CE 231
ENGINEERING ECONOMY

PROBLEM SET 5

PROBLEM 1

An asset has a first cost of 13.000 TL, an estimated life of 15 years, and an estimated salvage value of 1.000 TL. Using the straight-line method, find:

a) The annual depreciation charge,
b) The annual depreciation rate expressed as a percentage of first cost, and
c) The book value at the end of 9 years.

SOLUTION 1

P = 13.000 TL

n = 15 yrs

F = 1.000 TL

a) Annual depreciation charge = $\frac{13.000-1.000}{15}$ = 800 TL

b) $\frac{800}{13.000}$ = 0.0615 = 6,15%

c) 13.000 – (9 x 800) = 5.800 TL

PROBLEM 2

An asset has a first cost of 22.000 TL, an estimated life of 30 years, and an estimated salvage value of 2.000 TL. Using the double declining balance method, find:

a) The depreciation charge in the first year,
b) The depreciation charge in the 6^{th} year, and
c) The book value at the end of 6^{th}.

SOLUTION 2

P = 22.000 TL

n = 30 yrs $\qquad$ $r = \frac{2}{n} = \frac{2}{30} = 0{,}07$

F = 2.000 TL

End of Year	Depreciation	Book Value
0	-	22.000
1	22.000 x 0,07 = 1540	20.460
2	20.460 x 0,07 = 1432	19.027,80
3	19.027,8 x 0,07 = 1331,95	17.695,85
4	17.695,85 x 0,07 = 1238,71	16.457,14
5	16.457,14 x 0,07 = 1152	15.305,14
6	15.305,14 x 0,07 = 1071,36	14.233,78

PROBLEM 3

An asset has a first cost of 9.000 TL, an estimated life of 12 years, and an estimated salvage value of 1.200 TL. It is to be depreciated by the sum-of-the-years-digit method. What will be the depreciated charge;

a) in the first year and;

b) in the 7^{th} year?

c) What will be the book value at the end of 6 years?

SOLUTION 3

P = 9.000 TL

n = 12 yrs

F = 1.200 TL

$$s = \frac{n(n+1)}{2} = \frac{12x13}{2} = 78$$

a) $d_1 = 2(P-F)\left[\frac{n+1-i}{n^2+n}\right] = 2\,(9000-1200)\left[\frac{12+1-1}{12^2+12}\right] = 1200$ TL

b) $d_7 = 2\,(9000-1200)\left[\frac{12+1-7}{12^2+12}\right] = 600$ TL

c) $BV_6 = 9000 - (9000-1200)\,\frac{2x12x6-6^2+6}{12^2+12} = 3300$ TL

OR,

End of Year	Depreciation	Book Value
0	-	9.000
1	(9000-1200) x 12/78 = **1200**	7.800
2	7.800 x 11/78 = 1100	6.700
3	7.800 x 10/78 = 1000	5.700
4	7.800 x 9/78 = 900	4.800
5	7.800 x 8/78 = 800	4.000
6	7.800 x 7/78 = 700	**3.300**
7	7.800 x 6/78 = **600**	2.700

PROBLEM 4

A company has purchased a numerically controlled machine for 150.000 TL. It it estimated that it will have a salvage value of 50.000 TL four years from now. What rate must be used with the declining-balance method of depreciation so that the book value of the machine will be equal to its salvage value at the end of its life?

a) using the rate just calculated with declining-balance depreciation find the depreciation and book value for each year of the machine's life,

b) compare those figures with similar figures for straight-line and sum-of-the years-digits depreciation.

SOLUTION 4

P = 150.000 TL

n = 4 yrs

F = 50.000 TL

a) $R = 1 - \sqrt[n]{F/P}$

$R = 1 - \sqrt[4]{50{,}000/150{,}000} = 1\text{-}0{,}7598 = 0{,}2402$

End of Year	Depreciation	Book Value
0	-	150.000
1	150.000 x 0,24 = 36.000	114.000
2	114.000 x 0,24 = 27.360	86.640
3	86.640 x 0,24 = 20.793,6	65.846
4	65.846 x 0,24 = 15.803	50.042

b) Straight line depreciation = (150.000-50.000)/4 = 25.000

End of Year	Depreciation	Book Value
0	-	150.000
1	25.000	125.000
2	25.000	100.000
3	25.000	75.000
4	25.000	50.000

Sum-of-the-years digits: s = $\frac{4x5}{2}$ = 10

End of Year	Depreciation	Book Value
0	-	150.000
1	(150.000-50.000) x 4/10 = 40.000	110.000
2	100,000 x 3/10 = 30.000	80.000
3	100,000 x 2/10 = 20.000	60.000
4	100,000 x 1/10 = 10.000	50.000

PROBLEM 5

A piece of equipment that cost 5.000 TL was found to have a trade-in value of 4.000 TL at the end of the first year, 3.200 TL at the end of the second year, 2.560 TL at the end of the third year, 2.048 TL at the end of the fourth year. Determine the depreciation that occurred during each year.

