

**МНННСТЕРСТВО ОБРАЗОБАНА И НАУКИ РОСНННСКОИ
ОЕ^ЕРАТТНН**

**ОНННА^ ОЕ^ЕРА^bНОrО rОСУ^АРСТВЕННОrО ВМ^ЕТНОrО
ОбРАЗОБАТЕ^bНОrО УМРЕА/IEmm BbICmErO ОБРАЗОБАНА
«НА^ОНА.НбНбИИ НСС^Е^ОБАТЕ^bСКНН УННВЕРЧТЕТ «М^Н»
В r. СМО^ЕНСКЕ**

Ка^егра «TexHonorHneckKHx MamHH И
оборуроБаННА»

nOtfCHHTEnEHAH 3AnHCKA
K KypcoBon pa6oTe no gn^HnnHHe «npHKnagHaa MexaHHKa»
Ha TeMy: «PacneTbi Ha nponocTb MexaHHneckKHx
KoHcTpy^HH»

HaHpaBneHHe noгpOTOBKH: 13.03.02. ^eKTpo^ep^eTHKa И
3.neKTpoTexHHKa npo^Hnb noгpOTOBKH: По6oTOTexHHKa B
3^eKTpoMexaHHHeckKHx cHCTeMax

r nynna PT-20 АВТОР паОотби

АТaKHmneB ^.А.

PyKoBогHTenb
паОотби

(nogнucb)



ЕорncоВ А.В.

ПаОотa гоnурnpHa K 3арн,HTe 27.12.21

(nogнucb)



ЕорncоВ А.В.

ПаОотa 3a^H^eHa 28.12.21

(гаТа)

(nogнucb)

О^HKa xopomo

(гаТа)

^neHbi
KOMHCCHH

KoHHHHa
.H.B.

(nogнucb)



ЕорncоВ А.В.

(nogнucb)

**OH[^]HA[^] OE[^]EPA[^]bHOrO rOCY[^]APCTBEHHOrO BM[^]ETHOrO
OBPA3OBATE[^]BHOrO YHPE[^]EHHfl BBICmErO OBPA3OBAHHH
«HA[^]HOHA.HbHBIIH HCC[^]E[^]OBATE[^]bCKHH YHHBEPCHTET «M[^]H»**

B r. CMO[^]EHCKE

Ka[^]egpa «TexHoaorHHeckHe MamHHbi H
HanpaBaeHne nogroTOBKH 13.03.02060ayKOBHep[^]eTHKa H[^].aeKTopTexHHKa»

3A[^]AHHE

Ha KypcoBym pa6oTy CTygeHTa ATaKH^{ue}Ba. [^].A. (rpyнна PT-20)

TeMa: PacHTbi Ha npoHHOCTT MexaHHeckHX KOHcipy[^]HH Cogep[^]aHHe
pacHeTHo-noacHHTeabHoH 3anCKH:

1. BBegeHHe.
2. 3agana N°1: nocTpoHTb ^{^^}mpbl npogoabHbix cna, Hanpa^eHHH H nepememyHHH nonepenHMx ceneHHH 6pyca.
3. 3agana N°2: nocTpoHTb ^{^^}mpy KacaTeabHbix Hanpa^eHHH.
4. 3agana N°3: nocTpoHTb ^{^^}mpy nonepenHbix CHH H H3py6a.^{mm}Hx MOMeHTOB.
5. 3agana N°4: nogo6paTb nonepenHoe ceneHHe 6anKH.
6. 3agana N°5: nog6op gnaMeTpa Bana npH H3pH6e c KpyneHHem.
7. 3aKamneHHe.

nepeneHb rpa[^]nneckKoro MaTepnana:

1. 3nmpbi K 3agane N°1
2. 3nmpbi K 3agane N°2
3. 3nmpbi K 3agane N°3
4. 3nmpbi K 3agane N°4
5. 3nmpbi K 3agane N°5 [^]ara Bbigann 3agaHHa: 8.09.2021

Eopncob A.B.

3agaHHe npHHaaa K BbmoaHeHHM:

ATaKH^{me}B [^].A.

CTygeHT

[^]ara 3amHTbi Kypcobon pa6oTbi 28.12.2021

CMoaeHCK
2021

AHHOTaUHH

В КypcoBOH пa6oTe пaccMarpнBaroTca MexaHнecKне KOHCTpy^nn, гна KOTopbix BbmonHamTca нпoHHOCTHtie пacneTbi npн cneyMpnux Bngax ге\$opMa^HH: пacTa^eHHH (c^apnn), KпыeHHH, rornde, rornde c KпыeHneM.

ПacHeTHO-noacHHTenbHaa 3annKa KypcoBOH пadoTbi COCTOHT H3 28 cpaHH^ 5 npнno^eHHH, BKamnammux пncyHKH K 3aгanaM, 7 nnTeparypHbix HCTOHHHKOB. KnmneBbie cnoBa: danKa, ^^ropa, pacpa^eHne, KпыeHne, rornd, npouHOCTb.

Annotation

The coursework discusses mechanical structures for which toughness calculations are performed assuming that the following types of deformation occur: tension (compression), torsion, bending, bending and torsion.

The explanatory note on the calculations of this coursework comprises 28 pages, 5 applications, which include drawings for the tasks, and 7 literary sources.

Keywords: beam, diagram, tension, torsion, bending, strength.

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И.М.	flum	М доКыМ.	nodnucb	Uflma
Параб.		AmaKumuee		
		ff.A.		
поеер.		Eopncoe A.B.		

18. КР. 13. 03. 02. нМ. н3

Pacve Tbi Ha npo HHOcTb
MexaHUHeCKux
KOHCTpyкц

<i>flum.</i>	<i>flucm</i>	<i>flucmoe</i>
	4	
®UJIUCIJI 01 'HO V «HHY «M^H» e e. CMomHCKe		

BBegeHue

^aHHaa pacerao-rpa^uaecKaa, KypcoBaa pa6oTa aBaaeTca uToroM caMocToaTeabHoro u3yaeHua yae6Hbix MaTepuaaob, noayaeHHbix npy KoHTaKTHoa pa6oTe c npenoBaTeaeM, u pemeHua 3agaa no gu^unauHe «npyKaagHaa MexaHHKa» Ha TeMy «PacaeT Ha npoaHocTb MexaHuaecKux KOHCTpy^HH».

^abro BbmoaHeHua pa6oTbi aBaaeTca ocBoeHue MeToroB pacaeTa Ha npoaHocTb KOHCTpy^HH npy pa3Hbix cayaaax ge\$opMa^HH: pacTa^eHHy(c^aTHy), KpyaeHyy, u3py6e, u3py6e c KpyaeHueM. B xoge BbmoaHeHua pacaeTHo-rpa^uaecKoa pa6oTbi, 6biau BbmoaHeHbi pacaeTbi, gaa nocpoeHua ^^rop BHypeHHux cuaoBbix ^aKTopoB gaa npyBegeHHbix Bbime BugoB ge\$opMa^HH. A TaK^e cgeaHbi aepTe^y, Heo6xogymbie gaa pacaeTOB, B KoTopbix npegcTaBaeHbi ^^ropbi gaa Ka^goro Buga ge^opMaguu. Ebiau onpegeaeHbi npoaHocTHbie xapaKTepycTUKy KoHcTpy^ua, nogo6paHbi onTHMaabHbie ceaeHua u cgeaH aHaay3 npoaHocry KoHcTpy^ua.

KawaeBbie caoBa npn BbmoaHeHyy KypcoBoa pa6oTbi:

EaaKa - 6puc, raxogamyaca nog geacTBueM rоруSarorngx ycuaua, B aacTHocTy, nonepeaHbix cua, MoMeHToB u pacnpegeaeHHbix Harpy3oK.

3npa - oco6in Bug rpa^yKa, noKa3ibiBaromyH pacnpegeaeHue BeauauHbi Harpy3Ky Ha o6eKT.

PacTa^eHue - Bug npogoabHaa ge\$opMa^HH cTep^Ha uau 6puca, Bo3HHKaroM,uH B TOM cayaae, ecau Harpy3Ka K HeMy npyKaagbiBaeTca no ero npogoabHaa ocu (paBHogencTBymaa cua, Bo3gencTBymux Ha Hero, HopMaabHa nonepeaHoMy ceaeHuW crep^Ha u npoxoyT aepe3 ero ^mp Macc).

KpyaeHue - ogyH u3 BugoB ge^opMaguu Teaa. Bo3HHKaeT B TOM cayaae, ecau Harpy3Ka npyKaagbiBaeTca K Teay B Buge napbi cua (MoMeHTa) B ero nonepeaHaa naocKocTy. npy ^TOM B nonepeaHbix ceaeHuax Teaa Bo3HHKaeT ToabKo ogyH BHyTpeHHHH cuaoBoa ^aKTop — KpyamuH MoMeHT.

