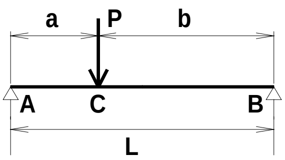
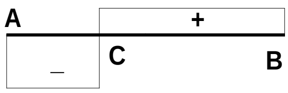
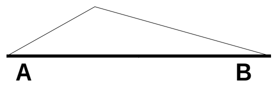
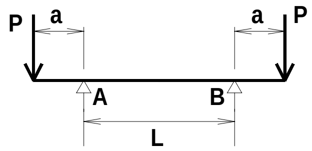
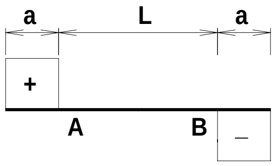
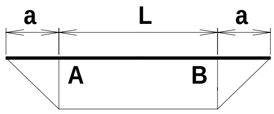
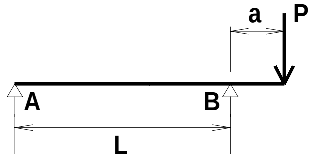
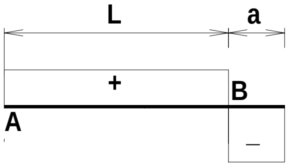
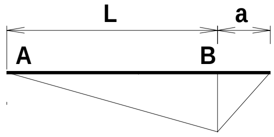
	Résistances des matériaux FLEXION	CONSTRUCTION 1/3
Date :	Formulaires des cas de charges courants	T°STI G.E.

I Notation

A	Appui de gauche
B	Appui de droite
x'x	Ligne moyenne continue représentative des centres de surface des sections le long de la poutre.
q	Intensité de la charge uniformément répartie par mètre de poutre.
P	Charge concentrée.
C, D	Points d'application de la charge P.
a	Distance de l'appui à la charge considérée.
R_A, R_B	Actions des appuis A et B sur la poutre AB.
V_A, V_B	Efforts tranchants aux appuis A et B.
x	Abscisse d'une section courante.
x_0	Abscisse où s'exerce le moment maximal M_0 dans la travée AB.
M_x	Moment de flexion dans une section d'abscisse x.
M_0	Moment maximale de flexion en travée.
f	Flèche

II Poutres sur deux appuis simples

	Effort tranchant	Moment de flexion	Observation
 $R_A = \frac{P.b}{L}$ $R_B = \frac{P.a}{L}$ Charge concentrée P	 $V_{\overline{AC}} = -R_A$ $V_{\overline{CB}} = R_B$	 $M_0 = \frac{P.a.b}{L}$ pour $x_0 = a$	Si $a = b = \frac{L}{2}$ $R_A = \frac{P}{2}$ $M_0 = \frac{P.L}{4}$ $f = \frac{P.L^3}{48EI}$
 $R_A = P$ $R_B = P$ Charges concentrées sur porte-à-faux	 $V_{gA} = P$ $V_{dB} = -P$ $V_{\overline{AB}} = 0$	 $M_0 = -P.a$	Moment constant de A à B.
 $R_A = +\frac{P.a}{L}$ $R_B = \frac{P(L+a)}{L}$ Charge concentrée sur un porte à faux	 $V_{\overline{AB}} = -R_A$ $V_{dB} = P$	 $M_0 = M_B = -P.a$	Sens des actions aux appuis : R_A : vers le bas. R_B : vers le haut.

