



Državni izpitni center



M 1 2 2 7 4 1 1 3

JESENSKI IZPITNI ROK

MEHANIKA

NAVODILA ZA OCENJEVANJE

Sreda, 29. avgust 2012

SPLOŠNA MATURA

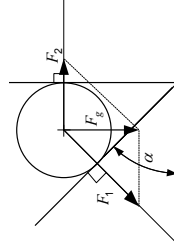
IZPITNA POLA 1

1. naloga

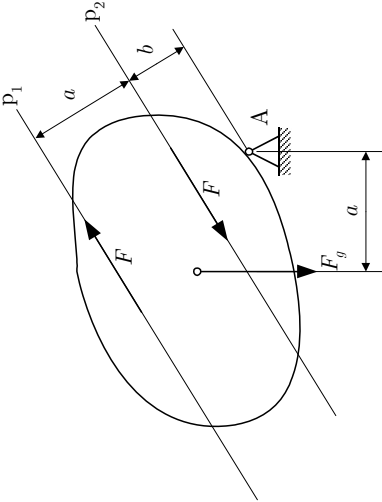
Vpr.	Točke	Odgovor	Dodatna navodila
1.1	1	$\diamond W = 370 \cdot 10^2 \text{ cm}^3 = 370 \cdot 10^2 \cdot (10^{-2} \text{ m})^3 = 3,7 \cdot 10^{-2} \text{ m}^3$	
1.2	1	$\diamond \tau = 34 \frac{\text{kN}}{\text{cm}^2} = 34 \cdot 10^3 \frac{\text{N}}{100 \text{ mm}^2} = 340 \text{ MPa}$	
1.3	1	$\diamond J = 22 \text{ kg m}^2 = 22 \cdot 1000 \text{ g} \cdot (1000)^2 \text{ mm}^2 = 22 \cdot 10^9 \text{ g mm}^2$	
1.4	1	$\diamond \omega = 360 \text{ min}^{-1} = 6 \text{ s}^{-1}$	
1.5	1	$\diamond a = 3,6 \frac{\text{km}}{\text{min}^2} = 3,6 \frac{1000 \text{ m}}{3600 \text{ s}^2} = 1 \frac{\text{m}}{\text{s}^2}$	

2. naloga

Vpr.	Točke	Odgovor	Dodatna navodila
2.1	2	\diamond	Narisani pravokotnici na obe podlogi 1 točka. Narisan paralelogram ali trikotnik sil 1 točka. Grafično določeni velikosti obeh sil 1 točka.
1	1	$\diamond m_F = \frac{100 \text{ N}}{\text{mm}} \Rightarrow F_1 = 22,6 \cdot 100 = 2260 \text{ N}$ in $F_2 = 15 \cdot 100 = 1500 \text{ N}$	
Skupaj	3		
2.2	1	$\diamond \cos \alpha = \frac{F_g}{F_1} \Rightarrow F_1 = \frac{F_g}{\cos \alpha}$	
1	1	$\diamond \tan \alpha = \frac{F_2}{F_g} \Rightarrow F_2 = F_g \tan \alpha$	
Skupaj	2		



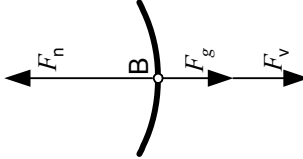
3. naloga

Vpr.	Točke	Odgovor	Dodatna navodila
3.1	1	♦	
3.2	1	♦ Podpora A je nepremična členkasta podpora.	
3.3	1	♦ $\sum M_{iA} = 0$	
	1	♦ $F_g a - F(a+b) + F b = 0$	
	1	♦ $F_g a - F a - F b + F b = 0$ $F = F_g$	
Skupaj	3		

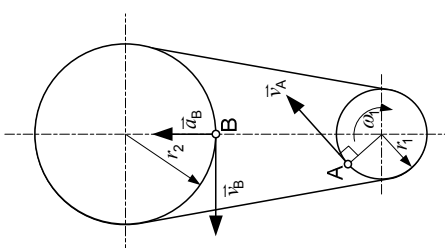
4. naloga

Vpr.	Točke	Odgovor	Dodatna navodila
4.1	2	♦ $\vec{F}_M = A \cdot \tau_M$	
	2	♦ $A = \pi r ds$	
	1	♦ $F_M = \pi r ds \tau_M$	
Skupaj	5		