H3py6 - TaKoa Bug ge\$opMa^HH, Korga nog geacTBueM BHeMHux cua B nonepeaHbix ceaeHuax cTep^Ha(6puca) Bo3HHKaeT rоруSaromua MoMeHT.

npoaHocTb - ^TO cnocoHocTb KoHcTpy^uu Bbigep^HbaTb 3agaHHyw Harpy3Ky, He pa3pumaacb.

						<i>flucm</i>
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<i>H.3M.flucm</i>	<i>NB doKyM.</i>	<i>nodnucb</i>	<i>ffama</i>			5

Задана №1

а) Ho:

$$a = 0; b = 9; B =$$

$$E = 210^5 \text{ Mna}$$

$$[G] = 160 \text{ Mna} = 1,6 \cdot 10^8 \text{ na}$$

СхеМа

$$P_1 = 17 \text{ KH}, P_2 = 19 \text{ KH};$$

$$A_1 = 2,0 \text{ CM}^I, A_2 = 2,9 \text{ CM}^I, A_3 = 2,7$$

$$\text{CM}^I; a = 0,8 \text{ M}, b = 0,7 \text{ M}, c = 0,6 \text{ M}.$$

РешеНие

ныHKТ 1: нодТроеНие \wedge ропИ нпогонтИтix CHH

$$\text{YnacTOK 1 AB: } N_{AB} = P_1 = 17 \text{ KH}$$

$$\text{YnacTOK 2 BC: } N_{BC} = P_2 = 19$$

$$\text{YnacTOK 3 CD: } N_{CD} = P_1 - P_2 = 17 \text{ KH} - 19 \text{ KH} = -2 \text{ KH}$$

$$\text{YnacTOK 4 DE: } N_{DE} = P_1 - P_2 = 17 \text{ KH} - 19 \text{ KH} = -2 \text{ KH}$$

ныHKТ 2: нодТроеНие \wedge wpM HopMantHbix Hanpa^eHHH

$$\text{YnacTOK 1 AB: } G_{AB} = \frac{N_{AB}}{A_{AB}} = \frac{1710^3}{2,0 \cdot 10^{-4}} = 8,5 \cdot 10^6 \text{ na} = 85 \text{ Mna}$$

$$\text{YnacTOK 2 BC: } G_{BC} = \frac{N_{BC}}{A_{BC}} = \frac{1710^3}{2,9 \cdot 10^{-4}} = 5,8640 \cdot 10^6 \text{ na} = 58,6 \text{ Mna}$$

$$\text{YnacTOK 3 CD: } G_{CD} = \frac{N_{CD}}{A_{CD}} = \frac{-2 \cdot 10^3}{2,9 \cdot 10^{-4}} = -6,9 \cdot 10^6 \text{ na} = -6,9 \text{ Mna}$$

$$\text{YnacTOK 4 DE: } G_{DE} = \frac{N_{DE}}{A_{DE}} = \frac{-2 \cdot 10^3}{2,7 \cdot 10^{-4}} = -7,4 \cdot 10^6 \text{ na} = -7,4 \text{ Mna}$$

ныHKТ 3: нодТроеНие \wedge ропИ непеMepн,eHHH nonepenHbix ceneHHH бpыca Al,.

$$U_{\xi} = r^I_i$$

$$M_E = 0;$$

$$\text{YnacTOK 4 DE: } U_{D+E} = A_M \cdot 4 = 0 + 2,2240 \cdot 10^{-5} = 2,2240 \cdot 10^{-5} \text{ M}$$

$$\text{YnacTOK 3 CD: } A_{C+D} = A_C + A_D = -2,2240 \cdot 10^{-5} + 3,427540 \cdot 10^{-5} = 1,203540 \cdot 10^{-5} \text{ M}$$

H.3M.	Guam	N doKyM.	nodnucb	ffama

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YnacTOK 2 BC: $M_{BC} = M_C + \frac{M_B}{2 \cdot 10^5} = -3,4275 \cdot 10^{15} + \frac{58,6 \cdot 10^{15}}{2} = 6,840^{15} M$

YnacTOK 1 AB: $bd_{AB} = M_B + \frac{M_A}{2 \cdot 10^5} = 6,840^{15} + \frac{85 \cdot 10^{15}}{2} = 40,8 \cdot 10^{15} M$

Bbreog: TaK KaK $|6_{\max}| < [5]^{85} < 160$, TO cpeп^eHt Btигeп^HT npнno^eHHbie Harpy3KH.

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						7
<i>H.3M.flucm</i>	<i>N doKyM.</i>	<i>nodnucb</i>	<i>ffama</i>			

K CTantHOMy Baay nprno^eHbi Tpn H3BecTHbix MOMeHTa: T_1, T_2, T_3 . Mogyab cgbHra $G = 0,8 \cdot 10^5$ Mna

ТребыеТса:

- 1) CgeaaTb nepTe^; Baaa no 3agaHHbiM pa3MepaM **B** MacmTa6e;
- 2) CocTaBHTt gaa Ka^goro ynacTKa Baaa **B** ceneHHH aHanHTHHeckHe Bbipa«:eHHa H3MeHeHHa KpyTarn,Hx MOMeHTOB T, KacaTenbHbix Hanpa^eHHH **T H** ypaOB 3aKpyHHBaHHa 9;
- 3) nocTpoHTb ^^wpM npogonbHbix ycnHHH T, KacaTenbHbix Hanpa^eHHH **T H** ypaOB 3aKpyHHBaHHa 9;
- 4) CgeaaTb BbiBog o nponocpa cTep^Ha nprn **[T]=50** Mna

HcxogHbie

gaHHbie	T2,	T3,	a,	b,	c,	d1,	d2,	d3,	[T],	G, Mna
KH- M	KH> M	KH> M	M M	MM	M M	MM	MM	MM	Mna	
0,19	0,17	0,29	600	500	700	60	50	30	50	$0,8 \cdot 10^5$

CxeMa no pncyHKy: 7 PemeHHe:

1) CocTaBHM gaa Ka^goro ynacraa Baaa aHanHTHHeckHe Bbipa^mna H3MeHeHHa KpyTam.Hx MoMeHTOB T H nocTpoHM ^^ropy Kpyramux MoMeHTOB.

$$M_z = T_3 = 0,29 \text{ KH} \cdot \text{M};$$

$$M^{\wedge} = T_3 - T_2 = 0,29 - 0,17 = 0,12 \text{ KH} \cdot \text{M};$$

$$M_z = T_3 - T_2 = 0,12 \text{ KH} \cdot \text{M};$$

M/CocTaBHM Taa Ka^goro ynacraa Baaa aHanHTHHeckHe Bbipa^mna H3MeHeHHa KacaTenbHbix Hanpa^eHHH **T H** nocTpoHM ^^ropy KacaTenbHbix Hanpa^eHHH.

$$W_{pi} = \frac{M}{\sigma \cdot x_i}$$

rge x_i - KacaTeabHoe Hanpa^eHHe Ha ynacrae i ;

M - KpyTamHH MoMeHT Ha ynacrae i ;

W_{pi} - MoMeHT conoTHBneHHa ceneHHa ynacTKa i , KoTopoe onpegeaaeTca

$$W_{pi} = \frac{B M_{pa}^{\wedge} d_i^3}{16 \cdot \sigma} = 0,2 d_i^3$$

rge d_i - gnaMeTp ceneHHa ynacraa i ;

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<i>H.3M.flucm</i>	<i>NB doKyM.</i>	<i>nodnucb</i>	<i>ffama</i>			8

$$\begin{aligned}
& M, \quad 0,29 \cdot 10^3 \\
^1AB - W_{PR} & \quad 0,2 - (3 \cdot 10^{-2})^2 \quad 0,0537 \cdot 10^9 \text{ na} - 53,7 \text{ Mna}; \\
& M, B \quad j^3 \cdot 0,12 \cdot 10^3 \\
^xBC W_{PC} & \quad 0,2 - (5 \cdot 10^{-2})^2 \cdot j^3 \quad 0,0048 \cdot 10^9 \text{ na} - 4,8 \text{ Mna}; \\
& M, B \quad 0,12 \cdot 10^3 \cdot 0,2 \\
^xCD W_{PD} & \quad -(6 \cdot 10^{-2})^2 \cdot j^3 \quad 0,0028 \cdot 10^9 \text{ na} - 2,8 \text{ Mna}; \\
& M, C \quad 0,31 \cdot 10^3 \\
^LD W_{PDE} & \quad 0,2 - (6 \cdot 10^{-2})^2 \quad 0,0072 \cdot 10^9 \text{ na} - 7,2 \text{ Mna}. \\
E & \quad j^3
\end{aligned}$$