SOLUTION 5

P = 5.000

P_1 = 4.000 $\quad$ d_1 = 5.000 – 4.000 = 1.000 TL

P_2 = 3.200 $\quad$ d_2 = 4.000 – 3.200 = 800 TL

P_3 = 2.560 $\quad$ d_3 = 3.200 – 2.560 = 640 TL

P_4 = 2.048 $\quad$ d_4 = 2.560 – 2.048 = 512 TL

PROBLEM 6

A firm purchases a computer for 2.000.000 TL. It has a life of 9 years and a salvage value of 200.000 TL at that time. Determine the depreciation charge for year 6 and the book value at the beginning of year 6, using:

a) Straight line depreciation
b) Declining balance depreciation
c) Sum of the years digits depreciation

SOLUTION 6

P = 2.000.000 TL

n = 9 yrs

F = 200.000 TL

a) $d = \dfrac{2.000.000 - 200.000}{9} = 200.000$

$D_6 = 200.000$

$BV_5 = 2.000.000 - 5 \times 200.000 = 1.000.000$

b) $R = 1 - \sqrt[n]{F/P} = 1 - \sqrt[9]{200.000/2.000.000} = 0{,}2257$

End of Year	Depreciation	Book Value
0	-	2.000.000
1	$2 \times 10^6 \times 0{,}2257 = 0{,}4519 \times 10^6$	$1{,}5485 \times 10^6$
2	$1{,}5485 \times 10^6 \times 0{,}2257 = 0{,}3495 \times 10^6$	$1{,}1990 \times 10^6$
3	$0{,}2706 \times 10^6$	$0{,}9285 \times 10^6$
4	$0{,}2096 \times 10^6$	$0{,}7189 \times 10^6$
5	$0{,}1623 \times 10^6$	$\mathbf{0{,}5566 \times} 10^6$
6	$\mathbf{0{,}1256 \times} 10^6$	

c) s = $\frac{n(n+1)}{2} = \frac{9x10}{2} = 45$

End of Year	Depreciation	Book Value
0	-	2.000.000
1	$1{,}8\ x10^6$ x 9/45 = $0{,}36\ x10^6$	1.640.000
2	$1{,}8\ x10^6$ x 8/45 = $0{,}32\ x10^6$	1.320.000
3	$1{,}8\ x10^6$ x 7/45 = $0{,}28\ x10^6$	1.040.000
4	$1{,}8\ x10^6$ x 6/45 = $0{,}24\ x10^6$	800.000
5	$1{,}8\ x10^6$ x 5/45 = $0{,}20\ x10^6$	**600.000**
6	$1{,}8\ x10^6$ x 4/45 = **0,16 x**10^6	

PROBLEM 7

A new 250.000 TL automobile will depreciate over the next 5 years approximately according to the sum of the years digit method with the first year depreciation being 50.000 TL.

a) Determine the salvage value at the end of 5-year period.
b) Determine the year-end book value for each year.

SOLUTION 7

P = 250.000 TL

n = 5 yrs

s = $\frac{n(n+1)}{2} = \frac{5x6}{2} = 15$

a) (250.000 – F) 5/15 = 50.000

F = 100.000 TL

b)

End of Year	Depreciation	Book Value
0	-	250.000
1	50.000	200.000
2	150.000 x 4/15 = 40.000	160.000
3	150.000 x 3/15 = 30.000	130.000
4	150.000 x 2/15 = 20.000	110.000
5	150.000 x 1/15 = 10.000	100.000

PROBLEM 8

A bulldozer has a first cost of 350.000 TL with an estimated life of 5 years. The salvage value at the end of 5 years is estimated to be 50.000 TL. What is the book value of this bulldozer at the end of 3rd year. Use:

a) The straight line method.
b) The double-declining-balance method
c) The declining balance method (R = 1 - $\sqrt[n]{F/P}$)
d) The sum-of-the-years-digit method.

SOLUTION 8

P = 350.000 TL

n = 5 yrs

F = 50.000 TL

a) $d = \dfrac{350.000 - 50.000}{5} = 60.000$

BV_3 = 350.000 – (3 x 60.000)

= 170.000 TL

b) r = 2 x 1/5 = 0,40

End of Year	Depreciation	Book Value
0	-	350.000
1	350.000 x 0,40 = 140.000	210.000
2	210.000 x 0,40 = 84.000	126.000
3	126.640 x 0,40 = 50.400	**75.600**
4		
5		

c) R = 1 - $\sqrt[n]{F/P}$

R = 1 - $\sqrt[5]{50.000/350.000}$ = 0.32

0.32 = 1 - $\sqrt[3]{F/350.000}$ => $\sqrt[3]{F/350.000}$ = 1 – 0,32

F = 350.000 $(1-0,32)^3$

F = 350.000 x $(0,68)^3$ = 110.051,20 TL

c) s = $\dfrac{n(n+1)}{2} = \dfrac{5x6}{2}$ = 15

(P-F) = 350.000 – 50.000 = 300.000

End of Year	Depreciation	Book Value
0	-	350.000
1	300.000 x 5/15 = 100.000	250.000
2	300.000 x 4/15 = 80.000	170.000
3	300.000 x 3/15 = 60.000	**110.000**
4		
5		