5. naloga

Vpr.	Točke	Odgovor	Dodatna navodila
5.1	1	♦ $E_p = mg(h_A - h_B) = mgR$	
5.2	1	♦ $W_{AB} = \vec{F}_g \cdot \Delta\vec{r} = mgR$	
5.3	1	♦ Obkrožen odgovor A, ker telo delo odda.	
5.4	1	♦	
			
	1	♦ F_g – teža telesa F_n – normalna sila vodila in F_v – vztrajnostna normalna sila ali centrifugalna sila	
Skupaj	2		

6. naloga

Vpr.	Točke	Odgovor	Dodatna navodila
6.1	1	<p>♦ Večjo kotno hitrost ima gonilna jermenica (ali manjša jermenica ali $\omega_1 > \omega_2$).</p> <p>♦ V skico vrisani hitrosti \vec{v}_A in \vec{v}_B.</p>	
			
6.3	1	♦ $\frac{v_A}{v_B} = 1$	
6.4	1	♦ Točka B ima pospešek.	
	1	♦ V skico vrisan pospešek \vec{a}_B (gl. skico pri 6.2).	
Skupaj	2		

7. naloga

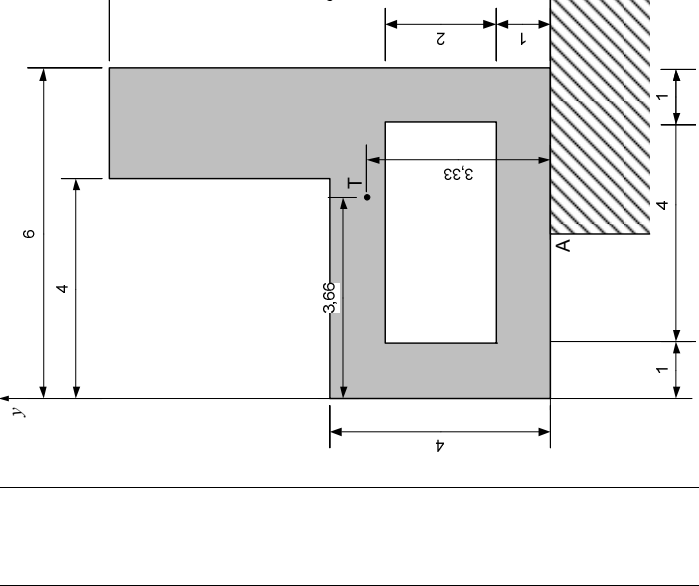
Vpr.	Točke	Odgovor	Dodatna navodila
7.1	1	♦ Obkrožen odgovor B.	
7.2	1	♦ Obkrožen odgovor B.	
7.3	1	♦ $F_V = F_g \Rightarrow V_{\text{iz}} \rho_i g = V \rho g$	Če kandidat samo napiše gostoti, dobi 3 točke.
1	♦ $A \cdot \frac{3}{4} h \rho_x = A \cdot h \rho \Rightarrow \rho_x = \frac{4\rho}{3} = \frac{4 \cdot 900}{3} = 1200 \text{ kg/m}^3$		
1	♦ $A \cdot h \rho_2 = A \cdot h \rho \Rightarrow \rho_2 = \frac{\rho}{1} = \frac{900}{1} = 900 \text{ kg/m}^3$		
Skupaj		3	

8. naloga

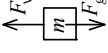
Vpr.	Točke	Odgovor	Dodatna navodila
8.1	1	♦ Obkrožen odgovor A.	
8.2	1	♦ $v_1 A_1 = v_2 A_2$	
1	♦ $v_2 = 4v_1$ $v_1 d_1^2 = 4v_1 d_2^2$		
1	♦ $\frac{d_1^2}{d_2^2} = 4$ $\frac{d_1}{d_2} = 2$ $d_2 = \frac{1}{2} d_1$		
Skupaj		3	
8.3	1	♦ Pravilna je trditev B.	