3) CocTaBHM gaa Ka^goro ynacraa Baaa aHaaHTHneckKHe BbipmeHHa yraoB 3aKpyHHBaHHa Θ H nocpoHM ^^ropy yraoB 3aKpyHHBaHHa. Yroa 3aKpyHHBaHHa onpegeaaeTca no ^opMyae:

$$Mz_i - li \ 9 \ -i-,$$

$$^G - Jp_i$$

rge l_i - gaHHa ynacraa i, M;

G - Mogyat cgBHra, Mna;

$J_p i$ - MOMeHT HHep^HH yaacraa i, KoTopaa onpegeaaeTca no ^opMyae: $J_p i -$

$$0,1d,^4;$$

$\Theta_E - O$ (T.K. ^TOT Kpan

$$3aKpenaeH);$$

$$9D - 9E + 9ED - 0 + \frac{M_{ZED} \cdot 0,31 \cdot 10^3 - 0,18}{ED \cdot PED} \cdot 0,8 \cdot 10^{11} - 0,1 - (6 \cdot 10^{-2})^2 \cdot j^4 \cdot 0,54 \cdot 10^3 \text{ pag};$$

$$9_C - 9_D + 9_{DC} - 0,54 \cdot 10^{-3} + \frac{M_{ZED} \cdot 0,12 \cdot 10^3 - 0,42}{G - J_P} \cdot 0,8 \cdot 10^{11} - 0,1 - (6 \cdot 10^{-2})^2 \cdot j^4$$

$$-1,03 \cdot 10^3 \text{ pag};$$

$$9_B - 9_C + 9_{CB} - 1,03 \cdot 10^{-3} + \frac{M_{ZED} \cdot 0,12 \cdot 10^3 \wedge 0,5}{G - J_P} \cdot 0,8 \cdot 10^{11} - 0,1 - (5 \cdot 10^{-2})^2$$

$$- 2,23 \cdot 10^3 \text{ pag};$$

$$9_A - 9_B + 9_{BA} - 2,23 \cdot 10^{-3} + \frac{M_{ZED} \cdot 0,29 \cdot 10^3 \wedge 0,7}{G - J_P} \cdot 0,8 \cdot 10^{11} - 0,1 - (3 \cdot 10^{-2})^2$$

$$- 33,53 \cdot 10^3 \text{ pag};$$

4) M3 ^^ropbl KacaTeatHoro Hanpa^eHHa MaKCHMaatHoe Hanpa^eHHe $x_{max} - x_{AB} - 53,7$, MMB;

npoBepHM npoHHocTt CTep^Ha npn gonycKaeMoM Hanpa^eHHH [x] - 50

Mna $x_{max} - 53,7 \text{ Mna} > [x] - 50 \text{ Mna};$

H.3M.flucm	NB doKyM.	nodnucb	ffama	

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fluc
m₉

Снегова TentHO, ycnobHe noHHoern He BbrnonHaeTca (cTep^eHt pa6oTaeT B ycnobHH nepepy3KH).

$$\% \quad \frac{\text{max} - \text{min}}{\text{max}} \cdot 100\% = \frac{50 - 53,7}{50} \cdot 100\% = 7,4\%$$

H.3M.	Rucm	NB doKyM.	nodnucb	ffama

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Ruc
m₀

Задача N°3

ночт роєнне \wedge роп ВHyтpeHHHx ycнaHH B cTapaecKH onпeгeaHMbix

6aaKax. тpeбyeтca:

1) Hаnнcaтb Bбpa«:eHHa noneпeaHoft cнaби Q_y H H3pH6apom,epo MOMeHTa M_x гaa

Ka^goro yaacTKa B o6^eM BHге;

2) ИocтpoHTb \wedge wpM noneпeHHOH cнaби Q_y H H3pH6apom,ero MOMeHTa

ИeкoгHbie гaHнбie:

M_x ; P, KH	M_y ; KH	a, M	b, M	c, M	d, M	q , T
10	19	1,0	2,9	2,7	1,0	7

CxeMa нo пncyHKy: 7 пeмeHHe:

1) OnпeгeaHM пea^HH onop. ^aa onпeгeaeHHa пea^HH cocTaBaaEM ypaBHeHHa cyMMM MoMeHToB Bcex cнa opaoHTeabHo ToaeK A H B.

$$\sum_{i=1}^n X M_{iA} = 0: P \cdot a + R_B \cdot (b + c) + m - q \cdot (c + d) \cdot \frac{c + b}{2} = 0;$$

$$- P \cdot a - m + q \cdot (c + d) \cdot (b + \frac{c+d}{2})$$

$$R_B = \frac{b + c}{2} = \frac{2,9 + 2,7}{2} = 2,8 \text{ KH};$$

$$R_A = \frac{P \cdot (a + b + c) + m + q \cdot (c + d) \cdot \frac{c + d}{2}}{b + c} = \frac{10 \cdot (1,0 + 2,9 + 2,7) + 19 + 7 \cdot (2,7 + 1,0) \cdot \frac{2,7 + 1,0}{2}}{2,9 + 2,7} = 19,11 \text{ KH.}$$

3HaK нapoc y пea^HH R_A H R_B нoKa3биBaeT, HTO HаnpaBaeHHe пea^HH бbiao Bби́paHo бepHo.

нpoBepKa нo ycaoBHW

пeHдeцпа: $R_A + R_B - q \cdot (c + d) = 0;$

$$19,11 + 16,79 - 7 \cdot (2,7 + 1,0) = 0;$$

$$0 = 0.$$

2) OnпeгeaHM noneпeaHbie cнaби Q_y H nocтpoHM \wedge ropy noneпeaHbix cнa.

нepBHH yqacTOK:

$$0 < z_1 < a = 1,0 \text{ M } Q_y = -P = -10 \text{ KH};$$

H.3M.	aucm	NB doKyM.	nodnuch	ffama

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БТОРОН ыгачТОК:

$$0 < z_2 < b = 2,9 \text{ M } Q_{Y2} = -P + R_A = -10 + 19,11 = 9,11 \text{ KH};$$

ТреТНН ыгачТОК:

$$0 < z_3 < d = 1,0 \text{ M } Q_{Y3} = q \cdot z_3;$$

$$\text{npu } z_3 = 0: Q_{Y3} = 0 \text{ KH};$$

$$\text{npu } z_3 = d = 1,0 \text{ M} : Q_{Y3} = q \cdot z_3 = 7 \cdot 1,0 = 7 \text{ KH}.$$

РеТБепТНН ыгачТОК:

$$0 < z_4 < c = 2,7 \text{ M } Q_{Y4} = -R_B + q \cdot (d + z_4);$$

$$\text{npu } z_4 = 0: Q_{Y4} = -R_B + q \cdot d = -16,79 + 7 \cdot 1,0 = -9,79 \text{ KH};$$

$$\text{npu } z_4 = c = 2,7 \text{ M} : Q_{Y4} = -R_B + q \cdot (d + z_4) = -16,79 + 7 \cdot (1,0 + 2,7) = 9,11 \text{ KH}.$$

3) OnpegenHM roruGammue MOMeHTti M_x u nocTpouM ^{^^}mpy H3rH6a.mmHx

MOMeHTOB. непБНН ыгачТОК:

$$0 < z_1 < a = 1,0 \text{ M } M_{X1} = -P \cdot z_1;$$

$$\text{npn } z_1 = 0: M_{X1} = 0 \text{ KH} \cdot \text{M};$$

$$\text{npn } z_1 = 1,0: M_{X1} = -10 \cdot 1,0 = -10 \text{ KH} \cdot \text{M};$$

БТОРОН ыгачТОК:

$$0 < z_2 < b = 2,9 \text{ M } M_{X2} = -P \cdot (a + z_2) + R_A \cdot z_2; \text{ npn } z_2 = 0: M_{X2} = -P \cdot a = -10 \text{ KH} \cdot \text{M};$$

$$\text{npu } z_2 = b = 2,9 \text{ M} : M_{X2} = -P \cdot (a + z_2) + R_A \cdot z_2 = -10 \cdot (1,0 + 2,9) + 19,11 \cdot 2,9 = 16,42 \text{ KH} \cdot \text{M};$$

ТреТНН ыгачТОК:

z

$$0 < z_3 < d = 1,0 \text{ M } M_{X3} = m - q \cdot z_3; \text{ npn } z_3 = 0: M_{X3} = 19 \text{ KH} \cdot \text{M};$$

