

工程力学模拟试卷（一）答案

一、 BADCA

二、

1. (i) AC受力图,作力多边形

有, $F_A = F_B = P \cos 45^\circ$

2.

(i)

$$M_B = 9549 \frac{368}{500} = 7 \text{ kNm}$$

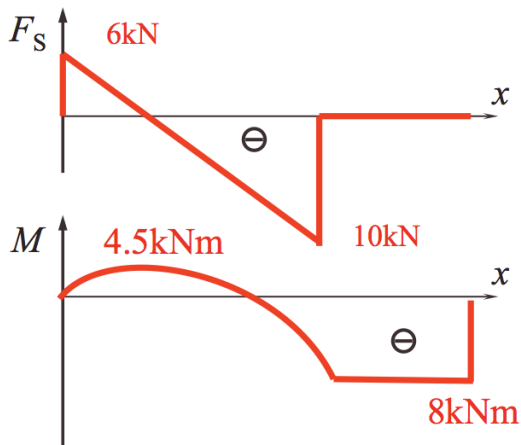
$$M_A = 9549 \frac{147}{500} = 2.8 \text{ kNm}, M_{T, \max} = 4.2 \text{ kNm}$$

$$M_C = 9549 \frac{221}{500} = 4.2 \text{ kNm}$$

(2)

$$\tau_{\max} = \frac{M_{T, \max}}{W_p} \leq [\tau], W_p = \frac{\pi d^3}{16} \quad d \geq \sqrt[3]{\frac{16 M_{T, \max}}{\pi [\tau]}} = 64 \text{ mm}$$

3.



4.

(i) $M_{\max} = 80 \text{ kNm}$

(2)

$$\sigma_{\max} = \frac{M_{\max}}{W_z}, W_z = \frac{bh^2}{6}, \sigma_{\max} = \frac{6 M_{\max}}{bh^2} = 120 \text{ MPa} < [\sigma], \text{强度满足要求。}$$

5.

$$\theta_c = \frac{Pl^2}{2EI_z} \quad y_c = \frac{Pl^2}{3EI_z} + \frac{Pl^2 a}{2EI_z}$$

工程力学模拟试卷（二）答案

一、 ACDCA

二、

1.

$$F_B = \frac{M}{2L} = 2.5\text{kN}$$

$$\sum F_x = 0, F_{Ax} = 0$$

$$\sum F_y = 0, F_{Ay} - ql - P + F_B = 0$$

$$\sum M_A = 0, -M_A - 1.5ql^2 - P2l - M + F_B 4l = 0$$

$$F_{Ax} = 0$$

$$F_{Ay} = 2\text{kN}$$

$$M_A = -7.5\text{kNm}$$

2.

$$F_{NAB} = 60\text{kN}$$

$$F_{NBC} = -20\text{kN}$$

$$F_{NCD} = 30\text{kN}$$

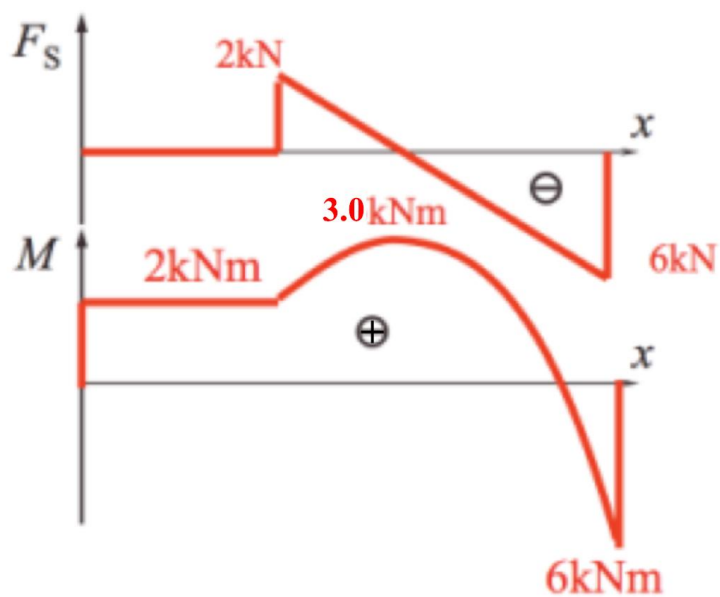
$$\sigma_{AB} = \frac{F_{NAB}}{A_1} = \frac{60 \times 10^3}{300 \times 10^{-6}} = 200\text{MPa} > [\sigma]$$

$$\sigma_{BC} = \frac{F_{NBC}}{A_2} = \frac{20 \times 10^3}{200 \times 10^{-6}} = 100\text{MPa} < [\sigma]$$

$$\Delta l = \frac{F_{NAB} l_{AB}}{EA_1} + \frac{F_{NBC} l_{BC}}{EA_2} + \frac{F_{NCD} l_{CD}}{EA_3}$$

$$= 0.5\text{mm}$$

3.



4.

(1) $M_{\max} = 3\text{kNm}$

(2) $\sigma_{\max} = \frac{M_{\max}}{W_z}, W_z = \frac{a^3}{6}, a \geq \sqrt[3]{\frac{M_{\max}}{[\sigma]}} = 21.5\text{mm}$

5.

$$F_{cr} = \frac{\pi^3 E d^2}{\lambda^2 4} = \frac{\pi^3 2 \times 10^{11} 60^2 \times 10^{-6}}{93^2 4} = 645.29\text{kN}$$