9. naloga

Vpr.	Točke	Odgovor	Dodatna navodila																																																												
9.1	2	♦ Smiselno izbrani elementi plosčinskega lika.																																																													
6		♦ Izpolnjena preglednica	Določitev lokalnega težišča el. 1 1 točka. Določitev lokalnega težišča el. 2 1 točka. Določitev težišča el. 3 1 točka. Določitev ploščine el. 1 1 točka. Določitev ploščine el. 2 1 točka. Določitev ploščine el. 3 1 točka.																																																												
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2		♦	$x_T = \frac{\sum x_i A_i}{\sum A_i} = \frac{88}{24} = \frac{11}{3} = 3,66 \text{ cm}$	(1+1)																																																											
2		♦	$y_T = \frac{\sum y_i A_i}{\sum A_i} = \frac{80}{24} = \frac{10}{3} = 3,33 \text{ cm}$																																																												
	12	Skupaj																																																													

Vpr.	Točke	Odgovor	Dodatna navodila
9.2	3	♦	Vrisano težišče v sliko 2 točki. Kotirano težišče 1 točka.
			
9.3	2	♦ Plošča se ne prevrne	
	3	♦ ker je $x_T = 3,66 \text{ cm} > 6 - 3 = 3 \text{ cm}$	Za vsako smiselno pojasnitev 3 točke.
Skupaj	5		

10. naloga

Vpr.	Točke	Odgovor	Dodatna navodila
10.1	2	$\diamond t = \frac{h}{v} = \frac{2,4}{0,4} = 6 \text{ s}$	(1+1)
10.2	1	\diamond 	
	1	$\diamond F_g = mg = 25 \cdot 10 = 250 \text{ N}$	
	1	$\diamond \sum F_{iy} = 0$ $F_v - F_g = 0$ $F_v = F_g = 250 \text{ N}$	
	3	Skupaj	
10.3	2	$\diamond \omega = \frac{v}{r_B} = \frac{0,4}{0,1} = 4 \text{ s}^{-1}$	(1+1)
	2	$\diamond \frac{v_R}{v_B} = \frac{\omega r_R}{\omega r_B} = \frac{r_R}{r_B} = \frac{0,4}{0,1} = 4$	(1+1)
	4	Skupaj	
10.4	2	$\diamond M_B = F_g r_B = 250 \cdot 0,1 = 25 \text{ Nm}$	(1+1)
	2	$\diamond M_R = F r_R = 80 \cdot 0,4 = 32 \text{ Nm}$	(1+1)
	3	$\diamond M_L = M_R - M_B = 32 - 25 = 7 \text{ Nm}$	(2+1)
	7	Skupaj	
10.5	2	$\diamond M_t^{1-1} = 25 \text{ Nm}$	
	2	$\diamond M_t^{2-2} = 32 \text{ Nm}$	
	4	Skupaj	

Skupno število točk IP1: 80

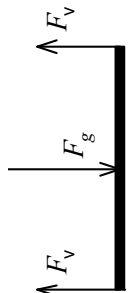
IZPITNA POLA 2


1. naloga

Vpr.	Točke	Odgovor	Dodatna navodila
1.1	1	♦ $\tau_s = \frac{F}{A} \leq \tau_{s\text{dop}}$	
	1	♦ $A = \frac{F}{\tau_{s\text{dop}}}$	
	2	♦ $A = \frac{9400}{60} = 156,7 \text{ mm}^2$	(1+1)
	3	♦ $A = 2 \cdot \frac{\pi d^2}{4}$	(2+1)
	1	♦ $d = \sqrt{\frac{2A}{\pi}}$	
	1	♦ $d = \sqrt{\frac{2 \cdot 156,7}{\pi}} = 10 \text{ mm}$	
Skupaj			
1.2	1	♦ $\sigma = \frac{F}{A} \leq \sigma_{\text{dop}}$	
	1	♦ $A = \frac{F}{\sigma_{\text{dop}}}$	
	1	♦ $A = \frac{9400}{90} = 104,4 \text{ mm}^2$	
	3	♦ $A = s_2 (b_2 - d)$	(1+2)
	1	♦ $b_2 = \frac{A}{s_2} + d$	
	1	♦ $b_2 = \frac{104,4}{8} + 10 = 23,1 \text{ mm}$	
Skupaj			
	8		

