

CH0401 Process Engineering Economics

Lecture 1d

Balasubramanian S



Department of Chemical Engineering
SRM University



Process Engineering Economics

- 1 **Introduction – Time Value of Money**
- 2 Equivalence
- 3 Equations for economic studies
- 4 Amortization
- 5 Depreciation and Depletion



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Amortization

Amortization is a generic term which describes the equivalence of a capital sum over a period of time, although in accounting it has more restricted meaning. In an industrial company it may be considered as a program or policy whereby the owners (stock-holders) of the company have their investment of depreciable capital protected partly against loss.

In general, **Amortization** (or **amortization**) is the process of decreasing, or accounting for, an amount over a period. Amortization of a loan with four different repayment mode is used as an example from the next slide onwards.

Four plans for repayment of \$5000 in 5 years with interest at 8%

Plan 1: At end of each year pay 1000 Principal plus interest due

Plan 2: Pay interest due at end of each year and principal at end of 5 years

Plan 3: Pay in five equal end of year payments

Plan 4: Pay principal and interest in one payment at end of 5 years

Process Engineering Economics – Amortization

Four plans for repayment of \$5000 in 5 years with interest at 8%

(a) Year	(b) Amount Owed at beginning of year	(c) Interest owed for that year 8% x (b)	(d) Total owed at end of year (b) + (c)	(e) Principal Payment	(f) Total End of year Payment
Plan 1: <i>At end of each year pay \$ 1000 Principal plus interest due</i>					
1	\$5,000	\$400.00	\$5,400.00	\$1,000	\$1,400.00
2	\$4,000	\$320.00	\$4,320.00	\$1,000	\$1,320.00
3	\$3,000	\$240.00	\$3,240.00	\$1,000	\$1,240.00
4	\$2,000	\$160.00	\$2,160.00	\$1,000	\$1,160.00
5	\$1,000	\$80.00	\$1,080.00	\$1,000	\$1,080.00
		\$1,200		\$5,000	\$6,200.00

Process Engineering Economics – Amortization

Four plans for repayment of \$5000 in 5 years with interest at 8%

(a) Year	(b) Amount Owed at beginning of year	(c) Interest owed for that year 8% x (b)	(d) Total owed at end of year (b) + (c)	(e) Principal Payment	(f) Total End of year Payment
Plan 2: <i>Pay interest due at end of each year and principal at end of 5 years</i>					
1	\$5,000	\$400.00	\$5,400.00	\$0	\$400.00
2	\$5,000	\$400.00	\$5,400.00	\$0	\$400.00
3	\$5,000	\$400.00	\$5,400.00	\$0	\$400.00
4	\$5,000	\$400.00	\$5,400.00	\$0	\$400.00
5	\$5,000	\$400.00	\$5,400.00	\$5,000	\$5,400.00
		\$2,000		\$5,000	\$7,000.00

Process Engineering Economics – Amortization

Four plans for repayment of \$5000 in 5 years with interest at 8%

(a) Year	(b) Amount Owed at beginning of year	(c) Interest owed for that year 8% x (b)	(d) Total owed at end of year (b) + (c)	(e) Principal Payment	(f) Total End of year Payment
Plan 3: <i>Pay in five equal end of year payments</i>					
1	\$5,000	\$400.00	\$5,400.00	\$852	\$1,252.28
2	\$4,148	\$331.82	\$4,479.53	\$920	\$1,252.28
3	\$3,227	\$258.18	\$3,485.44	\$994	\$1,252.28
4	\$2,233	\$178.65	\$2,411.81	\$1,074	\$1,252.28
5	\$1,160	\$92.76	\$1,252.29	\$1,160	\$1,252.28
		\$1,261		\$5,000	\$6,261.40

Process Engineering Economics – Amortization

Four plans for repayment of \$5000 in 5 years with interest at 8%

(a) Year	(b) Amount Owed at beginning of year	(c) Interest owed for that year 8% x (b)	(d) Total owed at end of year (b) + (c)	(e) Principal Payment	(f) Total End of year Payment
1	\$5,000	\$400.00	\$5,400.00	\$0	\$0
2	\$5,400.00	\$432.00	\$5,832.00	\$0	\$0
3	\$5,832.00	\$466.56	\$6,298.56	\$0	\$0
4	\$6,298.56	\$503.88	\$6,802.44	\$0	\$0
5	\$6,802.44	\$544.20	\$7,346.64	\$5,000	\$7,347
		\$2,347		\$5,000	\$7,346.64