工程力学模拟试卷（三）答案

一、CBDDBC

二、

(i)BC

$$\sum M_B = 0, -M + F_{Cy} 2a = 0$$

$$F_{Cy} = \frac{M}{2a}$$

(2)整体

$$\sum F_x = 0, F_{Ax} + F_{Cx} = 0$$

$$\sum F_y = 0, F_{Ay} - 2qa + F_{Cy} = 0$$

$$\sum M_A = 0, -2qa^2 - M + F_{Cy} 4a - F_{Cx} 2a = 0$$

$$F_{Ax} = 0.5qa$$

$$F_{Ay} = 1.5qa$$

$$F_{Cx}} = -0.5qa$$

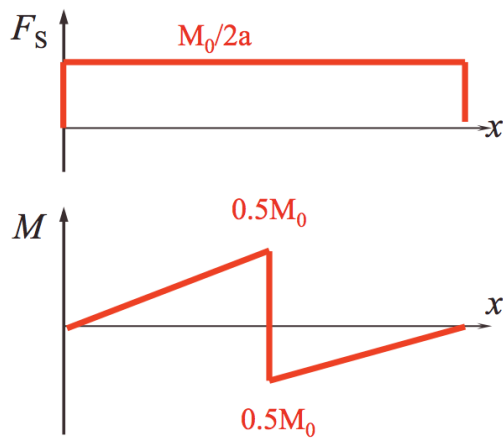
2.

$$(1) F_N = \frac{F}{2 \cos 40^\circ}$$

$$(2) \sigma = \frac{F_N}{A} \leq [\sigma]$$

$$F \leq 2[\sigma] A \cos 40^\circ = 49 \text{ kN}$$

3.



4.

$$(1) M_{\max} = 6 \text{ kNm}$$

$$(2) \sigma_{\max} = \frac{M_{\max}}{W_z}, W_z = \frac{bh^2}{6}$$

$$\sigma_{\max} = \frac{6M_{\max}}{bh^2} = 9 \text{ MPa}$$

5.

$$(1) F_s = F, A_s = \pi dt$$

(2)

$$\tau_{\max} = \frac{F_s}{A_s} \geq [\tau]$$

$$F \geq [\tau] A_s = 40 \times \pi \times 18 \times 5 = 11.3 \text{ kN}$$

工程力学模拟试卷（四）答案

一、 BDCDC

二、

1.

$$\sum F_x = 0, F + F_C = 0$$

$$\sum M_B = 0, -2lF_A + 0.5Fl + F_C l = 0$$

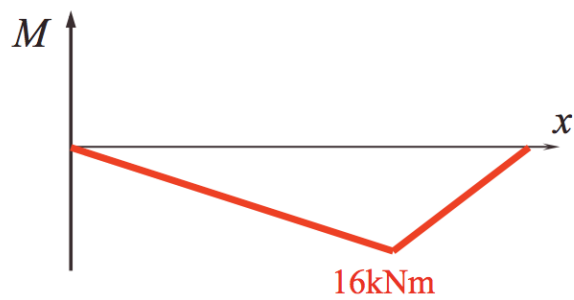
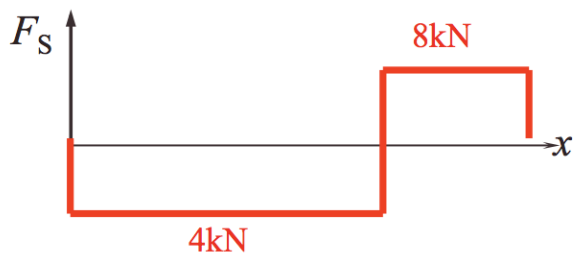
$$\sum M_A = 0, 0.5Fl + F_C l + F_B 2l = 0$$

$$F_C = F$$

$$F_A = -0.25F$$

$$F_B = 0.25F$$

2.



(2)

$$\sigma_{\max} = \frac{M_{\max}}{W_z}, W_z = \frac{\pi d^3}{32}$$

$$\sigma_{\max} = \frac{32 \times 16 \times 10^3}{\pi (0.1)^3} = 163 \text{MPa} > [\sigma], \text{ 不满足强度要求}$$

3.

(1)

$$\sum F_x = 0, -F_{N1} \sin 45 + F_{N2} \sin 30 = 0$$

$$\sum F_y = 0, F_{N1} \cos 45 + F_{N2} \cos 30 - P = 0$$

$$F_{N1} = \frac{P}{1.932}, F_{N2} = \frac{P}{1.366}$$

(2)

$$\sigma_1 = \frac{F_{N1}}{A_1} = \frac{4 \times 50 \times 10^3}{1.932 \pi (15 \times 10^{-3})^2} = 146 \text{MPa} < [\sigma]$$

满足强度要求

$$\sigma_2 = \frac{F_{N2}}{A_2} = \frac{4 \times 50 \times 10^3}{1.336 \pi (20 \times 10^{-3})^2} = 119 \text{MPa} < [\sigma]$$

4.

$$(1) M_{T, \max} = 4 \text{kNm}$$

$$(2) \tau_{\max} = \frac{M_{T, \max}}{W_p} \leq [\tau], W_p = \frac{\pi d^3}{16}$$

$$\tau_{\max} = \frac{16 M_{T, \max}}{\pi d^3} = 39.7 \text{MPa} \leq [\tau]$$

5.

$\lambda = 127.27$ 大柔度杆

$$F_{cr} = \frac{\pi^2 E}{\lambda^2} A = 46.3 \text{kN}, P \leq 15.4 \text{kN}$$

工程力学模拟试卷（五）答案

一、CBADD

二、

1.

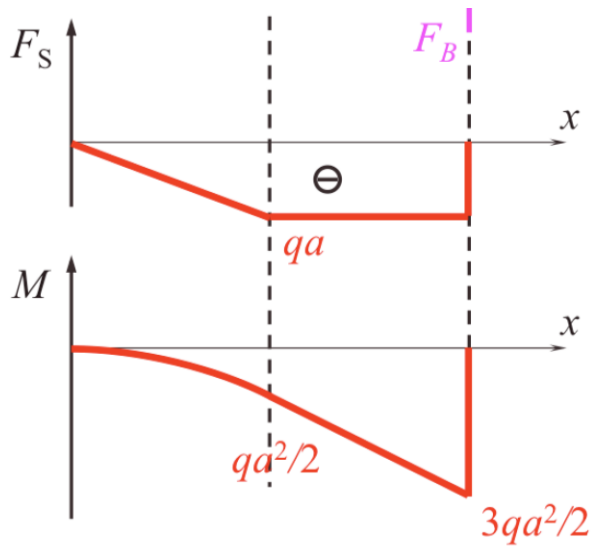
$$(1) F_C = \frac{P}{2}$$

$$\begin{aligned} \sum F_x = 0, F_{Ax} = 0 & \quad F_{Ax} = 0 \\ (2) \sum F_y = 0, F_{Ay} - P + F_C = 0 & \quad F_{Ay} = P/2 \\ \sum M_A = 0, M_A - Pa - m + F_C 3a = 0 & \quad M_A = 0 \end{aligned}$$

2.