7 1 0 M РеТБепТНН ыгачТОК:

$$\text{npn } z_4 = c = 2,7 \text{ M} : M_{X4} = m + R_B \cdot z_4 - q \cdot (z_4 + d) = 19 + 16,79 \cdot 2,7 - 7 \cdot (2,7 + 1,0) = 15,5 \text{ KH} \cdot \text{M};$$

$$\text{npu } z_4 = 0: M_{X4} = m - q \cdot d = 15,5 \text{ KH} \cdot \text{M};$$

$$\text{npH } z_4 = c = 2,7 \text{ M} : M_{X4} = m + R_B \cdot z_4 - q \cdot (z_4 + d) = \frac{19 + 16,79 \cdot 2,7 - 7 \cdot (2,7 + 1,0)}{2} = 15,5 \text{ KH} \cdot \text{M};$$

3nmpa 6ygeT aBnaTca napaGonofi BrnnyKnocTtm BBepx c MaKcuMyMOM B TogKe,

rge Q_{y4} = 0. HaHgeM ^Ty TogKy:

$$Q_{y4} = -R_B + q \cdot (d + z_4) = 0 \Rightarrow z_4 = \frac{R_B - q \cdot d}{q} = \frac{16,79 - 7 \cdot 1,0}{7} = 1,398 \text{ M};$$

H.3M.	ucm	NB doKyM.	nodnucb	ffama

ногсраВНМ $z_4 = 1,398$ М В аНанНТНнеКое урАВНННне гна Н3rH6arom,ero MOMEHTa
 Ha неТВепТОМ унаКТКе:

$$M_{x\max} = m + R_B \cdot 1,398 - 9 \cdot \frac{(1,398 + d)^2}{2} + 16,79 \cdot 1,398 - 7 \cdot \frac{(1,398 + 1,0)^2}{2}$$

= 22,34 КН ■
 М.

H.3M.	Rucm	NB doKyM.	nodnucb	ffama

18. KP. 13. 03. 02. nM. n3

3аgааа N4

^aa 3аgаHH0H GaaKu u3 3аgааu N 3 TpeGyeTca:

1. BbinepTHTb B MacmTa6e 3аgаHHoe ceaeHue GaaKu c yKa3aHueM aucaeHHbix 3HaneHHH pa3MepoB. OnpeгeаyTb noa^eHue ^HTpa Ta^ecTu ceaeHua u BbiaucayTb MOMeHT HHep^HH ceaeHua OTHOCHTenbHO HeHTpanbHOH ocu.
2. nocTpoHTb ^^ropbl HopMaabHbix Hanpa^eHun, pacnpeгeaeHHbix no BbicoTe ceaeHua gaa ceaeHua c MaKcyMaabHbiM rоруGarornuM MOMeHTOM M_x , B3aTbiM H3 3аgааu N 3.
3. Hcноab3ya ^^ropbl rоруGarornux MOMeHTOB M_x , nocTpoeHHbix B 3аgаae N 3, onpeгeаyTb y3 pacaeTa Ha npoHHOCTb HOMep npo^uaa gBypaBпоBon (nпу 3HanHTeabHOH Hегоры3Ke nпуHaTb gaa GaaKu ceaeHue B Bугe mBeaepa) npoKpaOH GaaKu. Mareпyaa GaaKu - cTaab CT.3, [a] = 160 Mna.
4. nпу TOM ®:e 3HaneHHH gonyCKaeMoro Hanpa^mua onpeгeаyTb no ycaoBuro npoHHocTи Ha pa3MepHocTи HoMepHoro ceaeHua B cлoM $\sigma = 0,6$
 a) Kпыra гyameTpa d; $h = 1,9$
 B) nпаMoypoabHHKa c oTHomeHHem cToпoH b
5. CocTaBHTb TaGaH^y oraomeHun naom,agen yKa3aHHbix ceaeHun K naom,agu gBypaBпоBopo npo^uaa.

HcxoйHbie gaHHbe:

[a], Mna	$M_{xmax} \cdot KH \cdot M$	B, MM	C, MM
160	22,34	22	26

HoMep ceaeHua: 7

1) OnpeгeаyM ^HTp Ta^ecra oTHocuTeabHo HeHTpaabHon ocu Ox:

$$y_c = \frac{\sum A_i \cdot y_{Ci}}{\sum A_i}$$

rge A_i - naom, agb i - Toro ceaeHHa, MM^2 ;

y_c - pacctoаHHeoT OCH Ox go i - Toro ^npa Ta^ecra, MM.

$$y_c = \frac{A_1 \cdot y_{C1} + A_2 \cdot y_{C2} + A_3 \cdot y_{C3}}{A_1 + A_2 + A_3}$$

rge $A_1 = B \cdot 4C = 22 \cdot 4 \cdot 26 = 2288 \text{ MM}^2$;

$$A_2 = 3B \cdot 2C = 3 \cdot 22 \cdot 2 \cdot 26 = 3168$$

$$A_3 = \frac{3,14 \cdot (1,5 \cdot 22)^2}{4} = 855 \text{ MM}^2$$

$$x_{c1} = \frac{B^2}{2} = \frac{22^2}{2} = 11 \text{ M}$$

					<i>flucm</i>
					1A
H.3M. <i>flucm</i>	NB doKyM.	nodnucb	ffama		14

18. KP. 13. 03. 02. nM. n3

$$EC_9 - h B - 3B - 3 \cdot 22 \text{ y p} - f_{22} = 55$$

$$J_{C_2} \cdot 2 \cdot 2 \quad MM;$$

$$y^{\wedge} - EC_3 - 3B - 3 \cdot 22 - 66 \text{ MM};$$

$$y_c = \frac{A_1 \cdot y_c + A_2 \cdot y_c - A_3 \cdot y_c}{A_1 + A_2 + A_3} = \frac{2288 - 11 + 3168 \cdot 55 - 855 \cdot 66}{2288 + 3168 - 855} = 31,1 \text{ MM};$$

2) OnpegenHM MOMeHT HHep^HH ceneHHa OTHOCHTeatHo OCH
 Ox: 2 0 0
 $J_{x_c} = J_{x_{C1}} + A_1 \cdot a_1 + J_{x_{C2}} + A_2 \cdot a_2 + J_{x_{C3}} + A_3 \cdot a_3$,
 rge $a_1 = CC_1 - y_c - y_{Cj} = 31,1 - 11 = 20,1 \text{ MM}$; $a_2 = CC_2 - y_c - y_c = 55 - 31,1 = 23,9 \text{ MM}$; $a_3 = CC_3 - y_c - y_c = 66 - 31,1 = 34,9 \text{ MM}$;

$$K = \frac{b_1 \cdot h^3 \cdot 4C \cdot B^3 \cdot 4 \cdot 26 \cdot 22^3}{12} = 92282 \text{ MM} = 9,22 \text{ CM};$$

$$J_{x^2} = \frac{b_2 \cdot h^2 \cdot 2C \cdot (3B)^3}{12} = 1245816 \text{ MM}^4 = 124,58 \text{ CM}^4;$$

$$J_{x^2} = \frac{12}{12} \cdot (1 > 5B)^4 = 58184 \text{ MM}^4 = 5,82 \text{ CM}^4;$$

$$J_{x^2} = \frac{64}{12} + A_1 \cdot a_1 + J_{x^2} + A_3 \cdot a_3 = A \sim i \cdot 3 \cdot 3^2$$

$$= 9,23 + 22,88 \cdot 2,01^2 + 124,58 + 31,68 \cdot 2,39^2 - 5,82 - 8,55 \cdot 3,49^2 = 297,25 \text{ CM}^4.$$

3) HopManbHbie Hanpa^eHHa npn H3rn6e no BbicoTe ceneHHa pacnpegeaeHbi no HHHeHHOMy 3aKoHy H B HM6OH Towe ceneHHa onpegeaaroTca no ^opMyae:

$$a = \frac{M_{bzmax} \cdot y^{\wedge}}{J_{x_c}}$$

rge M_z - H3FH6arom,HH MOMCHT B ceneHHH, $KH \cdot M$;

$J - \text{MOMeHT HHep}^{\wedge}\text{HH CeHCHHfl OTHOCHTeabHO HeHTpaabHOH OCH, CM};$

y_i - pacToaHHe OT HeftTpaabHoft OCH go pacMaTpHB aeMOH TOHKH i,
 MM. CTPOHM ^^ropy HopMaabHbix Hanpa^eHHH gga onacHoro ceneHHa: y_D
 $= CD = 56,9 \text{ MM}$; $y_E = CE = 31,1 \text{ MM}$;

$$a_D^{Mzmax} = \frac{22,34 \cdot 40^3 \cdot 0,0311 \text{ A}}{J_c} = 297,25 \cdot 40^{-8} = 42,056 \text{ Mna};$$

$$a_E^{Mzmax} = \frac{22,34 \cdot 40^3 \cdot 0,0311 \text{ A}}{J_c} = 233,7 \text{ Mna. } 3$$

4) OnpegeaHM MoMeHT conpoTHBaeHHa ceneHHa W_x

$$6aaKH: \frac{M_{bzmax}}{a_{max} W_x} < [4$$

H.3M.flucm	NB doKyM.	nodnucb	ffama	

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$$W = \frac{M_{zmx}}{r \cdot i} = \frac{22,34 \cdot 10^3}{160 \cdot 10^6} = 139,6^3 \text{ CM}^3$$

Bbi6epeM coraachHoe OCT 8239-89 gByTaBp N18: $W_x = 143 \text{ CM}^3, A = 23,4 \text{ CM}^2$.