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Depreciation

Depreciation has many meanings, but only two are discussed in our syllabus

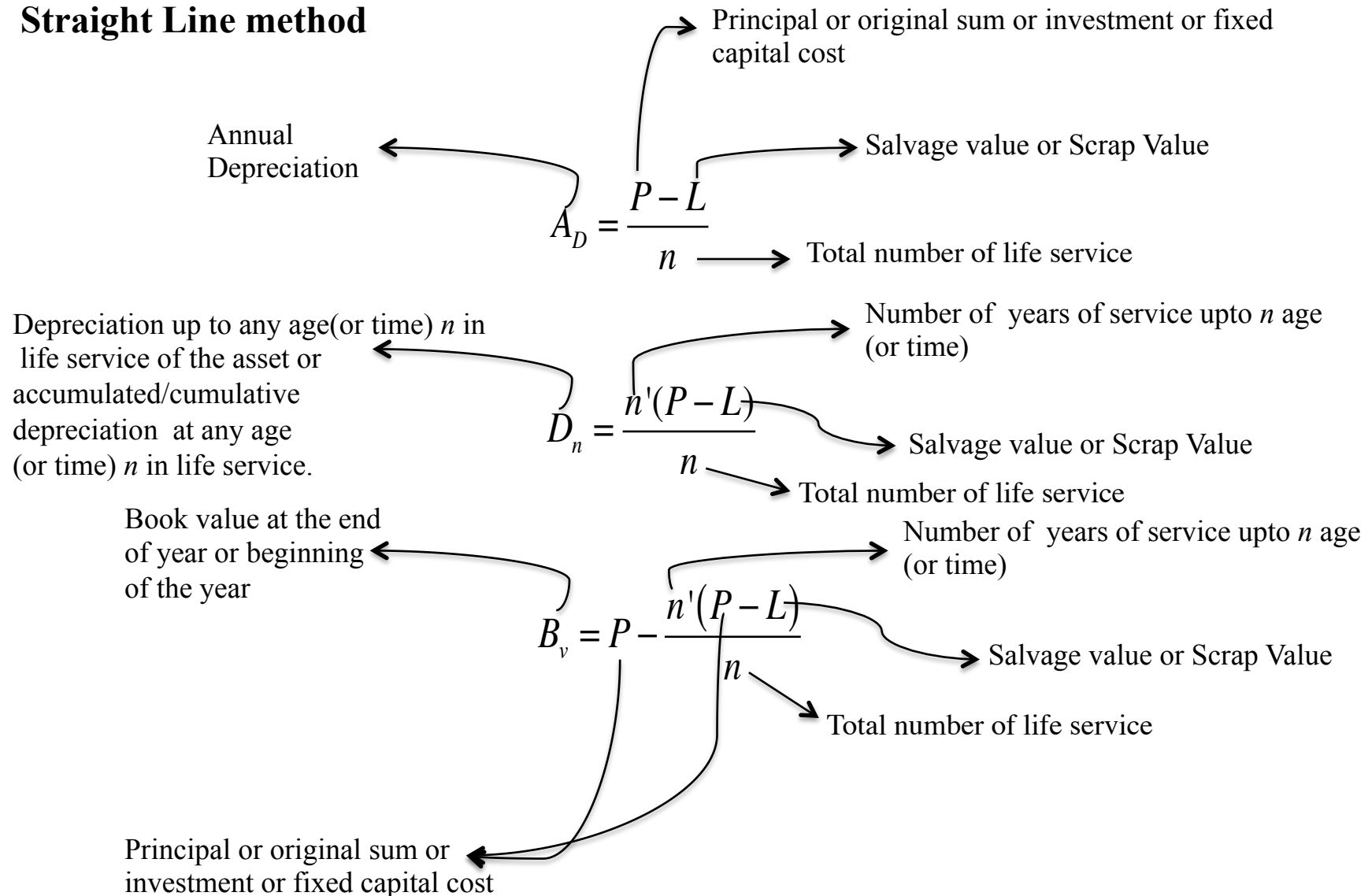
- loss of value of capital with the time when equipment wears out or becomes obsolete.
- the systematic allocation of costs of an asset that produces an income from operations.

In short, depreciation may be considered as a cost for protection of depreciating capital without interest over a period, which the capital (asset or equipment) is used.