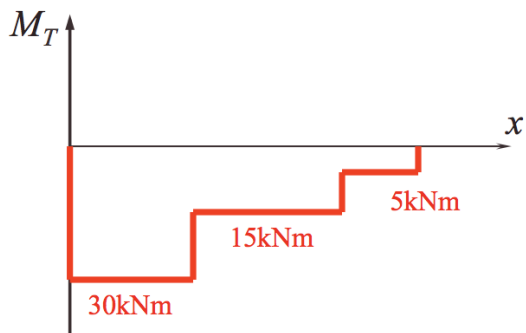
$$\Delta l_{AC} = \Delta l_{AB} + \Delta l_{BC} = -0.2\text{mm}$$

3.



4.

(1)



(2) A 轮与 B 轮互换。

5.

$$\left. \begin{array}{l} \sigma_{\max} \\ \sigma_{\min} \end{array} \right\} = \frac{\sigma_x + \sigma_y}{2} \pm \sqrt{\left(\frac{\sigma_x - \sigma_y}{2} \right)^2 + \tau_x^2} = \frac{-10-2}{2} \pm \sqrt{(-4)^2 + (-3)^2}$$

$$= -6 \pm 5 = \begin{cases} -1 \text{MPa} \\ -11 \text{MPa} \end{cases}$$

$$\sigma_1 = 0, \sigma_2 = -1 \text{MPa}, \sigma_3 = -11 \text{MPa},$$

$$\sigma_{r3} = 11 \text{MPa}$$

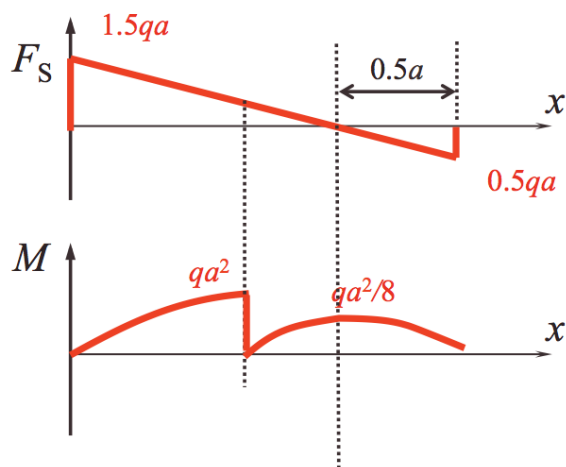
工程力学模拟试卷（六）答案

一、BCBCB

二、

$$1. F_C = qa, F_{Ax} = 0, F_{Ay} = qa, M_A = 2qa^2$$

2.



3.

(1)

$$M_T = 9549 \frac{3}{27} = 1061 \text{Nm}$$

(2)

$$\tau_{\max} = \frac{M_{T,\max}}{W_p} \leq [\tau], W_p = \frac{\pi d^3}{16} \quad d \geq \sqrt[3]{\frac{16 M_{T,\max}}{\pi [\tau]}} = \sqrt[3]{\frac{16 \times 1061}{\pi 40 \times 10^6}} = 51 \text{mm}$$

(3)

$$\theta_{\max} = \frac{M_{T,\max}}{GI_p} \frac{180}{\pi} \leq [\theta], I_p = \frac{\pi d^4}{32}$$

$$d \geq \sqrt[4]{\frac{32 M_{T,\max}}{G \pi [\theta]} \frac{180}{\pi}} = \sqrt[4]{\frac{32 \times 1061}{80 \times 10^9 \pi^2} 180} = 53 \text{mm}$$

$$d = 53 \text{mm}$$

4.(1)

$$M_{\max} = 40 \text{kNm}$$

(2)

$$\sigma_{\max} = \frac{M_{\max}}{W_z} \leq [\sigma], W_z = \frac{\pi D^3}{32} (1 - \alpha^4)$$

$$D \geq \sqrt[3]{\frac{32 M_{\max}}{\pi (1 - \alpha^4) [\sigma]}} = 145.8 \text{mm} \quad D = 146 \text{mm}, d = 73 \text{mm}$$

5

(1)

$$\lambda = 121$$

(2)

$$F_{cr} = \frac{\pi^2 E}{\lambda^2} A = 54 \text{kN}$$

工程力学模拟试卷（七）答案

一、BCACC

二、

I.

$$\sum F_x = 0, F_{Ax} + F_{Bx} - P \cos 45 = 0$$

$$\sum M_A = 0, -\frac{1}{2} q l_1^2 + M + P \cos 45' l_1 + P \sin 45' (l_1 + 2l_2) + F_{By}' (l_1 + l_2) = 0$$

$$\sum M_B = 0, q l_1 (0.5 l_1 + l_2) + M + P \cos 45' l_1 + P \sin 45' l_2 - F_{Ay}' (l_1 + l_2) = 0$$

$$F_{By} = -24.5 \text{ kN}$$

$$F_{Ay} = 17.6 \text{ kN}$$

(2)

$$\sum M_C = 0, \frac{1}{2} q l_1^2 - F_{Ay}' l_1 + F_{Ax}' l_1 = 0$$

$$F_{Ax} = 16.1 \text{ kN}$$

(3)

$$F_{Bx} = P \cos 45 - F_{Ax} = -6.2 \text{ kN}$$

2.

(1)

$$e = \frac{s}{E} = \frac{F}{EA}, \epsilon = -\frac{\Delta l}{l} = -\frac{F}{EA}$$

$$\frac{\epsilon}{-\frac{F}{EA}} = \frac{F}{EA}$$

(2)

$$\Delta l = \frac{\epsilon l}{-\frac{F}{EA}} = 0.67 \text{ mm}$$

3.

