

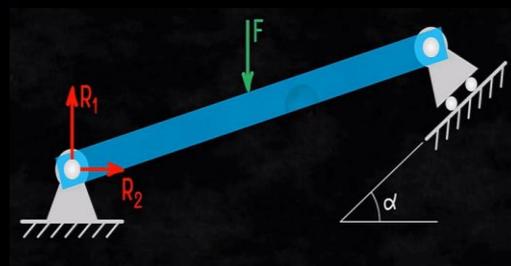
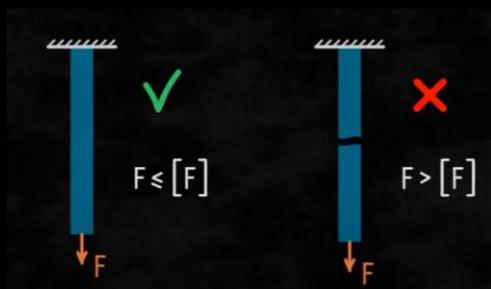
O‘ZBEKISTON RESPUBLIKASI
OLIY TA’LIM, FAN VA INNOVATSIYALAR VAZIRLIGI

TOSHKENT ARXITEKTURA QURILISH UNVERSITETI
"QURILISH MEXANIKASI VA INSHOOTLAR ZILZILABARDOSHLIGI"
KAFEDRASI

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QURILISH MEXANIKASI (MATERIALLAR QARSHILIGI)

fanidan qurilish mutaxassisligi bo‘yicha
tahsil olayotgan talabalar uchun hisob-grafik
ishini bajarish bo‘yicha o‘quv-uslubiy ko‘rsatma
va nazorat topshiriqlari



TOSHKENT - 2023

Qurilish mexanikasi (Materiallar qarshiligi): qurilish mutaxassisligi bo'yicha tahsil olayotgan talabalar uchun hisob-grafik ishlari masalalarining to'plami.
T., 36-bet.

Toshkent arxitektura qurilish universiteti,
Tuzuvchilar: Maksudova G.A., Xoltayeva A.K.

Qurilish mexanikasi (Materiallar qarshiligi) kursi bo'yicha tayyorlangan mazkur ko'rsatmada qurilish mutaxassisliklarida tahsil oluvchi talabalar uchun hisob-grafik ishlari masalalarining to'plami berilgan.

Keltirilgan masalalar Qurilish mexanikasi (Materiallar qarshiligi) kursining asosiy mavzularini o'z ichiga qamrab olgan.

"Qurilish mexanikasi va inshootlar zilzilabardoshligi" kafedrasida.

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Toshkent arxitektura qurilish universitetining ilmiy–uslubiy kengashi qarori bo'yicha bosilmoqda (№3 26-yanvar, 2023y.)

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HISOB GRAFIK ISHLARINI BAJARISH TARTIBI BO‘YICHA UMUMIY KO‘RSATMALAR

Hisob grafik ishlarida masalalar soni har bir mutaxassislik uchun o‘quv rejasida ko‘rsatiladi.

Har bir masala uchun berilgan qiymatlar va sxemalar o‘qituvchi tomonidan talabaga berilgan raqamli shifrga binoan ko‘rsatmada keltirilgan sxemalar va jadvallardan ko‘chirib olinadi.

Har bir mutaxassislik bo‘yicha yuklamada ko‘rsatilgan mavzular bo‘yicha hisoblash grafik ishlari bajariladi.

Barcha tushunilmagan savollar bo‘yicha hamda qo‘llanmadagi yo‘l qo‘yilgan xato va kamchiliklarni tahlil qilish uchun tuzuvchilarga murojaat qilishingizni iltimos qilamiz.

I-QISM
I-HISOB GRAFIK ISHI
BALKA, RAMA VA EGRI BRUSLAR UCHUN ICHKI KUCHLAR
EPYURALARINI CHIZISH.

