Resumen fórmulas examen final FOFT

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Ley de Hooke generalizada:

Esfuerzo de elongación $= \frac{F}{A}$

Deformación $= \frac{\Delta l}{L_{\text{tot.}}}$

Mód. de Young $\varphi = \frac{E}{D}$

Tensión de cizalladura $= \frac{F}{A}$

Deformación de ciz. $= \frac{\Delta x}{h}$

Módulo de cizalladura $= \frac{T}{D}$

Esfuerzo $= p$

Deformación $= -\frac{\Delta V}{V}$

Mód. de compresibilidad $B = \frac{E}{D}$

$p = \frac{dF}{dS}$

Ec. fund. de la hst.: $\frac{dP}{dh} = \rho g$

$p = p_0 + \rho g h$

$p = p_0 \cdot e^{-\frac{Mg}{RT}h}$

$p_{\text{aparente}} = mg - F_{\text{empuje}}$

$F_{\text{empuje}} = \rho_{\text{líquido}} V_{\text{desalojado}} g$

$F = 2\sigma l$

Tensión superficial $\sigma = \frac{F}{2l}$

Ec. Laplace: $\Delta p_{1\text{ sup. libre}} = 2\sigma\gamma$

$\Delta p_{2\text{ sup. libres}} = 4\sigma\gamma$

$\gamma = \frac{1}{2}\left(\frac{1}{R_1} + \frac{1}{R_2}\right)$

$R_1 = R_2 \implies \gamma = \frac{1}{R}$

Young-Drupé: $\cos\varphi = \frac{\sigma_{\text{SG}} - \sigma_{\text{SL}}}{\sigma_{\text{LG}}}$

Ley de Serin: $h = \frac{2\sigma\cos\varphi}{\rho g r}$

Ley de Tate: $V = \frac{2\pi R\sigma}{\rho g}$

Ec. contin.: $\rho_1 A_1 v_1 = \rho_2 A_2 v_2$

ρ cte. $\implies A_1 v_1 = A_2 v_2 \equiv G$

Ecuación de Bernoulli:

$p + \rho g y + \frac{1}{2}\rho v^2 = \text{cte.}$

$p_1 - p_2 = \frac{1}{2}\rho v_1^2\left[\left(\frac{A_1}{A_2}\right)^2 - 1\right]$

Th. Torricelli: $v_b = \sqrt{2gh}$

Ley Bunsen: $v_{\text{gas}} = \sqrt{\frac{2(p_{\text{I}} - p_{\text{O}})}{\rho}}$

Hyp. Navier: $F = \eta A \frac{\Delta v}{\Delta z}$

L. Poiseuille: $\Delta p = \underbrace{\frac{8\eta L}{\pi R^4}}_{\text{Imped. } k} G$

$F_p \cdot v = \Delta p \cdot G$

$v(r) = \frac{\Delta p}{4\eta L}(R^2 - r^2)$

Vel. caract. $v_0 = \frac{\eta}{\rho r}$

Núm. de Reynolds $R = \frac{v}{v_0}$

F. Stokes: $F_{a_{\text{lam.}}} = 6\pi\eta v r$

$F_{a_{\text{turb.}}} \propto v^2$

$\Delta L = \alpha L_0 \Delta T$

Coef. dilat. $\alpha(T) = \frac{1}{L} \cdot \frac{dL}{dT}$

$\beta = 3\alpha$

$t_{\text{F}} = t_{\text{C}} \cdot \frac{9}{5} + 32$

$T = \frac{T_3}{P_3} \cdot p$

$Q = \Delta E_{\text{int}} = C\Delta T$

Capacidad calorífica $C := \frac{dQ}{dT}$

Calor específico $c = \frac{C}{m}$

Cap. cal. molar $c'(T) = \frac{1}{n}\frac{dQ}{dT}$

$C_v = \left.\frac{dQ}{dT}\right|_{v\text{ cte.}}$ $\quad C_p = \left.\frac{dQ}{dT}\right|_{p\text{ cte.}}$

