Διαγώνισμα Β (με λύση Γ) 16/2/2019

Θέμα Α

Α1-γ Α2-δ Α3-γ Α4-β Α5 ΣΛΛΣΣ

Θέμα Β

Β1 **Α-β**

$v_1' = -0,8v_1 \Rightarrow \frac{w_1-w_2}{w_1+w_2}v_1 = -\frac{4}{5}v_1 \Rightarrow 5w_1-5w_2 = -4w_1-4w_2 \Rightarrow w_2 = 9w_1$

$\Rightarrow \boxed{\frac{w_1}{w_2} = \frac{1}{9}}$

Β-α $v_2' = \frac{2w_1}{w_1+w_2}v_1 = \frac{2w_1}{10w_1}v_1 \Rightarrow \boxed{v_2' = 0,2v_1}$

Β2-α $\Sigma\tau_A = \tau_Z + \tau_{F_3} - \tau_W = F_2\frac{l}{2} + F_3 l\,\text{συν}\varphi - W\frac{l}{2}\,\text{ημ}\varphi$

$\Sigma\tau_A = 8 + 20\cdot 0,8 - 20\cdot 0,6 = 8+16-12 \Rightarrow \boxed{\Sigma\tau_A = +12\,Nm}$

Β3 **Α-β**

$a_A = a_{cm} + r\alpha_{\rho\omega} = a_{cm} + \frac{R}{2}\alpha_{\rho\omega} = \frac{3}{2}a_{cm} \Rightarrow a_{cm} = \frac{2}{3}a_A \Rightarrow a_{cm} = 2\,m/s^2$

$\boxed{a_{\varepsilon\varphi B} = 2a_{cm} = 4\,m/s^2}$

$\alpha_{\rho\omega} = \frac{a_{cm}}{R} = 10\sqrt{2}\,rad/s^2$

Β-β $a_{\varepsilon\varphi\Gamma} = a_{cm} - \frac{a_{cm}}{2} = 1\,m/s^2$

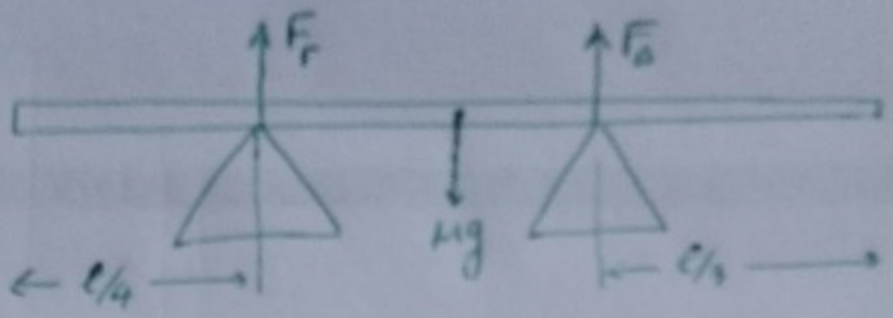
$a_K = \frac{v_{cm}^2}{r} = r\omega^2 \qquad \omega = \alpha_{\rho\omega}t = 10\,rad/s$

$a_K = 0,1\cdot 100 \Rightarrow a_K = 10\,m/s^2$

$a_{o\lambda\Gamma} = \sqrt{a_{\varepsilon\varphi\Gamma}^2 + a_K^2} = \sqrt{1+100} \Rightarrow \boxed{a_{o\lambda\Gamma} = \sqrt{101}\,m/s^2}$

ΘΕΜΑ Γ

$M = 6kg \quad l = 12m \quad m = 4kg$



[1] $F_r + F_\Delta = Mg + mg$ (1)

$\Sigma \tau_r = 0 \Rightarrow F_\Delta \left(l - \frac{l}{4} - \frac{l}{3}\right) = Mg \frac{l}{4}$

$\Rightarrow F_\Delta \frac{12-3-4}{12} = \frac{Mg}{4} \Rightarrow F_\Delta \frac{5}{3} = Mg \Rightarrow F_\Delta = \frac{3Mg}{5} \Rightarrow \underline{F_\Delta = 36N}$

(1) $\Rightarrow 36 + F_r = 60 + 40 \Rightarrow \boxed{F_r = 64N}$

[2] $\Sigma \tau_r = 0 \Rightarrow F_\Delta \left(l - \frac{l}{4} - \frac{l}{3}\right) = Mg \frac{l}{4} + mgx \Rightarrow \frac{5l}{12} F_\Delta = Mg \frac{l}{4} + mgx$ (2)

