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

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

PROBLEM 1

- ABC company has purchased an equipment whose first cost is Rs 2,00,000 with an estimated life of eight years. The estimated scrap value of the equipment at the end of the lifetime is Rs 40,000/-. Determine the depreciation charge and book value at the end of various years using sum of the years digits method of depreciation.

SOLUTION

- P= Rs. 2,00,000
- F = Rs.40,000
- n = 8 years
- Sum = (8 × 9)/2 = 36

End of Year (n)	Depreciation (D_t)	Book Value (B_t)
0	-	2,00,000
1	35,555.55	1,64,444.44
2	31,111.11	1,33,333.33
3	26,666.67	1,06,666.66
4	22,222.22	84,444.44
5	17,777.77	66,666.67
6	13,333.33	53,333.34
7	8888.88	44,444.46
8	4444.44	40,000.02

PROBLEM 2

- Consider problem 1 and find the depreciation and book value for the 5^{th} year.

- P= Rs. 2,00,000
- F = Rs.40,000
- n = 8 years

Using the formula

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

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

$$D_t = \frac{8-5+1}{8(8+1)/2}(2,00,000 - 40,000) = Rs.17,777.78$$

$$B_t = (2,00,000 - 40,000)\frac{8-5}{8}\frac{8-5+1}{8+1} + 40,000 = Rs.66,666.67$$

SINKING FUND METHOD

- In this method of depreciation a depreciation fund equal to actual loss in the value of the asset is estimated for each year.
- This amount is invested outside the business in a separate account sinking fund investment account and interest will be earned on the fund.
- The sinking fund will rise year after year.

FORMULA USED

- 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 of value of the asset (P-F) is made available in the form of cumulative depreciation amount**
- **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)**
- **B_t = P-(P-F)(A/F, i, n)(F/P,i,t-1)**

PROBLEM 1

- Find the depreciation annuity by annuity method after three years when the initial cost of the machine is Rs.8,00,000 and the salvage value at the end of three years is Rs. 4,00,000. Rate of interest is 10%.

SOLUTION

- P = Rs. 8,00,000
- F = Rs. 4,00,000
- n = 3 years
- i = 10%
- **A = (P-F)[A/F, i, n]**
- A = (8,00,000-4,00,000) [A/F,10%,3] value from interest table is substituted
- A = (8,00,000-4,00,000) x 0.3021 = Rs. 1,20,840
- **D_t = (P-F)(A/F, i ,n)(F/P,i,t-1)**
- **B_t = P-(P-F)(A/F, i, n)(F/P,i,t)**

SOLUTION

- $D_t = (P-F)(A/F, i, n)(F/P,i,t-1)$
- D_2 at the end of the second year (D_2) =
- $D_2 = 1,20,840 + 1,20,840 \times 0.10 = Rs.\ 1,32,924.$

End of the year 't'	Fixed D_t	Net D_t	Book Value B_t
0	1,20,840	-	8,00,000.00
1	1,20,840	1,20,840.00	6,79,160.00
2	1,20,840	1,32,924.00	5,46,236.00
3	1,20,840	1,46,216.40	4,00,019.60

PROBLEM 2

- ABC & Co has purchased a machinery and its first cost is Rs. 2,00,000 with an estimated standard life of 8 years. The salvage value is Rs. 40,000 find D_6 and B_7, rate of interest 12% compounded annually.
- **Solution :**
- P = Rs. 2,00,000 F = Rs. 40,000 n = 8 years i = 12%
- D_6= (P-F)(A/F,12%,8)(F/P,12%,5)**

  ** - From interest table
- D_6= (2,00,000-40,000) (0.0813)(1.762) = **Rs. 22,920**
- B_7 = P-(P-F) (A/F,12%,8)(F/A,12%,7)**
- B_7 = 2,00,000-(2,00,000-40,000)(0.0813)(10.089)

  = **Rs. 68,762.29**

SERVICE OUTPUT METHOD

- In this method the life of the machine is expressed in terms of number of units that a machine is expected to produce over the estimated life
- 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
- Depreciation/unit of service = (P-F)/X
- Depreciation for x unit of service period = $\frac{(P-F)}{X}(x)$

PROBLEM

- The first cost of a road laying machine is Rs 60,00,000/-. Its salvage value after 5 years of service is Rs. 40,000/-. The length of road that can be laid by the machine during the lifetime is 55,000km. In its third year of operation the length of road laid is 1500 km. Find the depreciation of the equipment for that year

Solution:

- P = 60,00,000 F = 40,000 X = 55,000 km, x = 1500 km
- Depreciation for x unit of service in year 3 =

$$D_3 = \frac{60,00,000 - 40,000}{55,000} \times (1500) = Rs.1,62,545.45$$

EVALUATION OF PUBLIC ALTERNATIVES

- Evaluation of public alternatives is selection of best alternative from the available alternatives.
- The factor considered in selection is profit maximization.
- For the evaluation of public alternatives the benefit – cost ratio is used
- BC ratio = $\frac{Equivalent Benefits}{Equivalent Costs}$

EVALUATION OF PUBLIC ALTERNATIVES

- P = initial investment
- C= Early cost of operation and maintenance
- P_A = Annual equivalent of the initial investment
- P_F = Future worth of the initial investment
- B_P = Present worth of total benefits
- B_F = Future worth of total benefits
- B_A = Annual equivalent of total benefits
- C_P = Present worth of yearly cost of operation and maintenance.
- C_F = Future worth of yearly cost of operation and maintenance.

$$BCRATIO = \frac{B_P}{P + C_P} = \frac{B_F}{P_F + C_F} = \frac{B_A}{P_A + C}$$

PROBLEM

- Project A_1 and Project A_2 are being considered for investment. Project A_1 requires an initial investment of Rs 40,00,00 and net receipts estimated as Rs10,00,000 per year for the next 5 years. The initial overlay for the A_2 is Rs 70,00,000 and the net receipts have been estimated as Rs. 16,00,000 per year for the next seven years. There is no salvage value associated with either of the projects. Using the benefit to cost ratio which project would you select? Interest rate = 10%

SOLUTION

Alternative 1 :

- P = Rs 40,00.000 B = Rs. 10,00,000 n = 5 Years
  i= 10%

$$BCRATIO = \frac{Annualequivalent Benefits}{Annualequivalent Costs}$$

- Annual equivalent of initial cost = P(A/P,10%,5)
  =40,00,000 x 0.2638
  = Rs. 10,55,200

$$BCRATIO = \frac{10,00,000}{10,55,200} = 0.9476$$

SOLUTION

Alternative 2 :

- P = Rs 70,00.000 B = Rs. 15,00,000 n = 7 Years
  i= 10%

$$BCRATIO = \frac{Annualequivalent Benefits}{Annualequivalent Costs}$$

- Annual equivalent of initial cost = P(A/P,10%,7)
  =70,00,000 x 0.2054 = Rs. 14,37,800

$$BCRATIO = \frac{15,00,000}{14,37,800} = 1.0432$$

- The benefit cost ratio of alternative 2 **(i.e 1.0342 >1)** is more than alternative 1. **Hence alternative 2 is selected**