(1)

$$M_A = 9549 \frac{147}{500} = 2807 \text{ Nm}$$

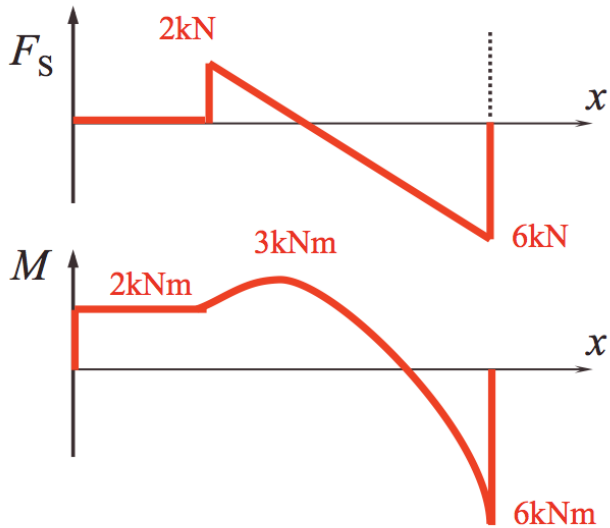
$$M_B = 9549 \frac{368}{500} = 7028 \text{ Nm} \quad M_{T, \max} = 4221 \text{ Nm}$$

$$M_C = 9549 \frac{221}{500} = 4221 \text{ Nm}$$

(2)

$$\tau_{\max} = \frac{M_{T,\max}}{W_p} \leq [\tau], W_p = \frac{\pi d^3}{16} \quad d \geq \sqrt[3]{\frac{16 M_{T,\max}}{\pi [\tau]}} = \sqrt[3]{\frac{16 \times 4221}{\pi 70 \times 10^6}} = 171 \text{mm}$$

4.



5.

(1)

$$M_{\max} = 7.5 \text{kNm}$$

(2)

$$\sigma_{t,\max} = \frac{M_{\max}}{I_z} \times 88 \times 10^{-3} = 86.8 \text{MPa}$$

工程力学模拟试卷（八）答案

一、 BDCDA

二、

I.

$$\begin{aligned} \textcircled{a} \quad F_x = 0, F_{Ax} + P &= 0 & F_{Ax} &= -P \\ \textcircled{a} \quad M_A = 0, -P' \cdot 12 + F_D' \cdot 8 &= 0 & F_D &= 1.5P \\ \textcircled{a} \quad M_D = 0, -F_{Ay}' \cdot 8 - P' \cdot 12 &= 0 & F_{Ay} &= -1.5P \end{aligned}$$

$$\textcircled{a} \quad M_E = 0, -F_{Cy}' \cdot 4 + F_D' \cdot 4 = 0 \quad F_{Cy} = 1.5P$$

$$\sum M_B = 0, -F_{Ay} \cdot 4 + F_{Ax} \cdot 8 - F_{Cy} \cdot 4 + F_{Cx} \cdot 4 = 0 \quad F_{Cx} = 0.5P$$

$$\begin{aligned} F_{Ax} &= -P & F_{Cx} &= 0.5P \\ F_{Ay} &= -1.5P & F_{Cy} &= 1.5P \\ F_D &= 1.5P \end{aligned}$$

2.(1)

$$\begin{aligned} \sum F_x &= 0, -F_{N1} \sin 30 + F_{N2} \sin 60 = 0 \\ \sum F_y &= 0, F_{N1} \cos 30 + F_{N2} \cos 60 - F = 0 \end{aligned} \quad F_{N1} = \frac{\sqrt{3}}{2} F, F_{N2} = 0.5F$$

,

(2)

$$\begin{aligned} F &\leq \frac{2A[s]}{\sqrt{3}} \quad [F] = 37\text{kN} \\ F &\leq 2A[s] \end{aligned}$$

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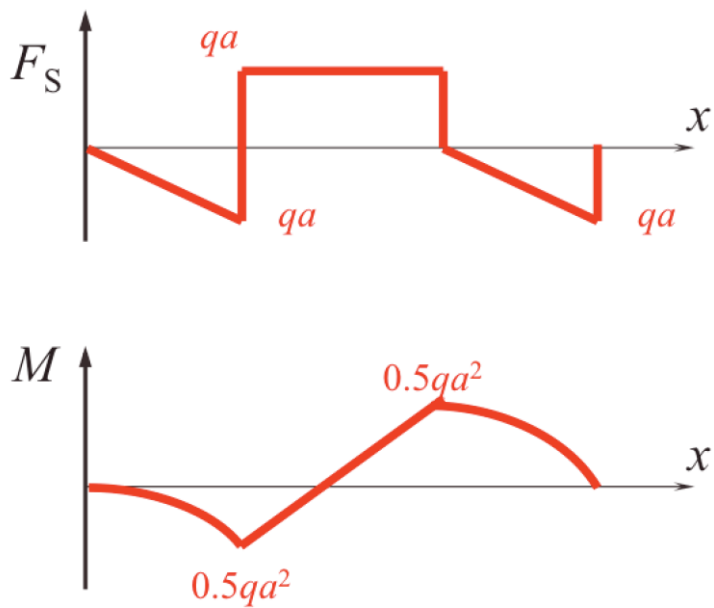
3.

$$\varphi = \frac{M_{T,\max}}{GI_p} \frac{l}{\pi}$$

$$\tau_{\max} = \frac{M_{T,\max}}{W_p}$$

$$\tau_{\max} = \frac{D}{2} \frac{G\pi}{180l} \varphi = 46.5\text{MPa}$$

4.



$$M_{\max} = 0.5qa^2$$

$$\sigma_{\max} = \frac{M_{\max}}{W_z}, W_z = \frac{\pi d^3}{32}$$

$$\sigma_{\max} = \frac{32M_{\max}}{\pi d^3} = 1.9\text{MPa}$$

5.

$$\lambda = 120$$

，大柔度杆

工程力学模拟试卷（九）答案

一、 CBCAD

二、

1.

