Al-Mustaqbal University
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2nd term / Lecture: Depreciation Accounting and Machine Replacement

CHAPTER 8

Depreciation Accounting and Machine Replacement

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1. Introduction:

Depreciation is the reduction in the value, or the effective economic life of the assets arising from the passage of time. The depreciation includes machines, equipment's and buildings. Reasons of depreciation are: الاندثار (الاستهلاك) هو نقص القيمة او التأثير على العمر الاقتصادي للأصول مع مرور الزمن واسبابه هي:

(a) Technological changes;

(b) Improvement in production methods;

(c) Change in market demand for the product or service output of the asset; or

(d) Wrong maintenance.

(e) Operation time (useful life).

The useful life of a depreciable asset should be estimated after considering the following factors:

(i) Expected physical wear and tear;

العمر المفيد للأصول (المكائن والآلات والمعدات) يجب ان يخمن
اعتمادا على العوامل التالية:
1- التآكل والاستهلاك المتوقع
2- التقادم
3- المحددات الأخرى على استخدام الاصل

(ii) Obsolescence;

(iii) Legal or other limits on the use of the asset.

2. Depreciation Methods:

There are many methods of calculating depreciation:

1. **Straight-line Method:** طريقة الخط المستقيم

This is the simple method mentioned in the definition depreciation.

$$Depreciation\ (D) = \frac{C - S}{N}$$

Where **C** is an original cost, **S** is a salvage value (scrap) and **N** is an useful economic life in years.

$$1^{st}\ year\ depreciation\ (D1) = 1 \times D \Rightarrow Book\ value\ (B1) = C - D1$$

$$2^{nd}\ year\ depreciation\ (D2) = 2 \times D \Rightarrow Book\ value\ (B2) = C - D2$$

$$3^{rd}\ year\ depreciation\ (D3) = 3 \times D \Rightarrow Book\ value\ (B3) = C - D3$$

$$4^{th}\ year\ depreciation\ (D4) = 4 \times D \Rightarrow Book\ value\ (B4) = C - D4$$

Where **B** (Book value) is the original cost of a fixed asset less accumulated depreciation.

B : (القيمة الدفترية) هو الكلفة الاصلية للأصل الثابت ناقصا الاستهلاك المتراكم
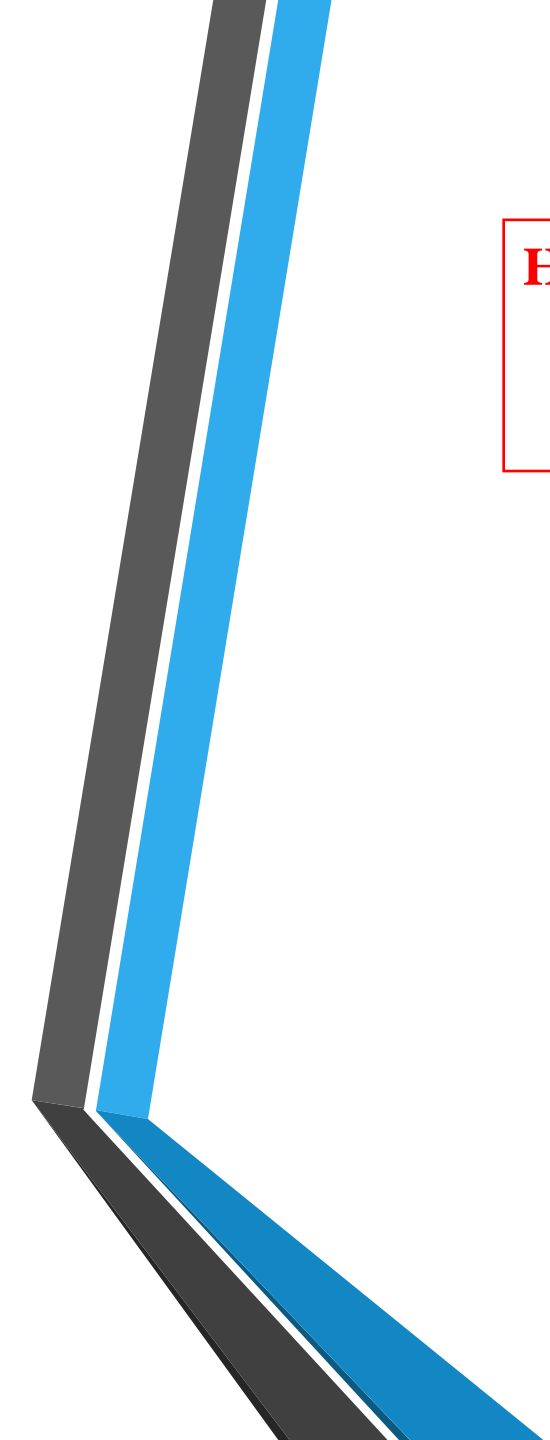C : الكلفة الاصلية
S : القيمة المسترجعة (مستهلك)
N : العمر الاقتصادي النافع للأصل (الآلة) بالسنوات