Hanna^eHHe B ^TOM cnynae 6ygeT paBHo:

$$a = \frac{M_{zmax}}{W_v} = \frac{22,34 \cdot 10^3}{143 \cdot 10^6} = 156,22 \text{ Mna.}$$

Hegorpy3 B ^TOM cnynae 6ygeT paBHo: $100\% = \frac{143}{156,22} \cdot 100\% = 2,4\% < 20\%$

[a] 160

ran

Hanp^eHHe B ^TOM cnynae 6ygeT paBHo: $a = \frac{M_{zmax}}{W_x} = \frac{22,34}{143} = 0,15622$

$$a = \frac{M_{zmax}}{W_x} = \frac{22,34}{143} = 0,15622$$

Hegorpy3 B ^TOM cnynae 6ygeT paBHo: $100\% = \frac{143}{172,97} \cdot 100\% = 8,1\% < 20\%$

paBHo: $100\% = \frac{143}{172,97} \cdot 100\% = 8,1\% < 20\%$ ^ y mBe^^ep Hegorpy300^bme,

[a] 160

neM y gByraBpa, ^o^TOMy 6epeM gByTaBp N18.

5) OnpegenHM nonepenHoe ceneHHe 6anKH B \$opMe Kpyra:

$$W = \frac{n \cdot d^3}{12} = \frac{32 - 22,34}{3,14 \cdot 160} = 112,5 \text{ MM};$$

$$\frac{n \cdot d^2}{4} = \frac{3,14 \cdot 11,25^2}{4} = 99,35 \text{ CM}^2;$$

OnpegenHM nonepenHoe ceneHHe 6anKH B \$opMe Konb:

$W = 0,87, \text{ T.e.}$

$$W = \frac{n \cdot d^3}{32} = \frac{32 - M_{zmax}}{3,14 \cdot 160 \cdot 10^6 \cdot 0,87} = 117,8 \text{ MM};$$

$$A = \frac{n \cdot d^2}{4} = \frac{0,87 \cdot 0,87 \cdot 3,14 \cdot 11,78^2}{4} = 94,77 \text{ CM}^2;$$

nog6epeM ceneHHe B \$opMe npaMoyronbHHKa (h = 1,9-b):

$$W = \frac{b \cdot h^2}{6} = \frac{0,6 \cdot b^3}{6} = 3 \frac{M_{zmax}}{160 \cdot 10^6 \cdot 0,6} = 61,5 \text{ MM};$$

$$h = 1,9 - b = 1,9 - 61,5 = 116,8$$

MM;

$A = b \cdot h = 6,15 \cdot 11,68 = 71,83 \text{ CM}^2$

H.3M.	Rucm	NB doKyM.	nodnucb	ffama

18. KP. 13. 03. 02. nM. n3

	ОопМа сенеННА	9 A _b CM	СпаВHeHHe A pe3yntTaTa A
1	#	99,35	4,24
2	©	94,77	4,05
3	W	71,83	3,07

						<i>flucm</i>
						18. KP. 13. 03. 02. nM. n3
<i>H.3M.flucm</i>	<i>M doKyM.</i>	<i>nodnuch</i>	<i>ffama</i>			<i>17</i> <i>1/</i>

CTanbHOH Ban BpamaeTcn c nOcTOnHHOH nactOTOH n u nepegaeT

MO^HOCTB N. Tpe6yeTca:

- 1) OnpegenuTb Harpy3Ku, geftcTByromue Ha Ban, nocTpoHTt ^^wpM KpyTnm, Hx MOMeHTOB, ^^ropbI u3ru6arom, ux MOMeHTOB B gByx nnocKocTnx (BepTUKanbHOH u rOpy3OHTanbHOH);
- 3) nogo6paTb guaMeTp Bana, ncnonb3yw TpeTbw Teopnro nponHocTH, ecnu H3BecTHO gonycKaeMoe HanpneHue [a] = 170 Mna

HcxonHbie

TeOpyH npOHOC TH	a, MM	b, MM	D ₁ , MM	D ₂ , MM	06 n, — MUH	[a], Mna
17	190	170	80	220	600	170

CxeMa no pycyHKy: N7 PemeHHe:

1) OnpegenuM BenunuHy Kpyrnm, ero MOMeHTa:

$$r_{r-A/r} = N \cdot nn$$

$$T_{Mkp} ; Q ;$$

$$Q 30$$

$$T = 30 \cdot N 30-17-10^3 = 271H \cdot M = 0,271 KH \cdot M;$$

$$nn = 3,14 \cdot 600$$

OnpegenuM BenunuHbi OKpy^Hbix u paguanbHbix can Ha 3y6naTbix Konecax:

$$T 2T$$

$$0,5D D$$

$$2T 2 \cdot 271$$

$$F = \frac{T}{D_1} = 6775 H = 6,775 KH;$$

$$F = \frac{T}{D_2} = 2464 H = 2,464 KH;$$

$$F_r = F_t \cdot tga = F_t \cdot 0,364, \text{ rge } a = 20^\circ$$

$$F_r = F_{ti} \cdot 0,364 = 6,775 \cdot 0,364 = 2,466 KH; F_{rz}$$

$$= F_{tz} \cdot 0,364 = 2,464 \cdot 0,364 = 0,897 KH;$$

2) nOcTpOHM ^^ropbI u3ru6a.roinux MOMeHTOB B nnocKocTnx xOz u yOz. ^nn ^TO^o HafigeM OnOpHbie pea^uu: a) PaccMOTpuM BepTUKanbHyro nnocKocTb:

$$\sum_{k=1}^n F_{yk} = 0; -R \quad A_y \quad R_{By} \quad F_{tr} + F_t = 0; \quad '2$$

$$\sum_{k=1}^n M = 0; -F \cdot 3a + F_2 \cdot a - R_{By} \cdot (3a + b) = 0;$$

H.3M.	flucm	NB doKyM.	nodnucb	ffama

$$R_{By} = -R_{By} - F_{rz} + F_{ti} = -1,049 - 0,897 + 6,775 = 4,829 \text{ KH};$$

$$R_{Ay} = -R_{By} - F_{rz} + F_{ti} = -1,049 - 0,897 + 6,775 = 4,829 \text{ KH};$$

npoBepKa:

$$\sum_{k=1}^n M = 0; F_1 \cdot b - F_2 \cdot a + R_{Ay} \cdot (3a + b) = 0;$$

$$0,897 \cdot 0,17 - 6,775 \cdot (2 \cdot 0,19 + 0,17) + 4,829 \cdot (3 \cdot 0,19 + 0,17) = 0;$$

6) PaccMOTpHM ropu3oHTaabHyro

naocKocTb:

$$\sum_{k=1}^n F_{xv} = 0; R_{Ax} + R_{Bx} - F_{t_1} = 0;$$

k=

$$\sum_{k=1}^n M_{y_A} = 0; F_{r_1} \cdot a + F_{t_2} \cdot 3a - R_{Bx} \cdot (3a + b) =$$

k=1

$$R_{Bx} = \frac{F_{r_1} \cdot a + F_{t_2} \cdot 3a - 2,466 \cdot 0,19 + 2,464 \cdot 3}{3a + b} = \frac{2,466 \cdot 0,19 + 2,464 \cdot 3}{3 \cdot 0,19 + 0,17} = 2,53 \text{ KH};$$

$$R_{Ax} = -R_{Bx} + F_{r_1} + F_{t_2} = -2,53 + 2,466 + 2,464 = 2,4 \text{ KH};$$

npoBepKa:

$$\sum_{k=1}^n M_{y_R} = 0; -F_{r_1} \cdot (2a + b) - F_{t_2} \cdot b + R_{Ax} \cdot (3a + b) = 0;$$

k=1

$$-2,466 \cdot (2 \cdot 0,19 + 0,17) - 2,464 \cdot 0,17 + 2,4 \cdot (3 \cdot 0,19 + 0,17) = 0;$$

nocTpoHM ^ropy H3ru6arom,Hx MOMeHTOB B BepTHKaabhofT

naocKocTb:

$$\sum_{k=1}^n M_{x_{AC}} < a =$$

$$M_{x_{AC}} = R_{Ay} \cdot Z_1 \cdot \text{npH } Z_3$$

$$= 0 \wedge M_{x_{AC}} = 0;$$

$$\text{npH } Z_3 = 190 \text{ MM} \wedge M = -4,829 \cdot 0,19 = -0,917 \text{ KH} \cdot \text{M};$$