$$F_C = \frac{P}{3}$$

(1) BC

(2)

$$\dot{a} F_x = 0, F_{Ax} + P = 0$$

$$\dot{a} F_y = 0, F_{Ay} + F_C = 0$$

$$\dot{a} M_A = 0, M_A - M - P' a + F_C' 1.5a = 0$$

$$F_{Ax} = -P$$

$$F_{Ay} = -\frac{P}{3}$$

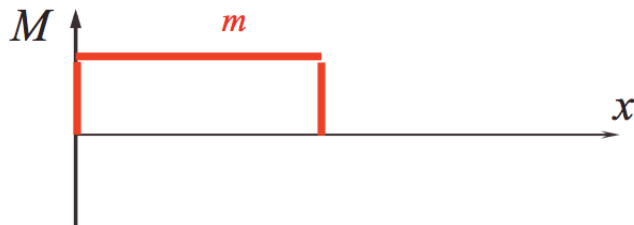
$$M_A = Pa$$

2.

$$\tau_{\max} = \frac{M_{T,\max}}{W_p}, W_p = \frac{\pi d^3}{16}$$

$$\tau_{\max} = \frac{16 M_{T,\max}}{\pi d^3} = 39.8 \text{MPa} < [\tau]$$

3.



4.

(1)

$$M_{\max} = \frac{Pl}{4} = 8 \text{kNm}$$

(2)

$$\sigma_{\max} = \frac{M_{\max}}{W_z}, W_z = \frac{bh^2}{6}$$

$$\sigma_{\max} = \frac{6 M_{\max}}{bh^2} = \frac{6 \times 8 \times 10^3}{0.14 \times 0.21^2} = 7.7 \text{MPa} < [\sigma]$$

满足强度要求。

5.解由题意知

$$\sigma_x = 40\text{MPa} \quad \sigma_y = 30\text{MPa} \quad \tau_x = 20\text{MPa}$$

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由主应力计算公式

$$\left. \begin{array}{l} \sigma_{\max} \\ \sigma_{\min} \end{array} \right\} = \frac{\sigma_x - \sigma_y}{2} \pm \sqrt{\left(\frac{\sigma_x - \sigma_y}{2} \right)^2 + \tau_x^2}$$

代入数据得

$$\left. \begin{array}{l} \sigma_{\max} \\ \sigma_{\min} \end{array} \right\} = \frac{40 + 30}{2} \pm \sqrt{\left(\frac{40 - 30}{2} \right)^2 + 20^2}$$

$$\left. \begin{array}{l} \sigma_{\max} \\ \sigma_{\min} \end{array} \right\} = \begin{cases} 55.6 \\ 14.4 \end{cases}$$

所以

$$\sigma_1 = 55.6\text{MPa} \quad \sigma_2 = 14.4\text{MPa} \quad \sigma_3 = 0$$

,

求最大剪应力

$$\tau_{\max} = \sqrt{\frac{(\sigma_x - \sigma_y)^2}{4} + \tau_x^2} = 21.21\text{MPa}$$

工程力学模拟试卷（十）答案

一、 ADCAB

二、

1.

$$\sum F_x = 0, F_{Ax} - F_B \cos 30^\circ + F \sin 30^\circ = 0$$

$$\sum M_A = 0, -2qa^2 + M + F_B \sin 30^\circ \cdot 4a - F \sin 30^\circ \cdot 2\sqrt{3}a - F \cos 30^\circ \cdot 4a = 0$$

$$\sum M_B = 0, -F_{Ay} \cdot 4a + 5qa^2 + M - F \sin 30^\circ \cdot 2\sqrt{3}a = 0$$

$$F_{Ax} = 2\sqrt{3}qa, F_{Ay} = \frac{3}{4}qa, F_B = 5qa$$

2.

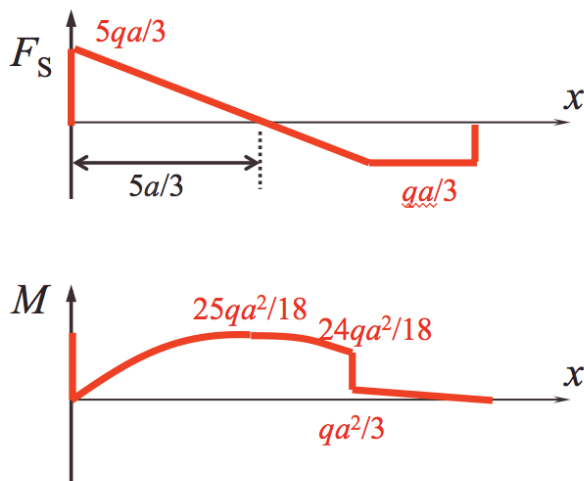
$$d \geq \sqrt[2]{\frac{4F_N}{\pi[\sigma]}} = 24.5\text{mm}$$

3.

$$\varphi = \frac{M_T l}{GI_P} \frac{180}{\pi}$$

$$l = \frac{\varphi GI_P}{M_T} \frac{\pi}{180} = \frac{\varphi G}{M_T} \frac{\pi d^4}{32} \frac{\pi}{180} = 2.3\text{m}$$

4.



5.

(1)

$$M_{\max} = \frac{ql^2}{2} = 20\text{kNm}$$

(2)

$$\sigma_{\max} = \frac{M_{\max}}{W_z}, W_z = \frac{\pi d^3}{32}$$

$$\sigma_{\max} = \frac{32 M_{\max}}{\pi d^3} = \frac{32 \times 20 \times 10^3}{\pi 0.1^3} = 203.7\text{MPa}$$

工程力学模拟试卷（十一）答案

一、 CDBDC

二、

1.

(1)整体

$$\sum F_x = 0, F_{Ax} + F + F_{Bx} = 0$$

$$\sum M_A = 0, -Fa - Fa + M + F_{By}a = 0$$

$$\sum M_B = 0, F_{Ay}a - Fa + M = 0$$

$$F_{By} = 0$$

$$F_{Ay} = -4\text{kN}$$

(2)BC

$$\sum M_C = 0, M + F_{Bx}a + F_{By}a = 0$$

$$F_{Bx} = -8\text{kN}$$

$$F_{Ax} = 4\text{kN}$$

2.

