ENGINEERING ECONOMY FACTORS

Discrete Payments and Discrete Compounding

Factor	Find	Given	Formula
Single-Payment			
Compound-Amount	F	P	$F = P(1+i)^n = P(F/P,i,n)$
Present-Worth	P	F	$P = F\dfrac{1}{(1+i)^n} = F(P/F,i,n)$
Equal-Payment Series			
Compound-Amount	F	A	$F = A\left[\dfrac{(1+i)^n - 1}{i}\right] = A(F/A,i,n)$
Sinking-Fund	A	F	$A = F\left[\dfrac{i}{(1+i)^n - 1}\right] = F(A/F,i,n)$
Present-Worth	P	A	$P = A\left[\dfrac{(1+i)^n - 1}{i(1+i)^n}\right] = A(P/A,i,n)$
Capital-Recovery	A	P	$A = P\left[\dfrac{i(1+i)^n}{(1+i)^n - 1}\right] = P(A/P,i,n)$
Uniform-Gradient Series			
	A	G	$A = G\left[\dfrac{1}{i} - \dfrac{n}{(1+i)^n - 1}\right] = G(A/G,i,n)$
Geometric-Gradient Series			
	P	F_1, g	$P = \dfrac{F_1}{(i-g)}\left[1 - \dfrac{(1+g)^n}{(1+i)^n}\right]$
Infinite Series			
	P	A	$P = A\left[\dfrac{1}{i}\right] = A(P/A,i,\infty) \quad , \quad i > 0$
	P	G	$P = G\left[\dfrac{1}{i^2}\right] = G(P/G,i,\infty) \quad , \quad i > 0$
	P	F_1, g	$P = \dfrac{F_1}{(i-g)} \quad , \quad i > g$

Discrete Payments and Continuous Compounding

Factor	Find	Given	Formula
Single-Payment			
Compound-Amount	F	P	$F = Pe^{rn} = P[F/P, r, n]$
Present-Worth	P	F	$P = Fe^{-rn} = F[P/F, r, n]$
Equal-Payment Series			
Compound-Amount	F	A	$F = A\left[\frac{e^{rn}-1}{e^{r}-1}\right] = A[F/A, r, n]$
Sinking-Fund	A	F	$A = F\left[\frac{e^{r}-1}{e^{rn}-1}\right] = F[A/F, r, n]$
Present-Worth	P	A	$P = A\left[\frac{1-e^{-rn}}{e^{r}-1}\right] = A[P/A, r, n]$
Capital-Recovery	A	P	$A = P\left[\frac{e^{r}-1}{1-e^{-rn}}\right] = P[A/P, r, n]$

Continuous Payments and Continuous Compounding

Factor	Find	Given	Formula
Funds Flow Conversion	A	$\bar{A}$	$A = \bar{A}\left[\frac{e^{r}-1}{r}\right] = \bar{A}[A/\bar{A}, r]$
Equal-Payment Series			
Compound-Amount	F	$\bar{A}$	$F = \bar{A}\left[\frac{e^{rn}-1}{r}\right] = \bar{A}[F/\bar{A}, r, n]$
Sinking-Fund	$\bar{A}$	F	$\bar{A} = F\left[\frac{r}{e^{rn}-1}\right] = F[\bar{A}/F, r, n]$
Present-Worth	P	$\bar{A}$	$P = \bar{A}\left[\frac{e^{rn}-1}{re^{rn}}\right] = \bar{A}[P/\bar{A}, r, n]$
Capital-Recovery	$\bar{A}$	P	$\bar{A} = P\left[\frac{re^{rn}}{e^{rn}-1}\right] = P[\bar{A}/P, r, n]$

CONVENTIONAL LOAN PAYMENT FORMULAS

$$A = P(A/P, i, n)$$

$$R_t = A(P/A, i, n-t) = P(F/P, i, t) - A(F/A, i, t)$$

$$I_t = iR_{(t-1)} = iA(P/A, i, n-t+1)$$

$$B_t = A - I_t$$

fixed loan particulars

P is the principal amount of the loan

A is the loan payment amount

i is the interest rate

n is the number of payments

time-dependent quantities (at time t)

R_t is the remaining balance after making the payment

I_t is the part of the payment going toward interest

B_t is the part of the payment going toward principal

total paid toward principal $= P - R_t$

total paid toward interest $= tA - (P - R_t)$

equity $=$ market value - R_t