	Résistances des matériaux **FLEXION**	**CONSTRUCTION** **1/3**
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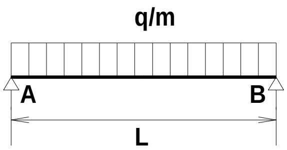
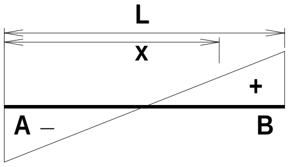
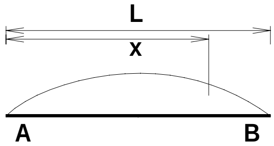
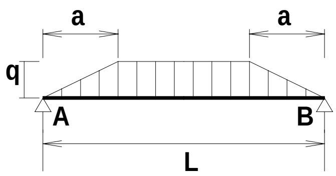
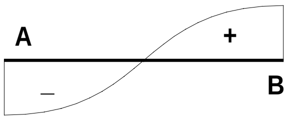
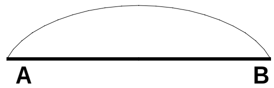
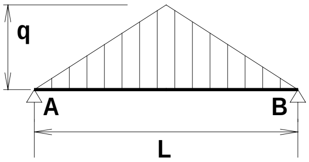
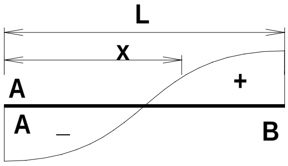
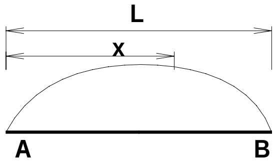
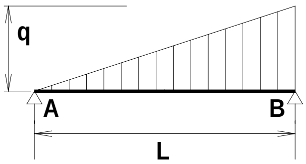
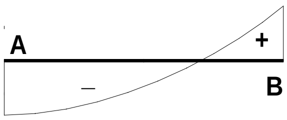
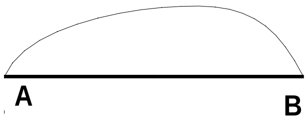
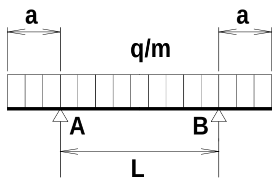
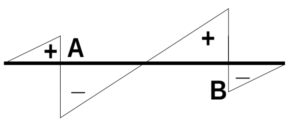
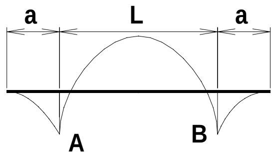
 $R_A = \frac{qL}{2}$ $R_A=R_B$ Charge uniformément répartie	 $V_A = -\frac{qL}{2}$ $V_A = -V_B$ $V(x) = \frac{q.L^2}{2} - q.x$	 $M_0 = \frac{q.L^2}{8}$ pour $x_0 = \frac{L}{2}$ $M(x) = \frac{q.x}{2}(L-x)$	Flèche $f = \frac{5}{384}.\frac{qL^4}{EI}$ pour $x = \frac{L}{2}$
 $R_A = \frac{q}{2}.(L-a)$ $R_A=R_B$ Charge en trapèze régulier	 $V_A = -\frac{q(L-a)}{2} - R_A$ $V_B = R_B$	 $M_0 = \frac{q}{2}.\left[\frac{L^2}{4} - \frac{a^2}{2}\right]$ pour $x_0 = \frac{L}{2}$	Charge uniformément répartie p/m² sur un trapèze avec S air du trapèze. $M'_0 = \frac{p.S}{2(L-a)}\left[\frac{L^2}{2} - \frac{a^2}{2}\right]$
 $R_A = \frac{qL}{4}$ $R_A=R_B$ Charge répartie (triangle isocèle)	 $V_A = -R_A$ $V_B = R_B$ $V(x) = \frac{qL^2}{4}\left[1-4\frac{x^2}{L^2}\right]$ pour $x \le \frac{L}{2}$	 $M_0 = \frac{qL^2}{12}$ pour $x_0 = \frac{L}{2}$	Avec $P = \frac{qL}{2}$: $R_A = \frac{P}{2} = R_B$ $M_0 = \frac{qL}{6}$ $V_0 = 0$ pour $x_0 = \frac{L}{2}$
 $R_A = \frac{qL}{6}$ $R_B = \frac{qL}{3}$ Charge à répartition variable	 $V_A = -R_A$ $V_B = R_B$ $V_0 = 0$ pour $x = \frac{L}{\sqrt{3}}$	 $M(x) = \frac{qLx}{6}\left[1-\frac{x^2}{L^2}\right]$ $M_0 = \frac{ql^2}{9\sqrt{3}}$ pour $x_0 = \frac{L}{\sqrt{3}}$	Avec $P = \frac{qL}{2}$ $R_A = \frac{P}{3}$ $R_B = \frac{2}{3}P$ $M_0 = \frac{2PL}{9\sqrt{3}}$
 $R_A = q\frac{(L+2a)}{2}$ $R_A=R_B$ Charges uniformément réparties	 $V_{gA} = qA$ $V_{dA} = -\frac{qL}{2}$ $V_{gB} = \frac{qL}{2}$ $V_{dB} = -qA$	 $M_0 = \frac{q}{8}(L^2-4a^2)$ à mi portée. $M_A = M_B = -q\frac{a^2}{2}$	V_{gA} signifie : effort tranchant immédiatement à gauche du point A. V_{dA} : V à droite du point A.