(1)

$$F_{N1} = F_{N2} = 20\text{kN}$$

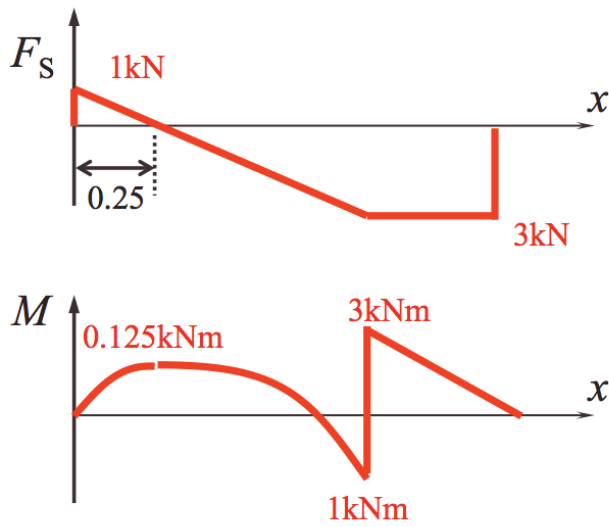
(2)

$$\sigma = \frac{F_N}{A} \leq [\sigma]$$

$$A \geq \frac{F_N}{[\sigma]} = 125\text{mm}^2$$

3.

(1)



$$M_{\max} = 3 \text{ kNm}$$

(2)

$$\sigma_{\max} = \frac{M_{\max}}{W_z}, W_z = \frac{bh^2}{6}$$

$$\sigma_{\max} = \frac{6 M_{\max}}{bh^2} = \frac{6 \times 3 \times 10^3}{0.1 \times 0.2^2} = 4.5 \text{ MPa} < [\sigma]$$

4.

$$\theta_B = \frac{Fl^2}{2EI}$$

$$v_B = \frac{5Fl^3}{6EI}$$

5.

$$\lambda = \frac{0.7 \times 1000}{20/4} = 140,$$

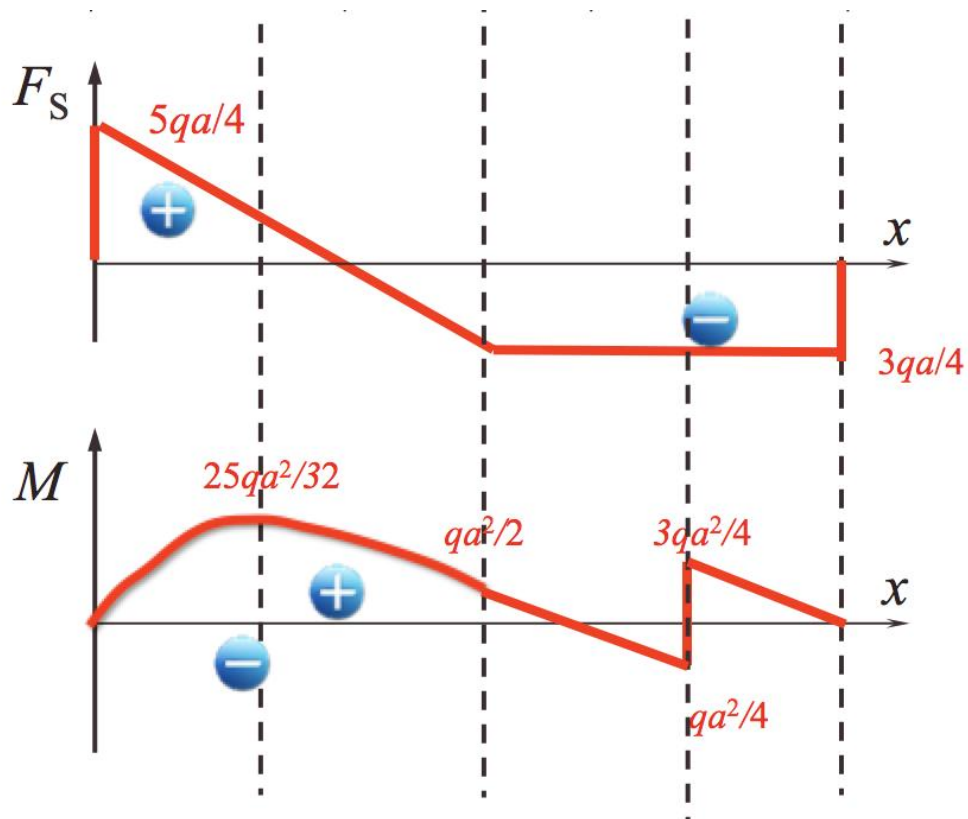
$$F_{cr} = \frac{\pi^2 E}{\lambda^2} A = \frac{\pi^2 200 \times 10^9}{140^2} \frac{\pi (20 \times 10^{-3})^2}{4} = 31.6 \text{ kN}$$

工程力学模拟试卷（十二）答案

一、 BDDCC

二、

1.



2.

(1)

$$F_{N,BC} = 2P$$

$$F_{N,AB} = \sqrt{3}P$$

(2)

$$\sigma_{AB} = \frac{F_{N,AB}}{A_{AB}} = \frac{\sqrt{3} \times 45 \times 10^3}{10^{-2}} = 7.8 \text{MPa} < [\sigma]_{AB}$$

$$\sigma_{BC} = \frac{F_{N,BC}}{A_{BC}} = \frac{2 \times 45 \times 10^3}{600 \times 10^{-6}} = 150 \text{MPa} < [\sigma]_{BC}$$

3.

$$\tau_{\max} = \frac{M_{T,\max}}{W_p}, W_p = \frac{\pi d^3}{16}$$

$$\tau_{\max} = \frac{16 M_{T,\max}}{\pi d^3} = \frac{16000}{\pi (5.5 \times 10^{-2})^3} = 30.6 \text{MPa} < [\tau]$$

4.