Ex1: An asset will cost 1,750$ when purchased this year. It is further expected to have a salvage value of 250$ at the end of its 5-year depreciable life. Calculate complete depreciation schedules giving the depreciation charge,$D\ (n)$, and end-of-year book value, $B\ (n)$,Use straight line (SL) method.

Ans:

$$Depreciation\ (D) = \frac{C - S}{N} = \frac{1750 - 250}{5} = 300\$$$

Years (n)	Annual depreciation $D(n)$	Book value $B(n)$
0	$Do = 0$	$B0 = 1750\$$
1	$D1 = 300\$$	$B1 = 1750 - 300 = 1450\$$
2	$D2 = 2 \times 300 = 600\$$	$B2 = 1750 - 600 = 1150\$$
3	$D3 = 3 \times 300 = 900\$$	$B3 = 1750 - 900 = 850\$$
4	$D4 = 4 \times 300 = 1200\$$	$B4 = 1750 - 1200 = 550\$$
5	$D5 = 5 \times 300 = 1500\$$	$B5 = 1750 - 1500 = 250\$$

H.W. A piece of machinery costs 35,000$ and has an anticipated 7,000$ scrap value at the end of its 10-year useful life. Compute the depreciation and book values for the machinery by using straight-line method.

2. Sum-of- Years Digits (SOYD) Method: طريقة مجموع ارقام السنوات

$$Sum\ of\ years\ digits\ (SOYD)\ =\ \frac{N}{2}\ (N\ +\ 1)$$

$$1^{st}\ year\ depreciation\ (D1) = \frac{N}{SOYD}\ (C - S)\ \Rightarrow Book\ value\ (B1) = C - D1$$

$$2^{nd}\ year\ depreciation\ (D2) = \frac{N - 1}{SOYD}\ (C - S)\ \Rightarrow Book\ value\ (B2) = B1 - D2$$

$$3^{rd}\ year\ depreciation\ (D3) = \frac{N - 2}{SOYD}\ (C - S)\ \Rightarrow Book\ value\ (B3) = B2 - D3$$

$$4^{th}\ year\ depreciation\ (D4) = \frac{N - 3}{SOYD}\ (C - S)\ \Rightarrow Book\ value\ (B4) = B3 - D4$$

Ex2: A machine costs 5,000$ and has an estimated value of 1,000$ at the end of five year useful life. Compute the depreciation schedule and book values for the machinery by the SOYD method.

Ans:

$$Sum\ of\ years\ digits\ (SOYD) = \frac{N}{2}(N + 1) = \frac{5(5 + 1)}{2} = 15$$

year	Depreciation	Book value
0	$D0 = 0$ \$	$B0 = C = 5000$\$
1	$D1 = \dfrac{5}{15}(5000 - 1000) \approx 1333$\$	$B1 = 5000 - 1333 = 3667$\$
2	$D2 = \dfrac{4}{15}(5000 - 1000) \approx 1067$\$	$B2 = 3667 - 1067 = 2600$\$
3	$D3 = \dfrac{3}{15}(5000 - 1000) = 800$\$	$B3 = 2600 - 800 = 1800$\$
4	$D4 = \dfrac{2}{15}(5000 - 1000) \approx 533$\$	$B4 = 1800 - 533 = 1267$\$
5	$D5 = \dfrac{1}{15}(5000 - 1000) \approx 267$\$	$B5 = 1267 - 267 = 1000$\$

H.W. Adventure Airlines recently purchased a new baggage crusher for 50,000$. It is expected to last for 14 years and have an estimated salvage value of 8,000$. Determine:

1. The depreciation charge on the crusher for the third year of its life.
2. The book value at the end of 8 years, using SOYD depreciation.