Depreciation- Methods

1. Straight Line method
2. Fixed Percentage (or) Declining Balance
3. Sinking fund
4. Sum-of-the-years' digits method

1. Straight Line method



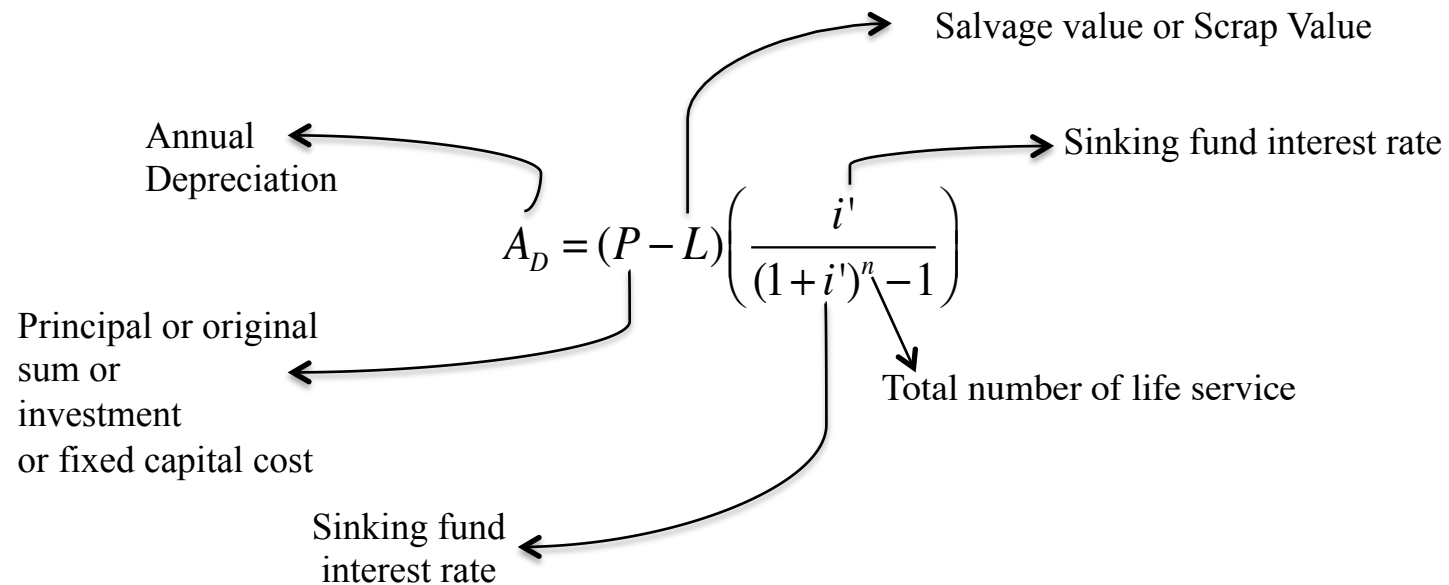
2. Fixed Percentage or Declining Balance Method

A_D = Depreciation factor (f) \times Book value at the beginning of the year

$$f = 1 - \sqrt[n]{\frac{L}{P}}$$

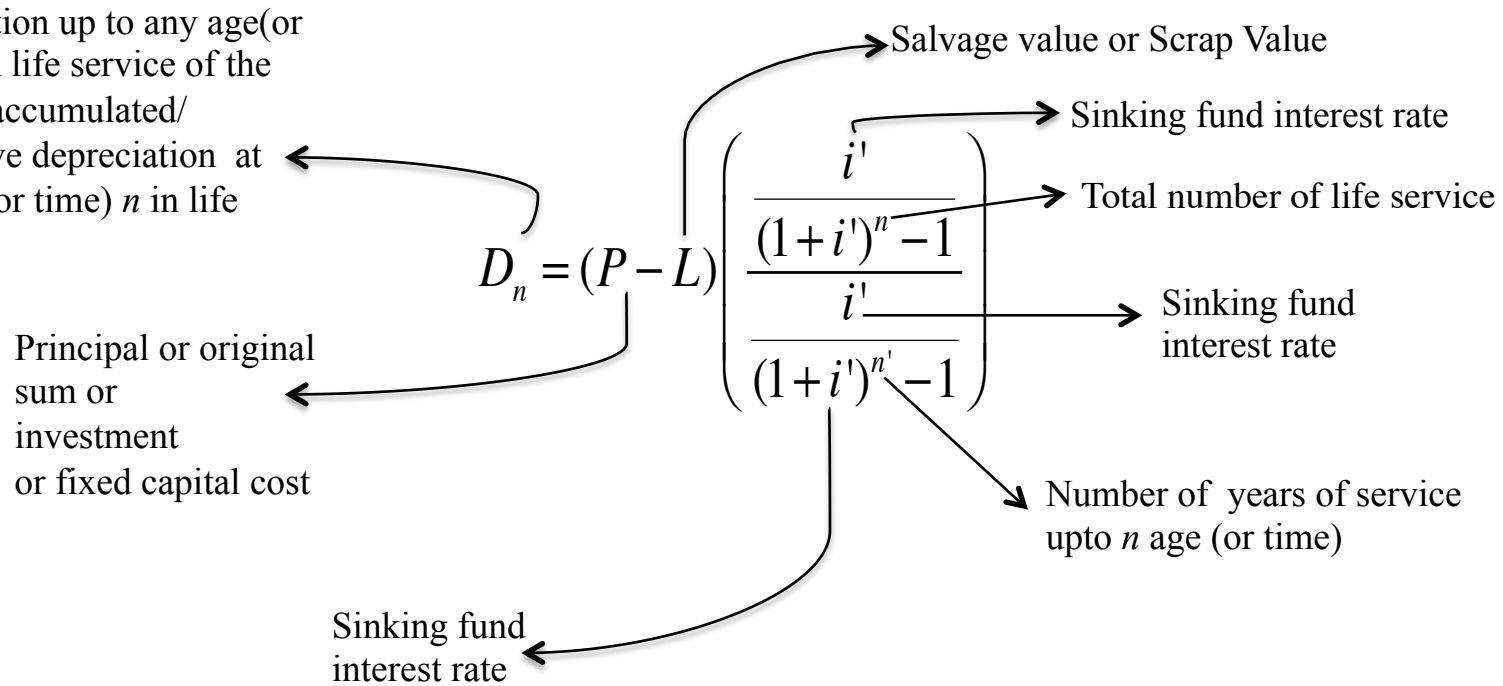
Where, f = depreciation rate (or) depreciation factor expressed in percentage; L = salvage value or scrap value; P = principal/ original sum or fixed capital investment; B_v = book value at the end or beginning of the year; n = total number of life service