II

$$\sum_{k=1}^n M_{y_3} < b = 170$$

$$M_{y_3} = R_{By} \cdot Z_3$$

$$\text{npH } Z_3 = 0 \wedge M_{x_{DDB}} = 0;$$

$$\text{npH } Z_3 = 170 \text{ MM} \wedge M = -1,049 \cdot 0,17 = -0,178 \text{ KH} \cdot \text{M};$$

nocTpoHM ^ropy H3ru6arom,Hx MoMeHTOB B roppoomaabhofT

naocKocTb:

$$\sum_{k=1}^n M_{x_{AC}} < a = 190$$

$$M_{x_{AC}} = R_{Ax} \cdot Z_1$$

H.3M.	ucm	NB doKyM.	nodnucb	ffama

18. KP. 13. 03. 02. nM. n3

fluc
n9

$$n p n z_3 = 0^{\wedge} = 0;$$

$$n p H z_3 = 190 \text{ MM}^{\wedge} M^{\wedge} = 2,4 \cdot 0,19 = 0,456 \text{ KH} \cdot \text{M};$$

II

$$0 < z_3 < b = 170 \text{ MM};$$

$$y_{DB} = \frac{J}{I_{DB}} \cdot z_3;$$

$$n p H z_3 = 0^{\wedge} M y_{DB} = 0;$$

$$n p H z_3 = 170 \text{ MM}^{\wedge} M^{\wedge} = 2,53 \cdot 0,17 = 0,43 \text{ KH} \cdot \text{M};$$

3) OnpegenHM gnaMeTp Bana ncxoga H3 ycnobHa obecneneHHa npoHHocTH

no TpeTten Teopnn npoHHocTH:

$$M_{KB} = J M_A + M_B + 0,75 T^2;$$

$$M_{3K} = J M_A + M_A + 0,75 T^2 = y l (-0,917)^2 + 0,456^2 + 0,75 \cdot 0,271^2 = 1,051 \text{ KH} \cdot \text{M}$$

$$M_{3K^B} = J M_B + M_B + 0,75 T^2 = y j (-0,178)^2 + 0,43^2 + 0,75 \cdot 0,271^2 = 0,521 \text{ KH} \cdot \text{M}$$

$$M_{3KB} = M_{3K} + M_{3K^B}$$

OnegoBaTentHo, pacneT Heo6xogHMo Becpa B ceneHHH A. 3KBHBanemHoe

Hanpa^eHHe n p n H3rn6e onpegeneTca B tupa^eHHeM:

$$a_{3K} = \frac{M_{3K}}{W_{BA}'} , \text{ rge } W_x = 0,1 d ;$$

$$d >^3 \frac{M_{3K}}{0,1 [B] A_v = 3} \frac{1,051 \cdot 3}{0,1 \cdot 170^6} 0,03954 \text{ M} = 39,54 \text{ MM};$$

OKpynraeM go GpHafiraero 6ontmero cTaHgapTHoro 3HaneHHH gnaMeTpa Bana:

$$d = 40 \text{ MM}.$$

H.3M.	Rucm	NB doKyM.	nodnucb	ffama

18. KP. 13. 03. 02. nM. n3

Ruc
m₂₀

3aKaroaeHH

В хогe BbmoaHeHHa KypcoBOH па6oTbi ноāyaeHM caegyrornue pe3yabTaTbi:

В 3аgaae 1 pacчHTaHa нpoHHocTb 3aKpenaeHHopo cTep^Ha, Haxogam,eroca nog гeHCTBHeM cна. нpoBepHB нpoHHocTb cTep^Ha нпн gонycKaeMOM Hanpa^eHHH, cgeaaH BMBog HTO, ycaoBHe нpoHHocTH BbmoaHaeTca.

В 3аgaae 2 pacчHTaHa нpoHHocTb 3aKpenaeHHopo cTaabHopo Baaa, Haxoga^eroca nog гeHCTBHeM Kпыра^nx MOMeHTOB. нпн нpoBegeHHH нpoBepKH Ha нpoHHocTb CTep^Ha нпн gонycKaeMOM Hanpa^eHHH cgeaaH BMBog HTO, Baa He Bbigep^HT Harpy3KH.

В 3аgaae 3 nocTpoeHM ^^ropbl nonepeHHbix cна H H3rH6arom,Hx MoMeHToB H onпegeaeHo onacHoe ceaeHHe.

В 3аgaae 4 gaa 3аgаHHon 6aaKH 3аgаan 3 onпegeaeHM нпн gонycKaeMoM Hanpa^eHHH no ycaoBHW нpoHHocTH па3MepM nonepeHHopo ceaeHHa В \$opMe gBypaBпа H mBeaaepa. H cgeaaHa cpaBHHTeabHaa Та6ан^ oraomeHHH naom,agen па3aHHHbix ceaeHHH, gaa onпegeaeHHa caMopo BbirogHopo нpo^naa ceaeHHa, KaKoBMM oKa3aaca mBeaaep.

В 3аgaae 5, ncноab3ya aeTBepTyw Teopнpo нpoHHocTH (Teopнpo HanSoabmnx KacaTeabHMx Hanpa^eHHH), MM pacчHTaan gнаMeTp Baaa no H3BecTHoMy gонycKaeMoMy Hanpa^eHHW [6] = 160 Mna, KOTOPMH 6bia oKпыраeH go San^anmero 6oabнpo. 2012aеHHa H3 cTaHgapTHopo paga pOCTa.

(gaTa) (nogнuch)

						<i>flucm</i>
					18. KP. 13. 03. 02. nM. n3	97
<i>H.3M.</i>	<i>flucm</i>	<i>NB doKyM.</i>	<i>nodнuch</i>	<i>ffama</i>		21

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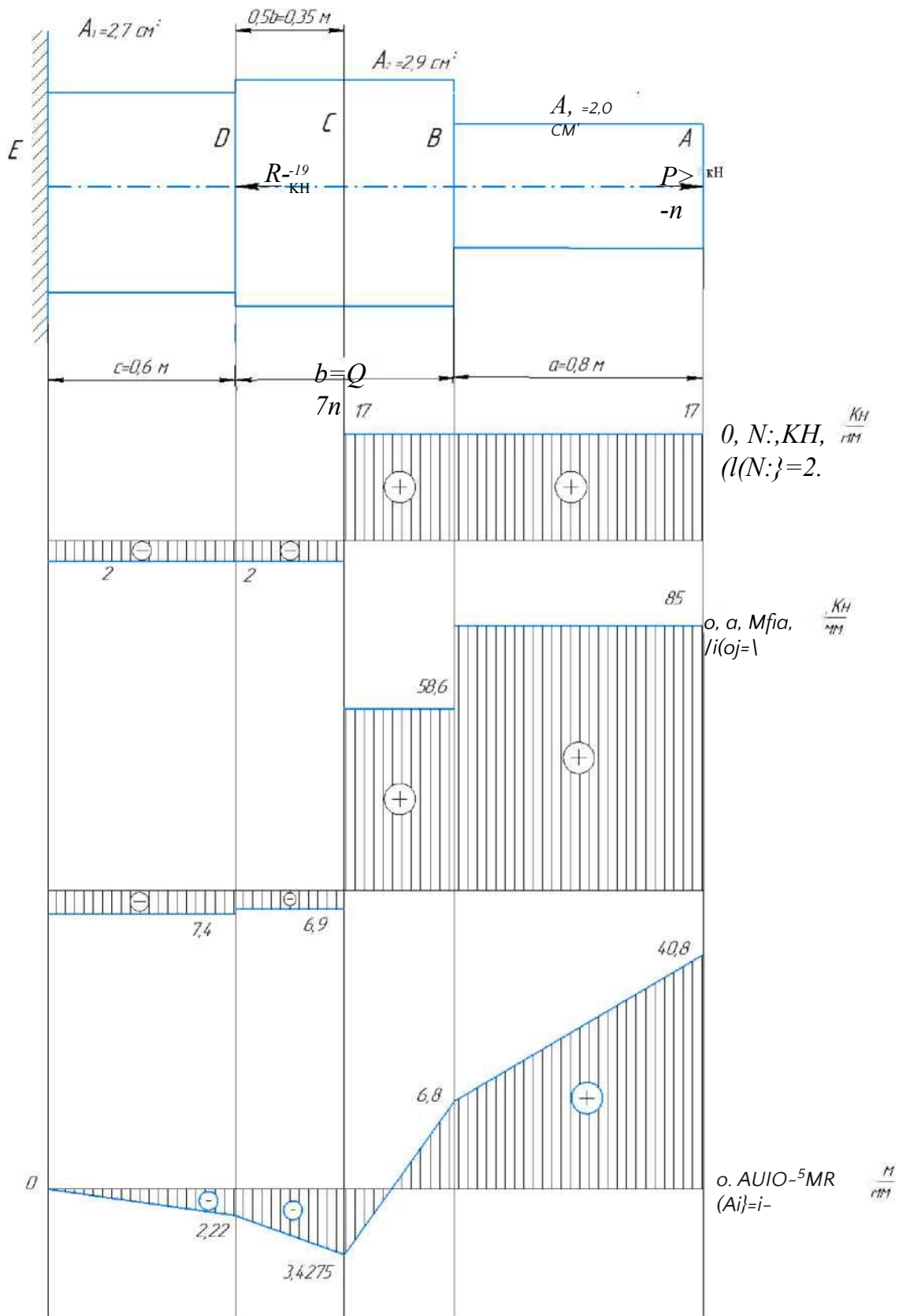
						<i>flucm</i>
					18. КР. 13. 03. 02. nM. n3	
<i>H.3M.</i>	<i>flucm</i>	<i>M doKyM.</i>	<i>nodnucb</i>	<i>ffama</i>		22