3. Reducing Balance (RB) Method: طريقة الرصيد المتناقص

With this method, a fixed percentage is applied to the net book value of the asset each year, with the net book value being cost minus total depreciation to date. This means that the depreciation charge in earlier years will be greater than in later years. The method that is chosen should reflect the way in which the asset will be used. If equal benefit will be gained each year, the straight-line method would be most appropriate, and if the asset will be more productive in earlier than later years the reducing balance method should be used.

In this method, the following equations can be used to find depreciation schedules (D and B)

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في هذه الطريقة يتم تطبيق نسبة ثابتة على القيمة الدفترية الصافية للأصل (الآلة) سنويا ، فتكون القيمة الدفترية هي الكلفة ناقصاً الاندثار (الاستهلاك) الكلي للتاريخ المحدد.

هذا يعني ان كلفة الاندثار في السنوات الأولى ستكون اكبر من السنوات الأخيرة.

ان اختيار طريقة الحل يعكس الطريقة التي سيتم استخدام الأصل فيها :

• اذا كان الربح المكتسب سنويا متساوي ستكون طريقة الخط المستقيم هي الملائمة

• اذا كان الأصل (الآلة) اكثر إنتاجية في السنوات الأولى منها في السنوات المتأخرة فتستخدم طريقة الرصيد المتناقص

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$$P\% = 1 - \left(\frac{S}{C}\right)^{\frac{1}{N}}$$

$Book\ value\ (B1) = C(1 - P\%) \Rightarrow 1^{st}\ year\ depreciation\ (D1) = C - B1$

$Book\ value\ (B2) = B1(1 - P\%) \Rightarrow 2^{nd}\ year\ depreciation\ (D2) = C - B2$

$Book\ value\ (B3) = B2(1 - P\%) \Rightarrow 3^{rd}\ year\ depreciation\ (D3) = C - B3$

$Book\ value\ (B4) = B3(1 - P\%) \Rightarrow 4^{th}\ year\ depreciation\ (D4) = C - B4$
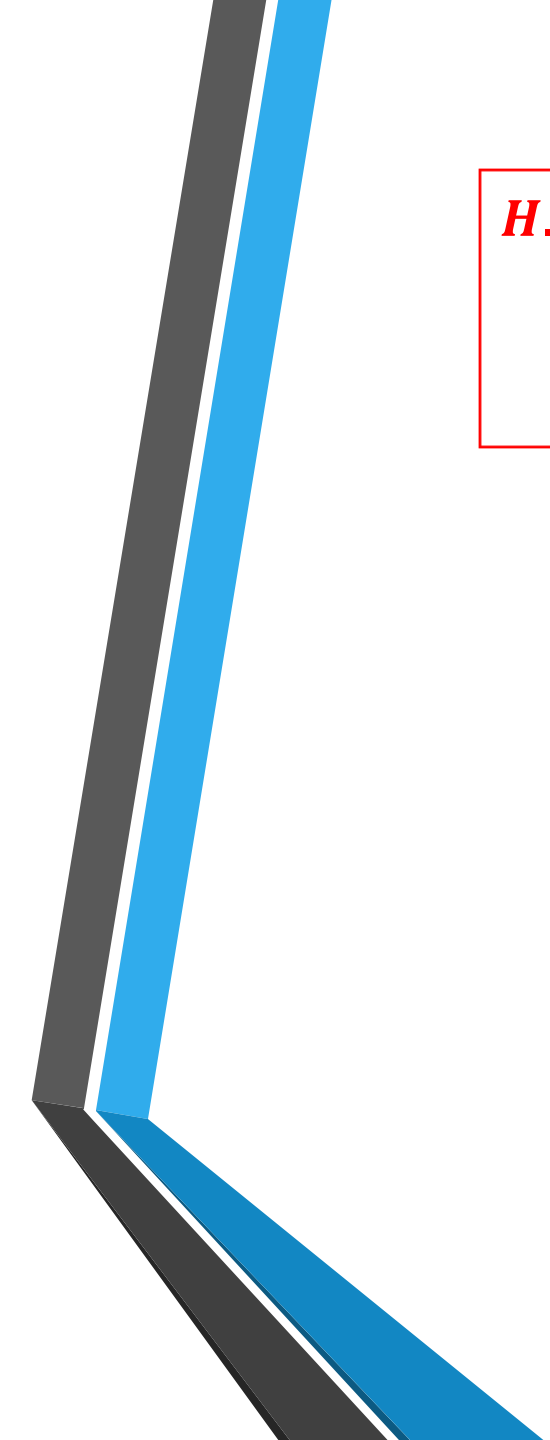
$\vdots$

$Book\ value\ (Bn) = B_{n-1}(1 - P\%) \Rightarrow n^{th}\ year\ depreciation\ (Dn) = C - Bn$

Ex3: A car costs 32,000$ and has an anticipated 8,000$ scrap value at the end of its 10-year useful life. Compute the depreciation and book values schedules for the car by the RB method.