3. Sinking Fund Method

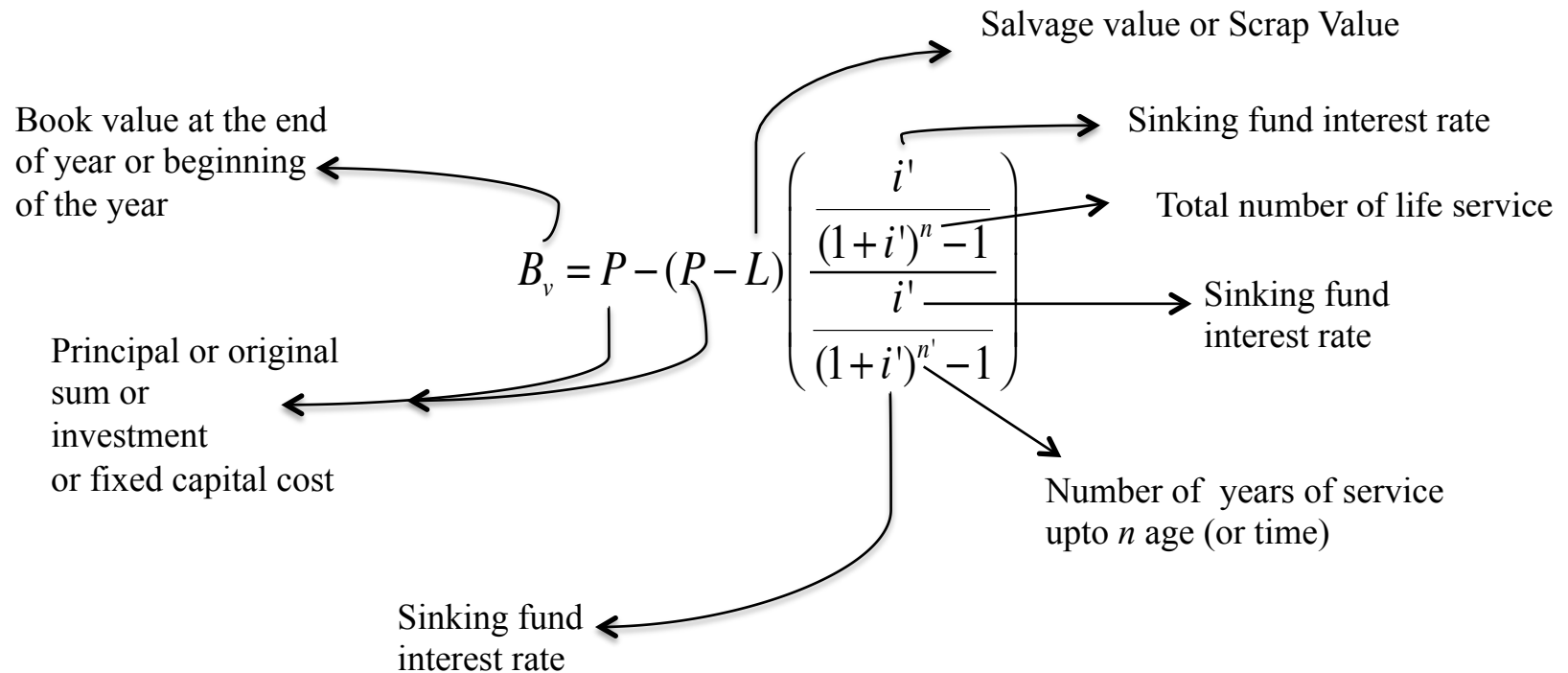


3. Sinking Fund Method

Depreciation up to any age(or time) n in life service of the asset or accumulated/ cumulative depreciation at any age (or time) n in life service.



3. Sinking Fund Method



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