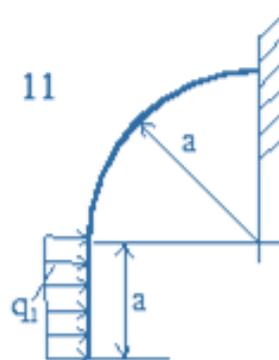
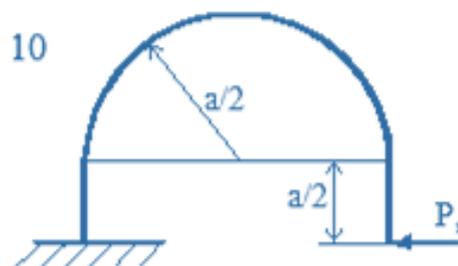
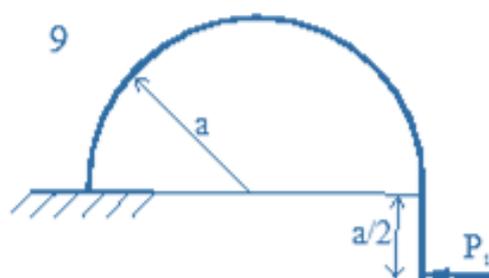
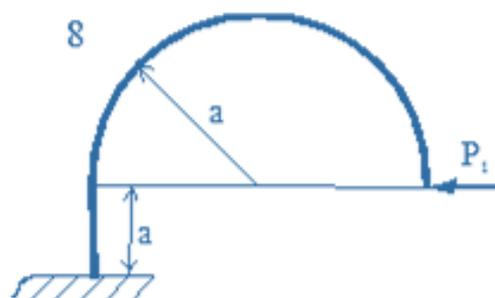
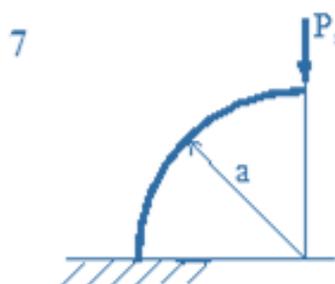
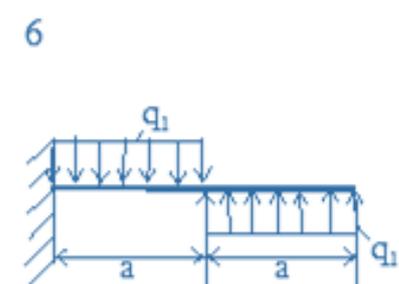
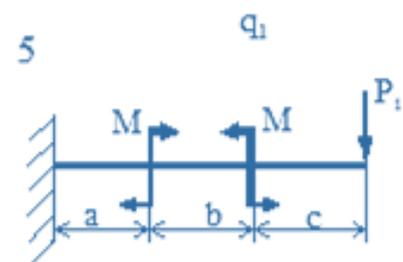
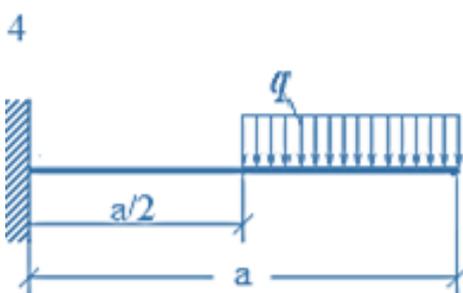
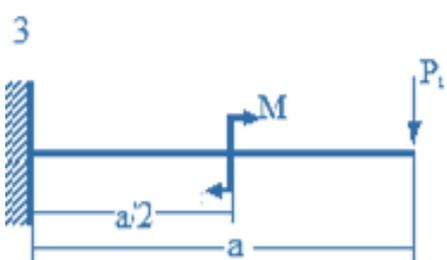
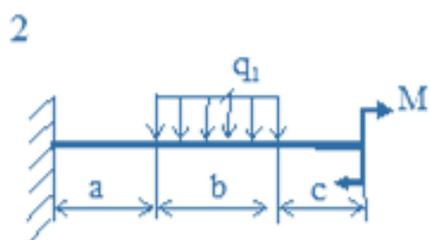
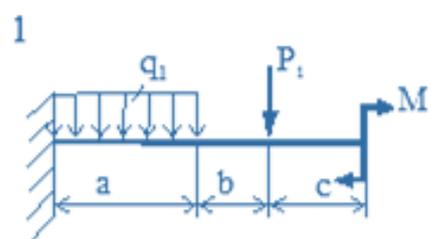
Berilgan balka, rama va egri bruslar uchun quyidagilarni bajarish talab qilinadi:

1. Tayanch reaksiya kuchlari aniqlansin.
2. Eguvchi moment (M), ko'ndalang kuch (Q) va bo'ylama kuch (N) epyuralari qurilsin.
3. Epyuralardan M, Q, N larning eng katta qiymatlari aniqlansin. Mazkur qiymatlarga mos kesimlar belgilansin.

Berilgan qiymatlar variantga binoan 1-jadvaldan, sxemasi esa 1-rasmdan olinsin.

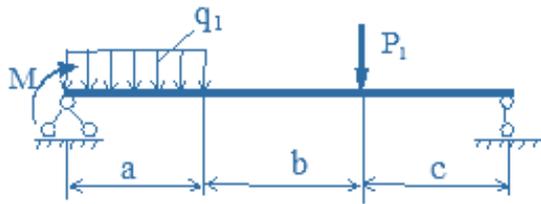
1-jadval

Variant raqami	Sxema raqamlari				a (m)	b (m)	c (m)	P ₁ (kN)	P ₂ (kN)	q ₁ (kN/m)	q ₂ (kN/m)	M (kN·m)
1	1	7	13	25	4	2	1	2	3	2	1	3
2	2	8	14	26	2	4	2	3	2	2	1	4
3	3	9	15	27	2	2	4	4	3	3	2	4
4	4	10	16	28	2	2	2	3	2	2	1	2
5	5	11	17	29	2	4	4	3	4	1	2	3
6	6	12	18	30	2	4	1	3	3	2	2	2
7	1	7	19	31	4	2	4	2	3	2	1	4
8	2	8	20	32	4	2	1	3	2	1	2	3
9	3	9	21	25	4	4	2	3	3	2	2	4
10	4	10	22	26	4	2	4	4	3	3	2	4
11	5	11	23	27	2	2	4	4	3	3	2	4
12	6	12	24	28	2	2	2	3	2	2	1	2
13	1	7	13	29	2	4	4	3	4	1	2	3
14	2	8	14	30	2	4	1	3	3	2	2	2
15	3	9	15	31	4	2	2	2	3	2	1	3
16	4	10	16	32	2	4	1	3	2	2	1	4
17	5	11	17	25	4	2	4	2	3	2	1	4
18	6	12	18	26	4	2	1	3	2	1	2	3
19	1	7	19	27	4	4	2	3	3	2	2	4
20	2	8	20	28	4	2	4	4	3	3	2	4
21	3	9	21	29	2	2	4	4	3	3	2	4
22	4	10	22	30	2	4	1	3	3	2	2	2
23	5	11	23	31	4	2	2	2	3	2	1	4
24	6	12	24	32	4	2	1	3	2	1	2	3
25	1	7	13	25	4	4	2	3	3	2	2	4
26	2	8	14	26	2	2	4	4	3	3	2	4
27	3	9	15	27	2	2	2	3	2	2	1	2
28	4	10	16	28	2	4	4	3	4	1	2	3
29	5	11	17	29	2	4	1	3	3	2	2	2
30	6	12	18	30	4	2	1	2	3	2	1	3