Vpr.	Točke	Odgovor	Dodatna navodila
1.3	1	♦ $\sigma = \frac{F}{A}$	
	1	♦ $\sigma = \frac{F_1}{b_1 s_1}$	
	1	♦ $\sigma = \frac{4700}{25 \cdot 5} = 37,6 \frac{\text{N}}{\text{mm}^2}$	
Skupaj	3		

2. naloga

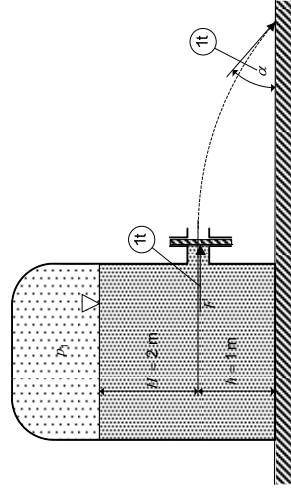
Vpr.	Točke	Odgovor	Dodatna navodila
2.1	1	♦ $F_g = mg$	
	1	♦ $F_g = 30 \cdot 9,81 = 294,3 \text{ N}$	
	1	♦ $F_v = \frac{F_g}{2}$	
	1	♦ $F_v = \frac{294,3}{2} = 147,15 \text{ N}$	
Skupaj	4		
2.2	3	♦	<p>Prečka, narisana kot model nosilca s silami vrvi 1 točka. Vrisana sila teže na sredini nosilca 1 točka. Enojni nihalni podpori 1 točka.</p> 

Vpr.	Točke	Odgovor	Dodatna navodila
2.3	5	♦ 	Narisan diagram notranje osne sile 1 točka. Narisan diagram notranjih prečnih sil (1+1) 2 točki. Narisan diagram notranjih upogibnih momentov (1+1) 2 točki.
2.4	1	♦ $\sigma_u = \frac{M_{\text{umaks}}}{W}$	
	1	♦ $W = \frac{\pi d^3}{32}$	
	1	♦ $W = \frac{\pi d^3}{32} = \frac{\pi \cdot 35^3}{32} = 4209 \text{ mm}^3$	
	1	♦ $\sigma_u = \frac{44,15 \cdot 10^3}{4209} = 10,5 \text{ N/mm}^2$	
	1	♦ $\sigma_u \leq \sigma_{\text{dop}}$	
	1	♦ Obremenitev prečke je v dopustnih mejah	
Skupaj	6		
2.5	1	♦ $F_{\text{maks}} = mg = 300 \cdot 9,81 = 2943 \text{ N}$	
	1	♦ $F_V = \frac{F_{\text{maks}}}{2} = \frac{2943}{2} = 1471,5 \text{ N}$; $F_V = \frac{F_V}{2} = \frac{1471,5}{2} = 735,75 \text{ N}$ ali ♦ $F_V = \frac{F_{\text{maks}}}{4} = \frac{2943}{4} = 735,75 \text{ N}$	
	1	♦ $\sigma = \frac{F}{A_V} \leq \sigma_{\text{dop}}$	