Ans:

$$P\% = 1 - \left(\frac{S}{C}\right)^{\frac{1}{N}} = 1 - \left(\frac{8000}{32000}\right)^{\frac{1}{10}} = 0.1294$$

year	Book value	Depreciation
1	$B1 = 32,000(1 - 0.1294) \approx 27858\$$	$D1 = 32,000 - 27858 = 4142\$$
2	$B2 = 27858(1 - 0.1294) \approx 24253\$$	$D2 = 32,000 - 24253\$ = 7747\$$
3	$B3 = 24253(1 - 0.1294) \approx 21115\$$	$D3 = 32,000 - 21115 = 10885\$$
4	$B4 = 21115(1 - 0.1294) \approx 18383\$$	$D4 = 32,000 - 18383 = 13617\$$
5	$B5 = 18383(1 - 0.1294) \approx 16004\$$	$D5 = 32,000 - 16004 = 15996\$$
6	$B6 = 16004(1 - 0.1294) \approx 13933\$$	$D6 = 32,000 - 13933 = 18067\$$
7	$B7 = 13933(1 - 0.1294) \approx 12130\$$	$D7 = 32,000 - 12130 = 19870\$$
8	$B8 = 12130(1 - 0.1294) \approx 10560\$$	$D8 = 32,000 - 10560 = 21440\$$
9	$B9 = 10560(1 - 0.1294) \approx 9194\$$	$D9 = 32,000 - 9194 = 22806\$$
10	$B10 = 9194(1 - 0.1294) \approx 8004\$$	$D10 = 32,000 - 8004 = 23996\$$

$H.W$: A cutting machine costs 50,000 $ and has an anticipated 10,000 $ scrap value at the end of its 8 year useful life. Compute the depreciation and book values schedules for the cutting machine using RB method.

Machine Replacement: إحلال الآلة

In replacement, one is concerned with equipment machinery that deteriorates with the passage of time. However; with increasing maintenance, the production life of equipment can be increased but the maintenance cost goes high.

Machine Replacement Factors (Reasons of Replacement): عوامل (أسباب) الاحلال

Two factors are affected to replace machines:

1. **Technical Factors: Equipments and machines are generally replaced for the following reasons:** 1. العوامل الفنية

a. **Deterioration: leads to** a. تدهور حالة الآلة

- **Increases maintenance costs.**

- **Reduces production quality and quantity.**

b. **Obsolescence: Technology is progressing, new and better equipment are being developed and turn out every year.** b. التقادم

c. Inadequacy: when existing equipment's become inadequate to product in large quantities.

c. عدم الكفاءة

d. Working conditions: It may be thought of replacing old equipment and machines which create unpleasant (i.e. smoke, noise and etc.) and hazardous working condition causing worker unsafely and leading to accidents.

d. ظروف العمل

2. **Financial factors:**

.2 العوامل الاقتصادية

a. The initial cost of the challenger.

b. Expected scrap value at the end of the service life.

c. Operating expenses include:

- Direct and indirect labor cost, and material cost.