	Résistances des matériaux FLEXION	CONSTRUCTION 1/3
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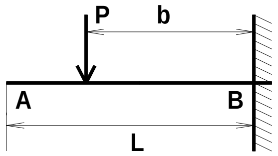
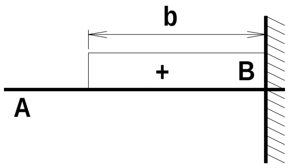
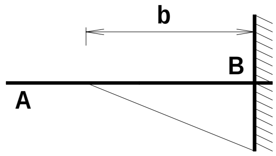
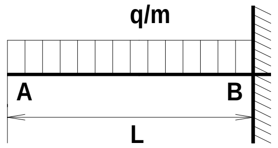
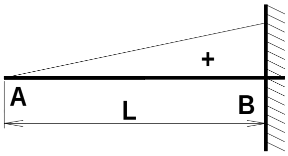
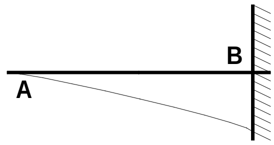
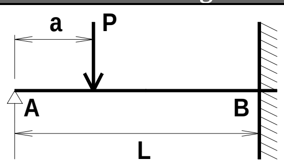
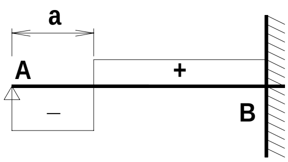
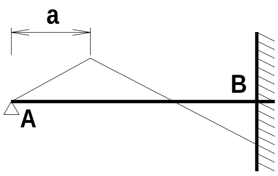
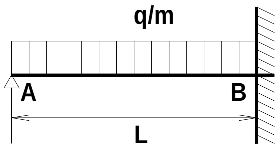
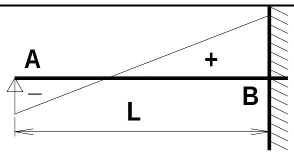
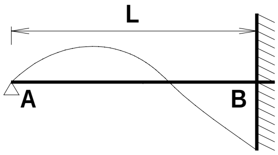
III Poutre encastrée à une extrémité ou poutre en console

Cas de charge	Effort tranchant	Moment de flexion	Observation
 $R_B = P.b \quad M_B = -P.b$ Charge concentrée	 $V_A = 0 \quad V_{\overline{CB}} = P$	 $M_B = -Pb$	Flèche en C : $f = \frac{pb^3}{3EI}$ Flèche en A : $f = \frac{Pb^2}{6EI}(3L - b)$
 $R_B = q.L \quad M_A = -\frac{q.L^2}{2}$ Charge uniformément répartie	 $V_B = qL$ $V(x) = px$	 $M_B = -\frac{qL^2}{2}$ $M(x) = -q\frac{x^2}{2}$	Flèche en A : $f = \frac{qL^4}{8EI}$