Приложения

					18. КР. 13. 03. 02. ПМ. ПЗ	Лист
Изм.	Лист	№ докум.	Подпись	Дата		23

npHno^eHHe 1

^epTe^; K 3agane N°1



H.3M.Rucm	M doKyM.	nodnuch	ffama	

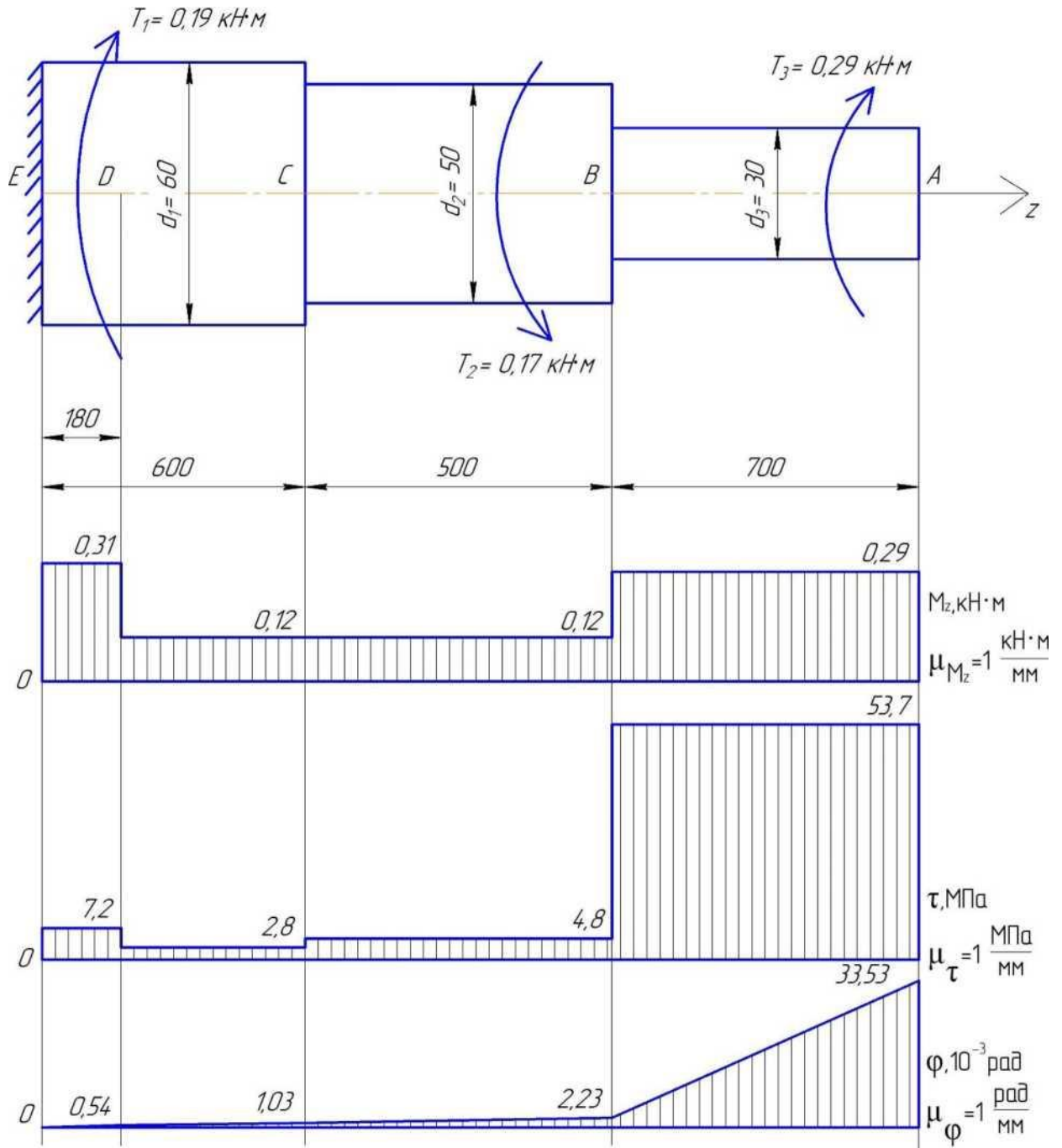
18. KP. 13. 03. 02. nM. n3

Ruc
m

npno^eHHe 2

^epTe^; K 3agane

N2

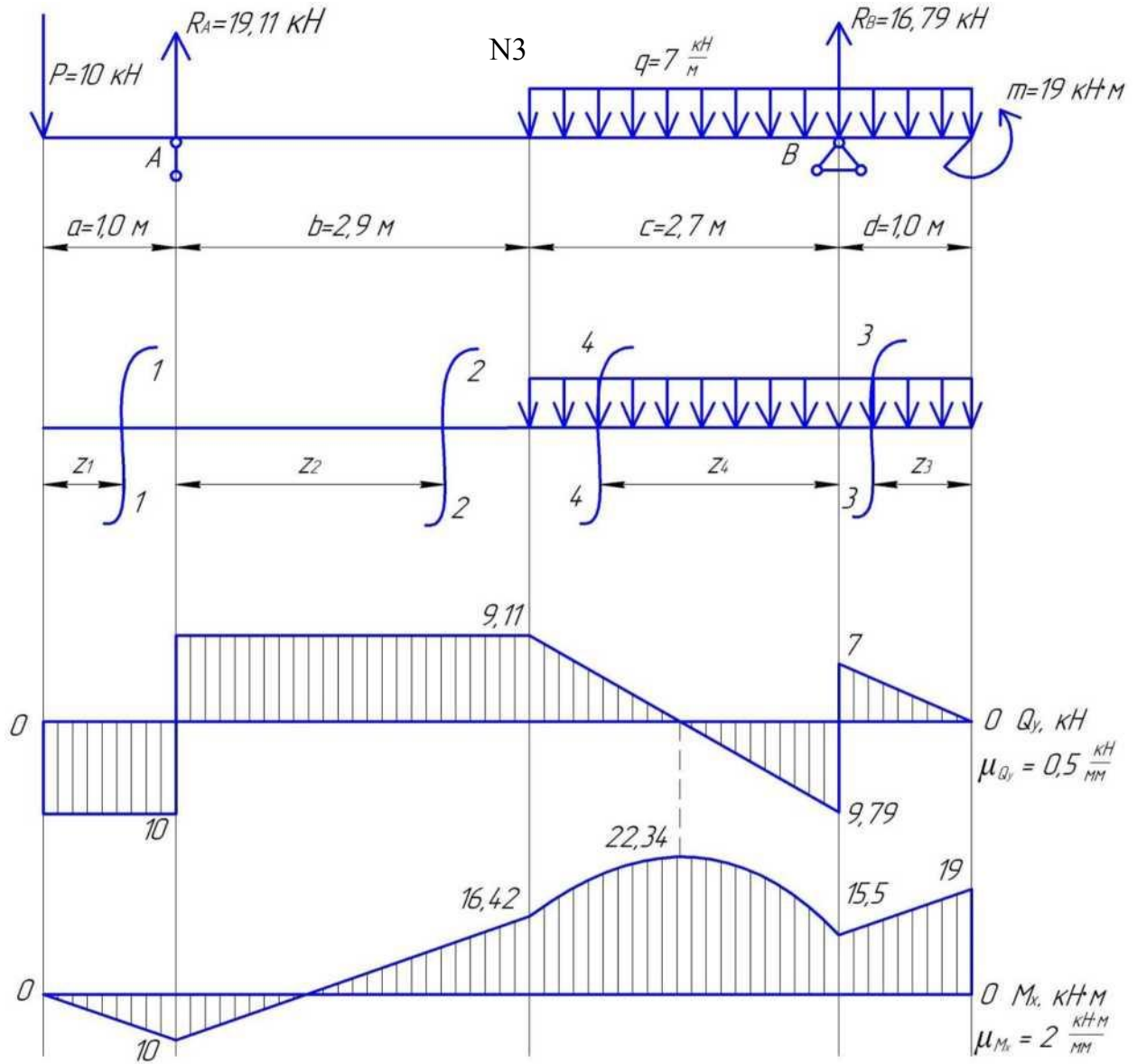


						<i>flucm</i>
						7S
H.3M.	<i>flucm</i>	M doKyM.	nodnucb	ffama		