1	$\diamond A_V \geq \frac{F_V}{\sigma_{\text{dop}}} = \frac{735,75}{60} = 12,26 \text{ mm}^2$	
1	$\diamond A_V = \frac{\pi d_V^2}{4}$ $d_V = \sqrt{\frac{4 \cdot A_V}{\pi}} = \sqrt{\frac{4 \cdot 12,26}{\pi}} = 3,95 \text{ mm}$	
5		
1	$\diamond \varepsilon = 4 \% = 0,04$	
1	$\diamond A = \frac{\pi d^2}{4} = \frac{\pi \cdot 10^2}{4} = 78,54 \text{ mm}^2$	
1	$\diamond \sigma = \varepsilon E = \frac{F}{A}$	
1	$\diamond E = \frac{F}{A \varepsilon} = \frac{800}{78,54 \cdot 0,04} = 254,6 \text{ N/mm}^2$	
1	$\diamond \sigma_V = \frac{F_V}{A} = \frac{147,15}{78,54} = 1,87 \text{ N/mm}^2$	
1	$\diamond \varepsilon_1 = \frac{\sigma_V}{E} = \frac{1,87}{254,6} = 0,0074$	
1	$\diamond \Delta l_1 = l_0 \cdot \varepsilon_1 = 1000 \cdot 0,0074 = 7,4 \text{ mm}$	
7		
Skupaj		

3. naloga

Vpr.	Točke	Odgovor	Dodatna navodila
3.1	1	♦ $p_d = p_1 + \rho g(h + H)$	
	1	♦ $p_d = 1,4 \cdot 10^5 + 10^3 \cdot 9,81 \cdot (1 + 2) = 1,694 \cdot 10^5 \text{ Nm}^{-2}$	
Skupaj			
3.2	1	♦	(1+1)
	1	♦ $p_z = p_1 + \rho gH$	
	1	♦ $p_z = 1,4 \cdot 10^5 + 10^3 \cdot 9,81 \cdot 2 = 1,5926 \cdot 10^5 \text{ Nm}^{-2}$	
	1	♦ $A_z = \frac{\pi d^2}{4}$	
	1	♦ $A_z = \frac{\pi \cdot 0,05^2}{4} = 19,6 \cdot 10^{-4} \text{ m}^2$	
	1	♦ $F = p_z A_z$	
	1	♦ $F = 1,5926 \cdot 10^5 \cdot 19,6 \cdot 10^{-4} = 313 \text{ N}$	
Skupaj			
3.3	1	♦ $\tau_s = \frac{F}{A_s}$	
	1	♦ $A_s = \pi ds$	
	1	♦ $A_s = \pi \cdot 50 \cdot 6 = 942,5 \text{ mm}^2$	



	1	♦ $\tau_s = \frac{313}{942,5} = 0,3 \text{ Nmm}^{-2}$	
Skupaj	4		
3.4	2	♦ $z_1 + \frac{p_1}{\rho g} + \frac{v_1^2}{2g} = z_2 + \frac{p_2}{\rho g} + \frac{v_2^2}{2g}$	
	1	♦ $z_1 = H, v_1 = 0$	
	1	♦ $z_2 = 0, p_2 = 0$	
	1	♦ $H + \frac{p_1}{\rho g} = \frac{v_2^2}{2g} \Rightarrow v = \sqrt{2g \left(H + \frac{p_1}{\rho g} \right)}$	
	1	♦ $v = \sqrt{2 \cdot 9,81 \cdot \left(2 + \frac{1,4 \cdot 10^5}{10^3 \cdot 9,81} \right)} = 17,87 \text{ m/s}$	
Skupaj	6		
3.5	1	♦ $\dot{Q} = A_z v$	
	1	♦ $\dot{Q} = 19,6 \cdot 10^{-4} \cdot 17,87 = 0,035 \text{ m}^3/\text{s}$	
Skupaj	2		
3.6	1	♦ $h = \frac{gt^2}{2}$	
	1	♦ $t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2 \cdot 1}{9,81}} = 0,45 \text{ s}$	
	1	♦ $x = v_x t = vt$	
	1	♦ $x = 17,87 \cdot 0,45 = 8,04 \text{ m/s}$	
Skupaj	4		

Vpr.	Točke	Odgovor	Dodatna navodila
3.7	1	♦ $v_y = gt$	
	1	♦ $v_y = 9,81 \cdot 0,45 = 4,41 \text{ m/s}$	
	1	♦ $\tan \alpha = \frac{v_y}{v_x}$	
	1	♦ $\tan \alpha = \frac{4,41}{17,87} = 0,247 \Rightarrow \alpha = 13,8^\circ$	
	1	♦ Na skici označen kot curka α .	
Skupaj	5		

Skupno število točk IP2: 80