$Q = \Delta E_{\text{int}} + W$

Dulong y Petit: $c' \to 25\ \frac{\text{J}}{\text{mol K}}$

$\Delta E_{\text{int}} = Q - W$

Clapeyron: $\frac{\Delta P}{\Delta T} = \frac{L}{T\Delta v_{\text{molar}}}$

Ley Fourier: $I = \frac{dQ}{dt} = -KA\frac{dT}{dx}$

$I = \text{conduct. } KA\frac{T_H - T_L}{L}$

Resistencia térmica $R := \frac{L}{KA}$

$|\Delta T| = IR$

$R_{\text{eq. s.}} = R_1 + R_2$

$R_{\text{eq. p.}} = \left(\frac{1}{R_1} + \frac{1}{R_2}\right)^{-1}$

L. convección: $I = \text{quality} \cdot A\Delta T$

$I_r = Ae\sigma T^4$

Stefan-Boltzmann: $I_r = A\sigma T^4$

L. Kirchoff: $a = e$

$I_{\text{neta}} = e\sigma A(T^4 - T_0^4)$

L. despl. Wien: $\lambda_{\max} = \frac{2.898\ \frac{\text{mm}}{\text{K}}}{T}$

$PV = nRT \quad R = N_A \cdot K_B$

$\left(p + \frac{n^2 a}{v^2}\right)(v - nb) = nRT$

Ley de Dalton: $p = \sum_i p_i$

Fracción molar $x_i = \frac{n_i}{n} \implies$

$p_i = x_i \cdot p$

$W_{\text{pistón}} = -\int_{v_1}^{v_2} p\, dV$

$W_{\text{pistón isobárico}} = -p_0(v_i - v_f) > 0$

$W_{\text{pistón isocoro}} = 0$

$v_x^2 = \frac{v^2}{3} \quad N = n \cdot N_A$

$P = \frac{Nv^2}{3V}m \quad \frac{K_{\text{tr}}}{N} = \frac{3}{2}K_B T \implies$

$v_{\text{CM}} = \sqrt{\frac{3RT}{M}}$

F. distr. Maxwell-Boltzman:

$f(v) = \frac{4}{\sqrt{\pi}}\left(\frac{m}{2K_B T}\right)^{\frac{3}{2}} v^2 e^{-\frac{mv^2}{2K_B T}}$

$C_v = \frac{dE_{\text{int}}}{dT} \quad C_p = \frac{dQ_p}{dT}$

$C_v = \text{gr. de libertad} \times \frac{1}{2}R$

$F = -kx \quad \omega = 2\pi f \quad \omega = \sqrt{\frac{K}{m}}$

$E_m = \frac{1}{2}KA^2 \quad v = \pm\omega\sqrt{A^2 - x^2}$

$\omega_{\text{pénd.}} = \sqrt{\frac{g}{L}} \quad T_{\text{pénd.}} = 2\pi\sqrt{\frac{L}{g}}$

$v = \lambda f$

$v = \sqrt{\frac{F_T}{\text{dens. lin. } \mu}}$

$P = -F_T \cdot \frac{\partial y(x,t)}{\partial t} \cdot \frac{\partial y(x,t)}{\partial x}$

$P_{\max} = \mu v \omega^2 A^2$

$P_{\text{media}} = \frac{1}{2}\mu v \omega^2 A^2$

$\frac{\partial^2 y}{\partial x^2} = \frac{1}{v^2}\frac{\partial^2 y}{\partial t^2}$

$A_i + A_r = A_t \quad 2A_i = (1 + \frac{v_1}{v_2})A_t$

Coeficiente transmisión amplitud:

$t = \frac{A_t}{A_i} = \frac{2}{1 + \frac{v_1}{v_2}} = \frac{2v_2}{v_1 + v_2}$

$t = \frac{2\sqrt{\mu_1}}{\sqrt{\mu_1} + \sqrt{\mu_2}}$

Coeficiente reflexión amplitud:

$r = \frac{A_r}{A_i} = \frac{v_2 - v_1}{v_2 + v_1} = \frac{\sqrt{\mu_1} - \sqrt{\mu_2}}{\sqrt{\mu_1} + \sqrt{\mu_2}}$

Coef. transm. $T = \frac{P_{m_t}}{P_{m_i}} = \frac{v_1}{v_2}t^2$

Coef. reflex. $R = \frac{P_{m_r}}{P_{m_i}} = r^2$

$S(x,t) = A\cos(kx - wt) \implies P(x,t) = BKA\sin(kx - wt)$

$v_{\text{fl.}} = \sqrt{\frac{B}{\rho}} \quad v_{\text{sól.}} = \sqrt{\frac{\varphi}{\rho}}$