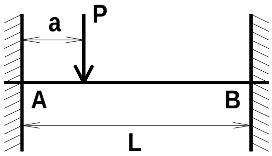
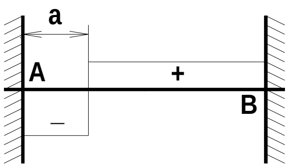
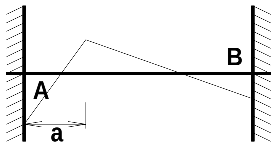
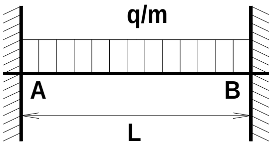
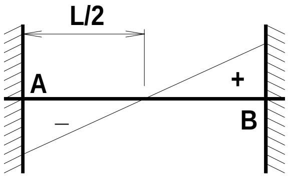
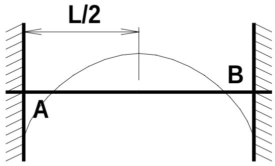
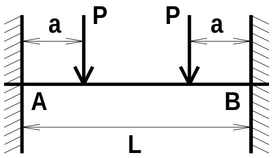
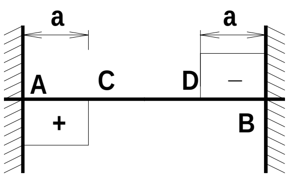
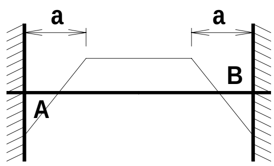
IV Poutre encastrée à une extrémité et sur appui libre de l'autre

(hyperstatique de degré 1)

Cas de charge	Effort tranchant	Moment de flexion	Observation
 Charge concentrée P	 $V_B = \frac{Pa(3L^2 - a^2)}{2L^3} = -R_b$ $V_A = -\frac{P(L-a)^2(2L+a)}{2L^3} = R_A$	 $M_A = 0$ $M_B = -\frac{Pa(L^2 - a^2)}{2L^2}$	Pour $x_0 = a$: $M_0 = \frac{Pa(L-a)^2(2L+a)}{2L^3}$
 $R_A = \frac{3}{8}q.L \quad R_A = \frac{5}{8}q.L$ Charge uniformément répartie	 $V(x) = -(R_A - qx)$ $V_A = -R_A \quad V_B = R_B$	 $M_A = 0 \quad M_B = -\frac{qL^2}{8}$ $M_0 = \frac{9}{128}qL^2$ pour $x_0 = \frac{3L}{8}$	$V = 0$ pour $x_0 = \frac{3L}{8}$ $M = 0$ pour $x_0 = \frac{3L}{4}$

V Poutre encastrée à chaque extrémité

(hyperstatique de degré 3)

Cas de charge	Effort tranchant	Moment de flexion	Observation
 Charge concentrée P	 $V_A = -R_{Ay}$ $V_B = R_{By}$	 $M_A = -\frac{Pa(L-a)^2}{L^2}$ $M_B = -\frac{Pa(L-a)^2}{L^2}$	Pour $x_0 = a$ V = 0 $M_0 = -\frac{2Pa(L-a)^2}{L^3}$
 $R_{Ay} = \frac{q.L}{2}$ $R_{Ay} = R_{By}$ Charge uniformément répartie	 $V_A = -R_{Ay}$ $V_B = R_{By}$	 $M_A = -\frac{qL^2}{12}$; $M_B = -\frac{qL^2}{12}$	Pour x=L/2 : V = 0 $M_0 = \frac{qL^2}{24}$ $f = \frac{qL^4}{384EI}$
 $R_{Ay} = P$ $R_{By} = P$ Deux charges concentrées P	 $V_A = -R_{Ay}$ $V_B = R_{By}$ $V_{\overline{CD}} = 0$	 $M_A = -\frac{Pa(L-a)}{L} = M_B$	Entre C et D : $M = \frac{Pa^2}{L}$