(1) $\overset{F_\Delta = 4F_r}{\Rightarrow} \frac{F_\Delta}{4} + F_\Delta = Mg + mg \Rightarrow \frac{5F_\Delta}{4} = 100 \Rightarrow F_\Delta = 80N$

άρα $\frac{5 \cdot 12}{12} 60 = 60 \cdot 3 + 40x \Rightarrow 400 - 180 = 40x \Rightarrow 40x = 220 \Rightarrow \boxed{x = 5,5m}$

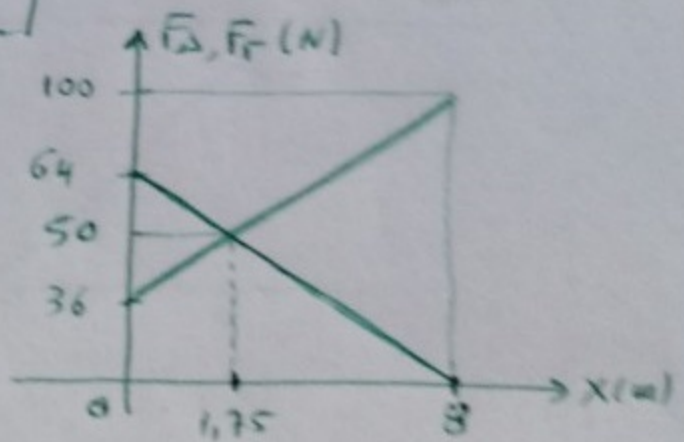
[3] (2) $\Rightarrow 5F_\Delta = 180 + 40x \Rightarrow \boxed{F_\Delta = 36 + 8x}$

(1) $\Rightarrow F_r + 36 + 8x = 100 \Rightarrow \boxed{F_r = 64 - 8x}$

ανάτρωση $F_r = 0 \quad x = 8m$ από Γ

$F_r = F_\Delta \Rightarrow 36 + 8x = 64 - 8x \Rightarrow 16x = 28$

$\Rightarrow x = \frac{7}{4} m = 1,75m$



[4] $\Sigma \tau_\Delta = 0 \quad (F_r = 0)$

$W_{2max} \frac{l}{3} = Mg \frac{l}{6} \Rightarrow W_{2max} = \frac{Mg}{2}$

$\Rightarrow \boxed{W_{2max} = 30N}$

ΘΕΜΑ Δ

$m_1 = 3kg$ $K_1 = 400 N/m$ $d = 0,4\,m$ $U_1 = 4\,m/s$

$m_2 = 1kg$ $R = 0,6\,m$

1| ΘΜΚΕ $\frac{1}{2}m_1U_1^2 = -\mu m_1 g \cdot d + \frac{1}{2}kd^2 \Rightarrow \frac{3}{2}16 = -\mu \cdot 12 + \frac{1}{2}400\frac{16}{100}$

$\Rightarrow 24 = -12\mu + 32 \Rightarrow 12\mu = 8 \Rightarrow \boxed{\mu = 2/3}$

2| $U_1' = \frac{m_1 - m_2}{m_1 + m_2}U_1 = \frac{3-1}{4} \cdot 4 \Rightarrow \boxed{U_1' = 2\,m/s}$

$U_2' = \frac{2m_1}{m_1 + m_2}U_1 = \frac{2 \cdot 3}{4} 4 \Rightarrow \boxed{U_2' = 6\,m/s}$

3| $\frac{dK_1}{dt} = -T_1 \cdot U_1' = -\mu m_1 g \cdot U_1' = -\frac{2}{3}30 \cdot 2 \Rightarrow \boxed{\frac{dK_1}{dt} = -40\,J/s}$

4| $m_3 = 1kg$ $K_2 = 100 N/m$ $U = 2\,m/s$

ΘΜΚΕ m_2 : $\frac{1}{2}m_2U^2 - \frac{1}{2}m_2U_2'^2 = -m_2 g(h+R) \Rightarrow U^2 - U_2'^2 = -2gh - 2gR$

$\Rightarrow 4 - 36 = -20h - 12 \Rightarrow \boxed{h = 1\,m}$

5| ΘΙ $K\Delta l = m_3 g$ $U_3' = U = 2\,m/s$

ΘΜΚΕ $m_3U_3'^2 = Ky^2 \Rightarrow y^2 = \frac{m_3}{K}U_3'^2 = \frac{1}{100} \cdot 4 \Rightarrow \boxed{y = 0,2\,m}$