(I)

$$M_{\max} = Pl = 80 \text{kNm}$$

(2)

$$\sigma_{\max} = \frac{M_{\max}}{W_z}, W_z = \frac{bh^2}{6} = \frac{2b^3}{3}$$

$$b \geq \sqrt[3]{\frac{3M_{\max}}{2[\sigma]}} = \sqrt[3]{\frac{3 \times 80 \times 10^3}{2 \times 15 \times 10^6}} = 200 \text{mm} \quad h = 400 \text{mm}$$

5.

$$(1) F_C = qa$$

(2)

$$\overset{\circ}{a} F_x = 0, F_{Ax} = 0$$

$$\overset{\circ}{a} F_y = 0, F_{Ay} - 2qa + F_C = 0$$

$$\overset{\circ}{a} M_A = 0, M_A - M - 6qa^2 + 4aF_C = 0$$

$$F_{Ax} = 0$$

$$F_{Ay} = qa$$

$$M_A = 3qa^2$$

工程力学模拟试卷（十三）答案

一、 CBCBD

二、

I.

(I)AD

$$F_A = F_D = \frac{M}{2a} = 2qa$$

(2) DBC

$$\sum F_x = 0, \sum F_D + F_{Cx} = 0$$

$$\sum M_B = 0, -F_D(2a) - Fa - 4qa^2 + F_{Cy}(3a) = 0$$

$$\sum M_C = 0, -F_D(2a) - Fa + 8qa^2 - F_B(3a) = 0$$

$$F_{Cx} = -2qa$$

$$F_{Cy} = 3qa$$

$$F_B = qa$$

2.

$$(1) M_{T,\max} = 2m$$

(2)

$$\tau_{\max} = \frac{M_{T,\max}}{W_p}, W_p = \frac{\pi d^3}{16}$$

$$\tau_{\max} = \frac{16 M_{T,\max}}{\pi d^3} = \frac{16 \times 10 \times 10^3}{\pi (8 \times 10^{-2})^3} = 99.47 \text{ MPa}$$

3.

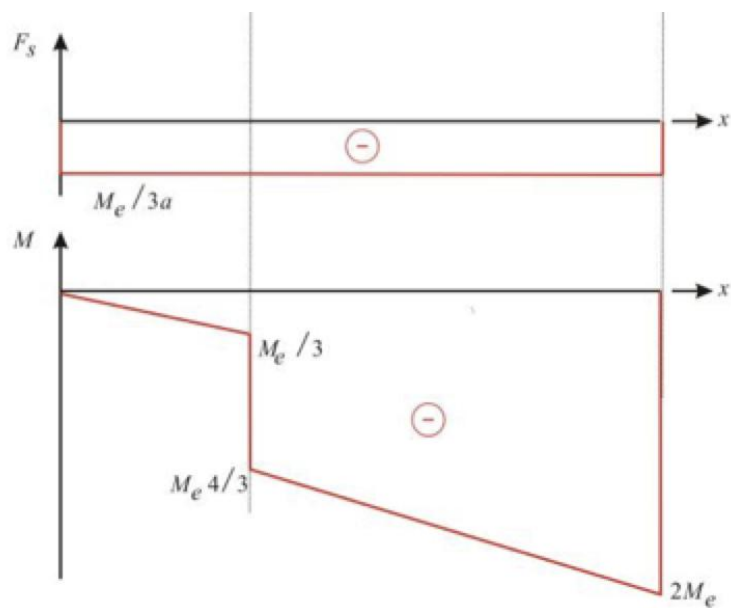
$$F_{N,CD} = \frac{M_0}{1} = 7 \text{ kN}$$

$$M_{\max} = 7 \text{ kNm}$$

$$\sigma_{CD} = \frac{F_{CD}}{A} = \frac{4 \times 7 \times 10^3}{\pi (10 \times 10^{-3})^2} = 89 \text{ MPa} < [\sigma]$$

$$\sigma_{\max} = \frac{M_{\max}}{W_z} = \frac{7 \times 10^3}{49 \times 10^{-6}} = 142.86 \text{ MPa} < [\sigma]$$

4.



5.

$$\sigma_{cr} = \frac{\pi^2 E}{\lambda^2} = 137.08 \text{ MPa}$$

工程力学模拟试卷（十四）答案

一、 CBD CD

二、

1.

(1) AC

$$\dot{a} F_x = 0, F_{Cx} + F = 0$$

$$\dot{a} F_y = 0, F_A + F_{Cy} = 0$$

$$\dot{a} M_C = 0, -F_A' \cdot 3l + F' \cdot 4l = 0$$

$$F_{Cx} = -3ql$$

$$F_{Cy} = -4ql$$

$$F_A = 4ql$$

(2) CDB

$$\sum F_x = 0, -F_{Cx} + F_{Bx} = 0$$

$$\sum F_y = 0, -F_{Cy} + F_D - 6ql + F_{By} = 0$$

$$\sum M_B = 0, F_{Cx} \cdot 8l + F_{Cy} \cdot 9l - F_D \cdot 6l + 18ql^2 + M = 0$$

$$F_{Bx} = -3ql$$

$$F_{By} = 7ql$$

$$F_D = -5ql$$

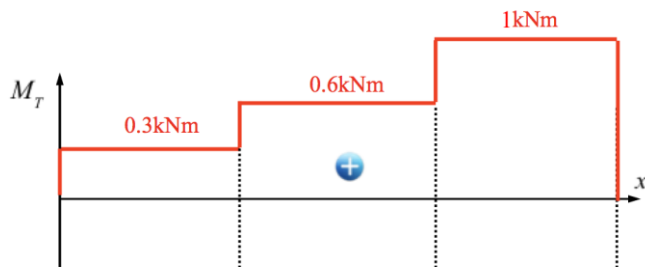
验证：整体

$$\sum F_y = F_A + F_D - 6ql + F_{Bx} = 0$$

$$\sum M_A = -F_D \cdot 4l + F_D \cdot 6l - 54ql^2 + M + F_{By} \cdot 12l = 0$$

$$\sum M_D = -F_A \cdot 6l + F_D \cdot 4l - 18ql^2 + M + F_{Bx} \cdot 8l + F_{By} \cdot 6l = 0$$

2.