- Maintenance cost.
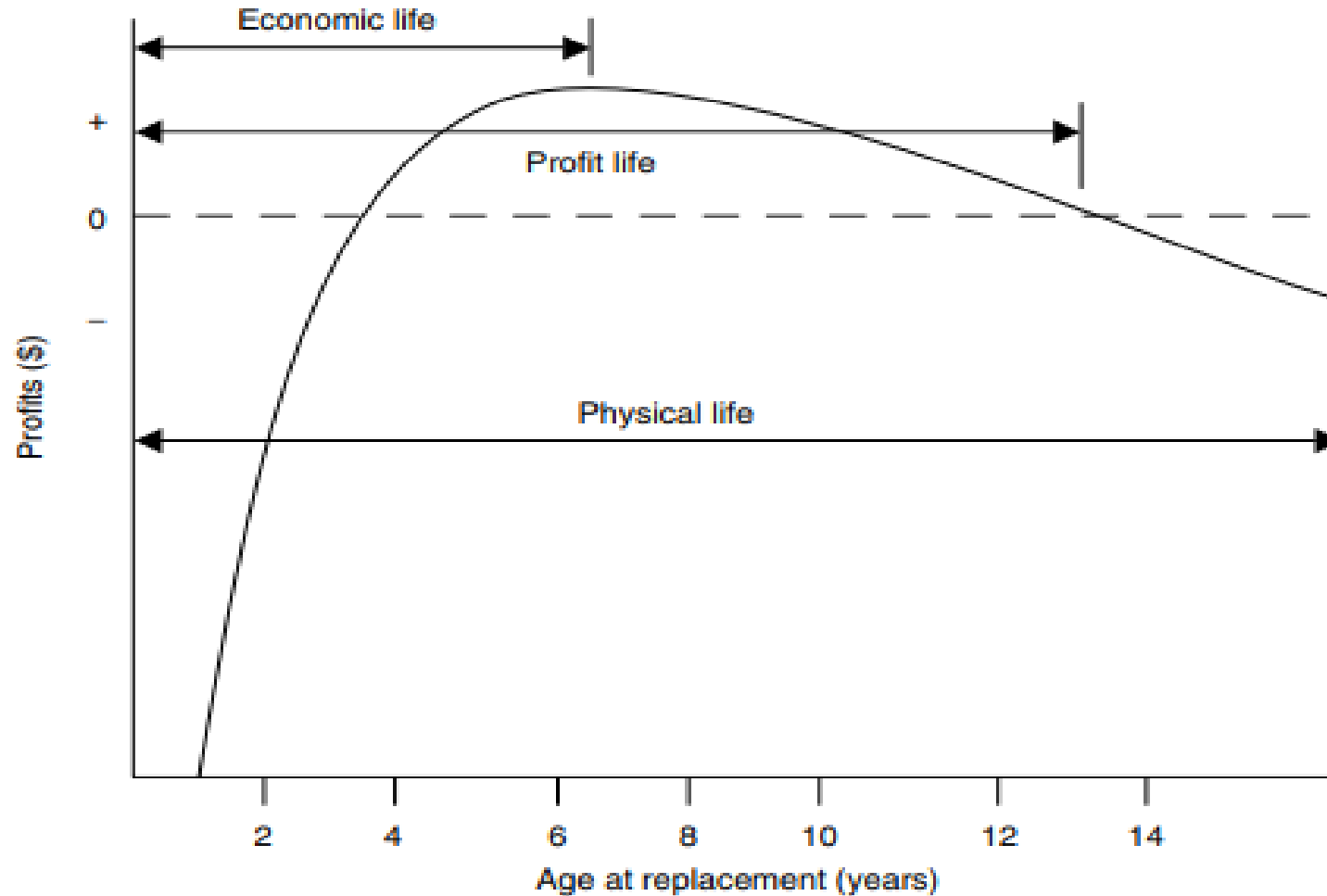
- Replaced parts cost.

a. الكلفة الأولية للبديل المنافس

b. توقع قيمة الآلة المستهلكة

c. مصروفات التشغيل

Equipment Life:

Equipment life can be defined in three ways. Physical life, profit life and economic life.

1. Physical Life:

Physical life is the age at which the machine is worn out and can no longer reliably produce. At this point, it will usually be abandoned or scrapped. As construction equipment ages, maintenance and operating costs increase.

العمر الفيزيائي هو العمر الذي تكون عنده الآلة متهالكة ولا يعول عليها وعنده يتم استهلاكها حيث تزداد تكاليف الصيانة والتشغيل

2. Profit Life:

Profit life is the life over which the equipment can earn a profit. The retention beyond that point will create an operating loss . This essentially is the point where the machine seemingly spends more time in the repair shop than it does on the project site.

العمر الربحي هو العمر الذي يمكن ان تحقق الآلة خلاله ربحاً، الاحتفاظ بالآلة بعد هذه النقطة يسبب خسارة، في هذه النقطة ستصرف الالة وقتا أطول في الصيانة مما تعمل في موقع العمل

3. Economic Life:

Economic life equates to the time period that maximizes profits over the equipment's life. Equipment owners constantly strive to maximize production while minimizing the cost of production.

العمر الاقتصادي يمثل الفترة الزمنية التي تتعاظم أرباح الآلة خلاله حيث يجتهد المالك لتعظيم الربح وتقليل تكاليف الانتاج