18. KP. 13. 03. 02. nM. n3

npno^eHHe 3

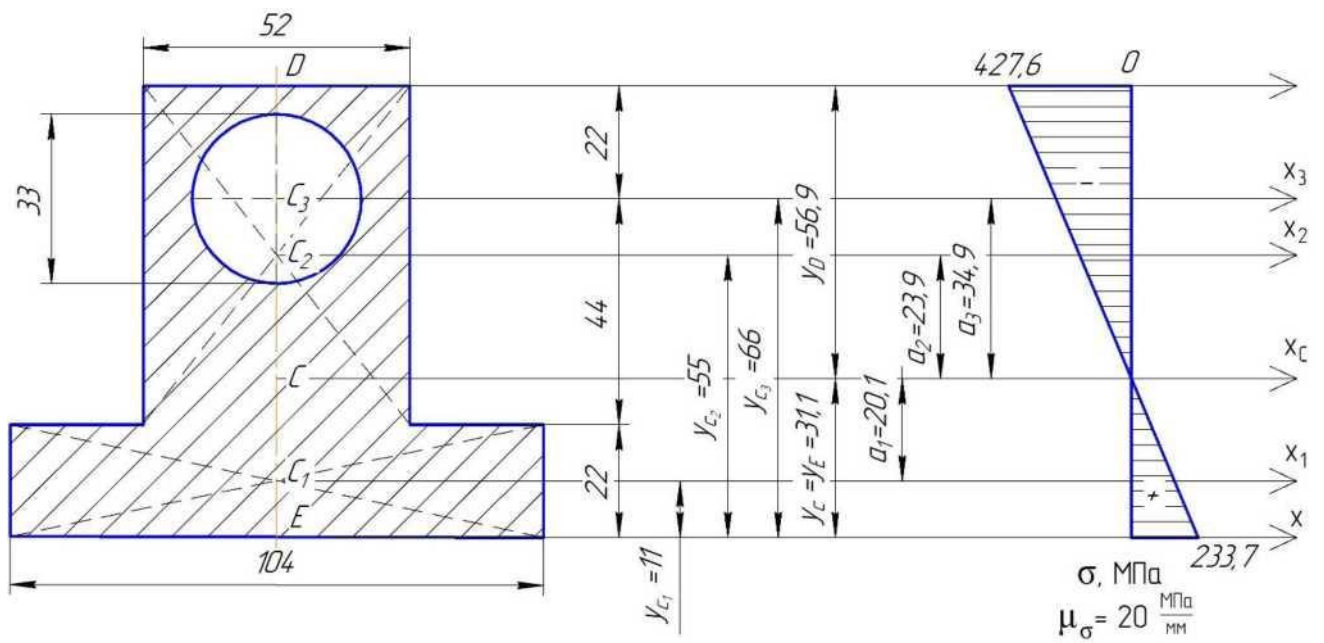
^epTe^; K 3agane



H.3	M	flucm	M doKyM	nodnych ffama

18. KP. 13. 03. 02. nM. n3

^ucm

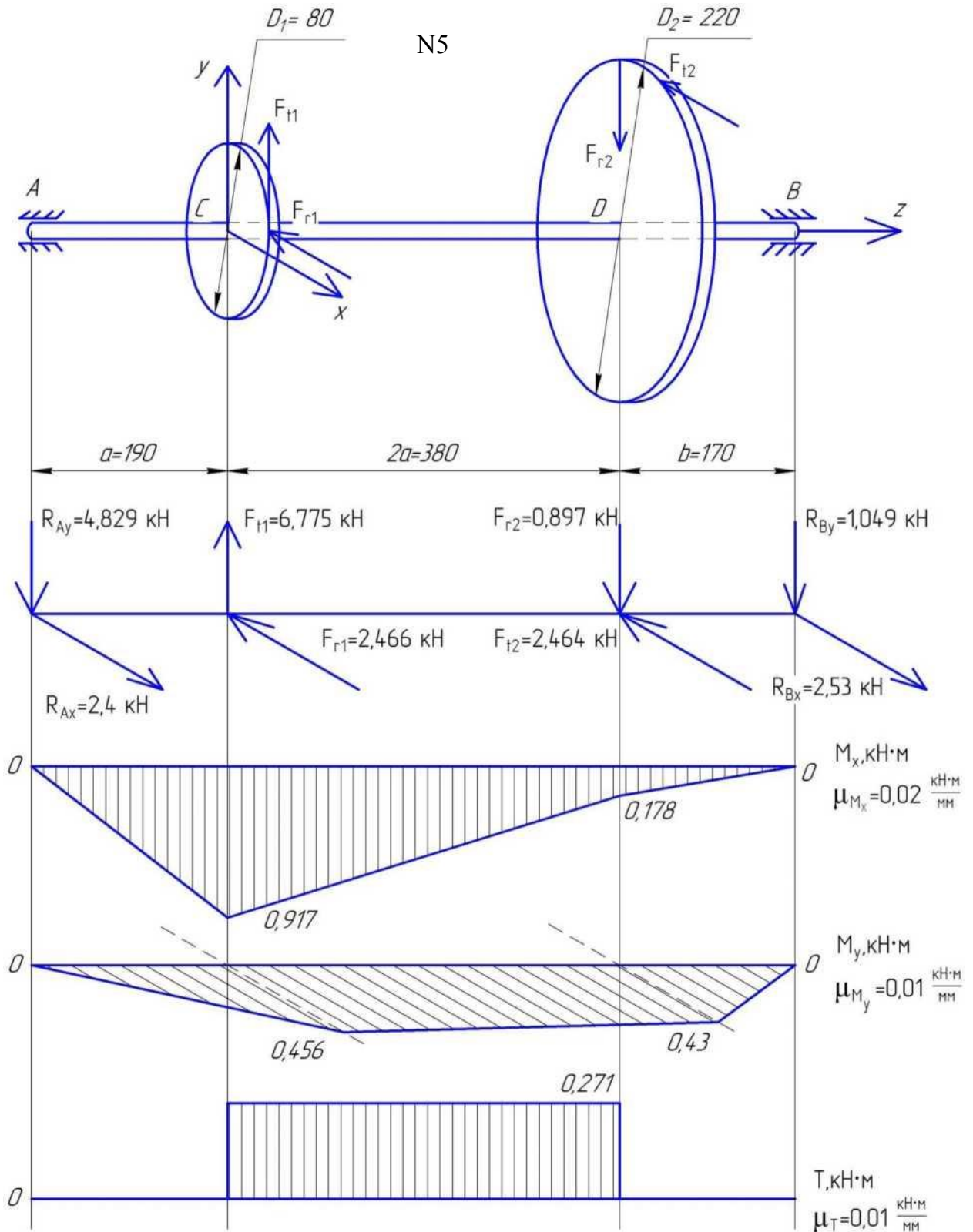


H.3M.flucm	M doKyM.	nodnuch	ffama	

npnno^eHHe 5

^epTe^; K 3agane

N5



						<i>flucm</i>
18. KP. 13. 03. 02. nM. n3						
<i>H.3M.flucm</i>	<i>M doKyM.</i>	<i>nodnuch</i>	<i>ffama</i>			