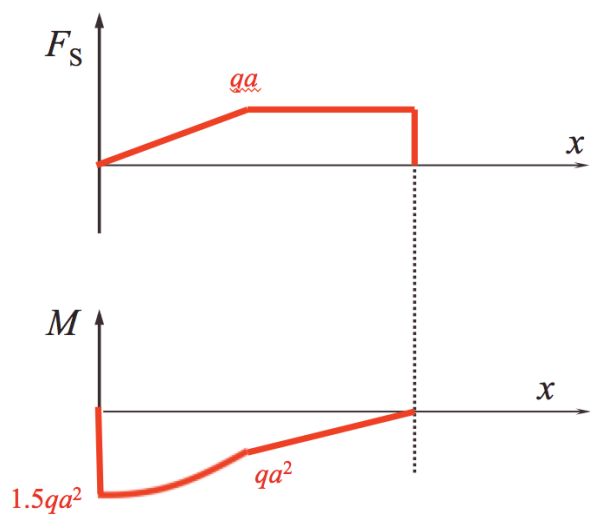
$$M_{T,\max} = 1 \text{ kNm}$$

$$\tau_{\max} = \frac{M_{T,\max}}{W_p}, W_p = \frac{\pi d^3}{16}$$

$$d \geq \sqrt[3]{\frac{16 M_{T,\max}}{\pi [\tau]}} = \sqrt[3]{\frac{16 \times 10^3}{\pi 30 \times 10^{-6}}} = 55.37 \text{ mm}$$

$$d = 56 \text{ mm}$$

3.



4.

$$(1) M_{\max} = 0.2F$$

(2)

$$\sigma_{\max} = \frac{M_{\max}}{W_z}, W_z = \frac{bh^2}{6}$$

$$\sigma_{\max} = \frac{6M_{\max}}{bh^2} = \frac{6 \times 0.2 \times 4 \times 10^3}{0.02 \times 0.04^2} = 150 \text{ MPa} < [\sigma]$$

5.

$$(1) F_{CD} = \frac{4F}{\sqrt{3}}$$

(2)

$$\sigma_{CD} = \frac{F_{CD}}{A} = \frac{4F_{CD}}{\pi d^2} \leq [\sigma]$$

$$d \geq \sqrt[2]{\frac{4F_{CD}}{\pi[\sigma]}} = \sqrt[2]{\frac{16 \times 500 \times 10^3}{\pi \sqrt{3} \times 160 \times 10^6}} = \sqrt[2]{\frac{5}{\pi \sqrt{3} \times 10 \times 10}} = 95.8 \text{ mm}$$

工程力学模拟试卷（十五）答案

一、 DAACA

二、

1.

(1)

$$F_C = \frac{M}{CD \sin 60} = 2\sqrt{3}qa$$

(2)

$$\begin{aligned} \sum F_x = 0, F_A \cos 60 + F_C + F_{Bx} = 0 \end{aligned}$$

$$\sum M_A = 0, -F_C a \sin 60 + M - 1.5qa^2 + F_{By} 2a = 0$$

$$\sum M_B = 0, -F_A \sin 60 \cdot 2a - F_C a \sin 60 + M + 0.5qa^2 = 0$$

$$F_{Bx} = -\sqrt{3}qa \left(\frac{25}{12} \right)$$

$$F_{By} = \frac{3}{4}qa$$

$$F_A = \frac{qa}{2\sqrt{3}}$$

2.

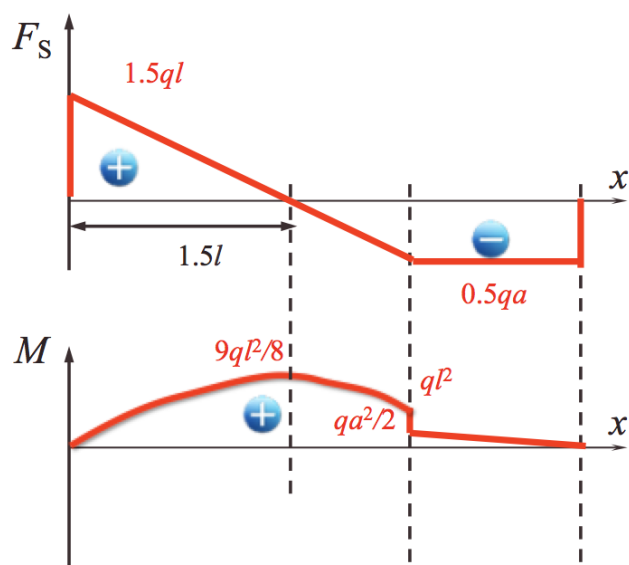
$$(1) M_{T,AB} = 3\text{kNm}, M_{T,BC} = 1\text{kNm}$$

(2)

$$\tau_{AB,\max} = \frac{M_{T,AB}}{W_{p,AB}}, W_{p,AB} = \frac{\pi d_1^3}{16} (1 - \alpha^4), \quad \tau_{AB,\max} = \frac{16M_{T,AB}}{\pi d_1^3 (1 - \alpha^4)} = 75.45\text{MPa} < [\tau]$$

$$\tau_{BC,\max} = \frac{M_{T,BC}}{W_{p,BC}}, W_{p,BC} = \frac{\pi d_3^3}{16}, \quad \tau_{BC,\max} = \frac{16M_{T,BC}}{\pi d_3^3} = \frac{16 \times 10^3}{\pi (4)^3} = 79.58\text{MPa} < [\tau]$$

3.



4.

$$(1) M_B = -M_0$$

$$(2) \sigma_{t_{\max}} = \frac{|M_B|}{I} \cdot 140 \cdot 10^{-3} = \frac{25 \cdot 10^3}{102 \cdot 10^6 \cdot 10^{-12}} \cdot 140 \cdot 10^{-3} = 34.3 \text{ MPa}$$

5.

$$(1) F_{CD} = \frac{3}{2} F$$

(2)

$$\lambda_{\max} = \frac{\sqrt{12}l}{b} = \frac{\sqrt{12} \times 1000}{20} = 173.2$$

$$F_{cr} = \frac{\pi^2 E}{\lambda^2} A = 39.4 \text{ kN}$$

(3)

$$F \leq \frac{F_{cr}}{n_{st}} = 8.77 \text{ kN}$$