$B_{\text{gas id.}} = \gamma \cdot p$

$v_{\text{sonido}} = \sqrt{\frac{1{,}4 \cdot RT}{M}}$

$I(r) = \frac{P_m}{4\pi r^2} \quad \beta = 10 \cdot \log_{10}\frac{I}{I_0}$

Efecto Doppler: $f_{\text{L}} = f_{\text{S}}\frac{v \pm v_L}{v \mp v_S}$

$\lambda_{\text{delante}} = \frac{v - v_S}{f_S} \underset{v_S \to v}{\Longrightarrow} \lambda_{\text{del.}} \to 0$

Número Mach: $\sin\alpha = \frac{v}{v_S}$

$C_{\text{H}_2\text{O, 1 atm, 0ºC-100ºC}} = 4184 \frac{\text{J}}{\text{K kg}}$

$L_{v\ \text{H}_2\text{O}} = 2.25 \times 10^6 \frac{\text{J}}{\text{kg}}$

$\sigma = 5.6703 \times 10^{-8} \frac{\text{W}}{\text{m}^2\,\text{K}^4}$

$N_A = 6{,}022045 \cdot 10^{23}$

$R = 8.314 \frac{\text{J}}{\text{mol K}} = 0.082 \frac{\text{atm L}}{\text{mol K}}$

$K_B = 1.381 \times 10^{-23} \frac{\text{J}}{\text{K}}$

$\gamma_{\text{gas id.}} \approx 1{,}4$

$I_0 = 10^{-12} \frac{\text{W}}{\text{m}^2}$

$\sin(\alpha + \beta) = \sin(\alpha)\cos(\beta) + \cos(\alpha)\sin(\beta)$

$\sin(\alpha - \beta) = \sin(\alpha)\cos(\beta) - \cos(\alpha)\sin(\beta)$

$\cos(\alpha + \beta) = \cos(\alpha)\cos(\beta) - \sin(\alpha)\sin(\beta)$

$\cos(\alpha - \beta) = \cos(\alpha)\cos(\beta) + \sin(\alpha)\sin(\beta)$

$\tan(\alpha + \beta) = \frac{\tan(a) + \tan(b)}{1 - \tan(a)\tan(b)}$

$\tan(\alpha - \beta) = \frac{\tan(a) - \tan(b)}{1 - \tan(a)\tan(b)}$

$\sin(2\alpha) = 2\sin(\alpha)\cos(\alpha)$

$\cos(2\alpha) = \cos^2(\alpha) - \sin^2(\alpha)$

$\tan(2\alpha) = \frac{2\tan(\alpha)}{1 - \tan^2(\alpha)}$

$\sin\left(\frac{\alpha}{2}\right) = \pm\sqrt{\frac{1 - \cos(\alpha)}{2}}$

$\cos\left(\frac{\alpha}{2}\right) = \pm\sqrt{\frac{1 + \cos(\alpha)}{2}}$

$\tan\left(\frac{\alpha}{2}\right) = \pm\sqrt{\frac{1 - \cos(\alpha)}{1 + \cos(\alpha)}}$

Ley del seno:

$\frac{a}{\sin(\alpha)}\frac{b}{\sin(\beta)}\frac{c}{\sin(\gamma)} = 2R$

Ley del coseno:

$a^2 = b^2 + c^2 - 2bc\cos(\alpha)$

Ley del coseno:

$\cos(\alpha) = \frac{b^2 + c^2 - a^2}{2bc}$

$\sin\theta \pm \sin\varphi = 2\sin\left(\frac{\theta \pm \varphi}{2}\right)\cos\left(\frac{\theta \mp \varphi}{2}\right)$

$\cos\theta + \cos\varphi = 2\cos\left(\frac{\theta + \varphi}{2}\right)\cos\left(\frac{\theta - \varphi}{2}\right)$

$\cos\theta - \cos\varphi = -2\sin\left(\frac{\theta + \varphi}{2}\right)\sin\left(\frac{\theta - \varphi}{2}\right)$

$\tan(\alpha) = \frac{\sin(\alpha)}{\cos(\alpha)}$

$\sin^2(\alpha) + \cos^2(\alpha) = 1$