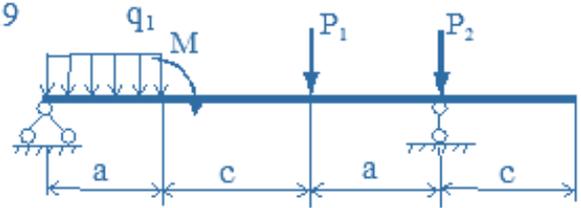


1 - rasm
6

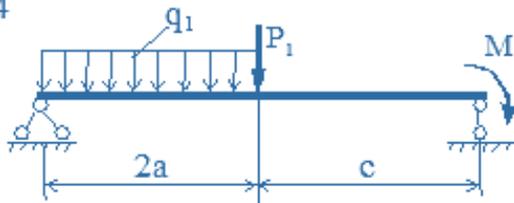
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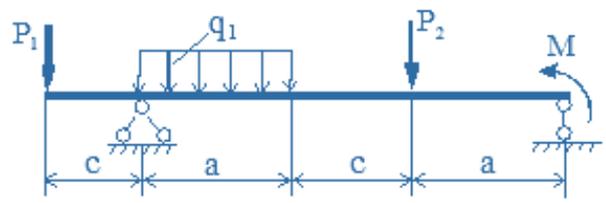
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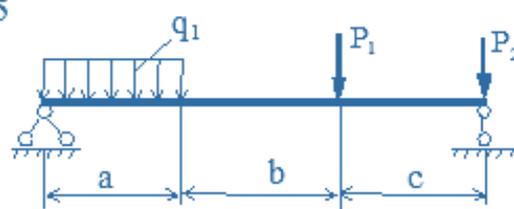
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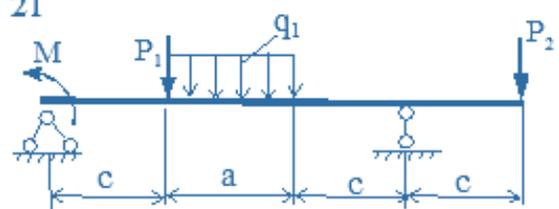
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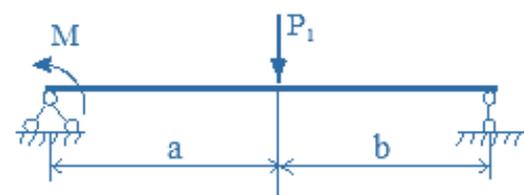
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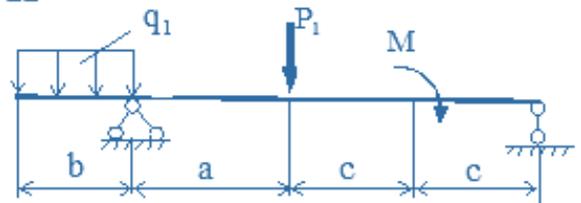
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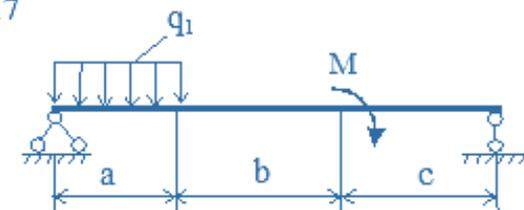
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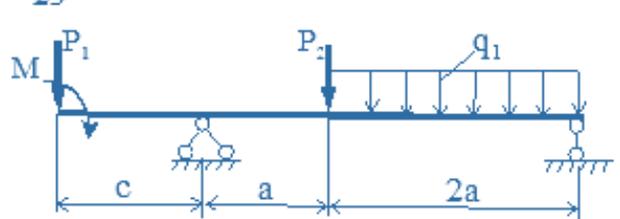
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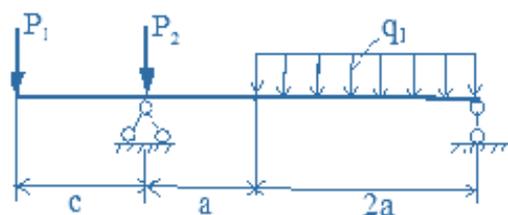
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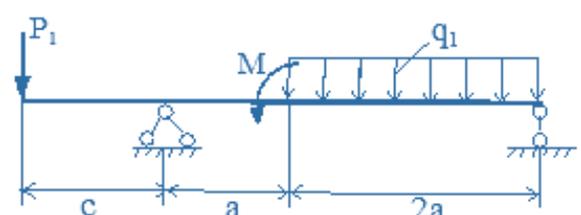
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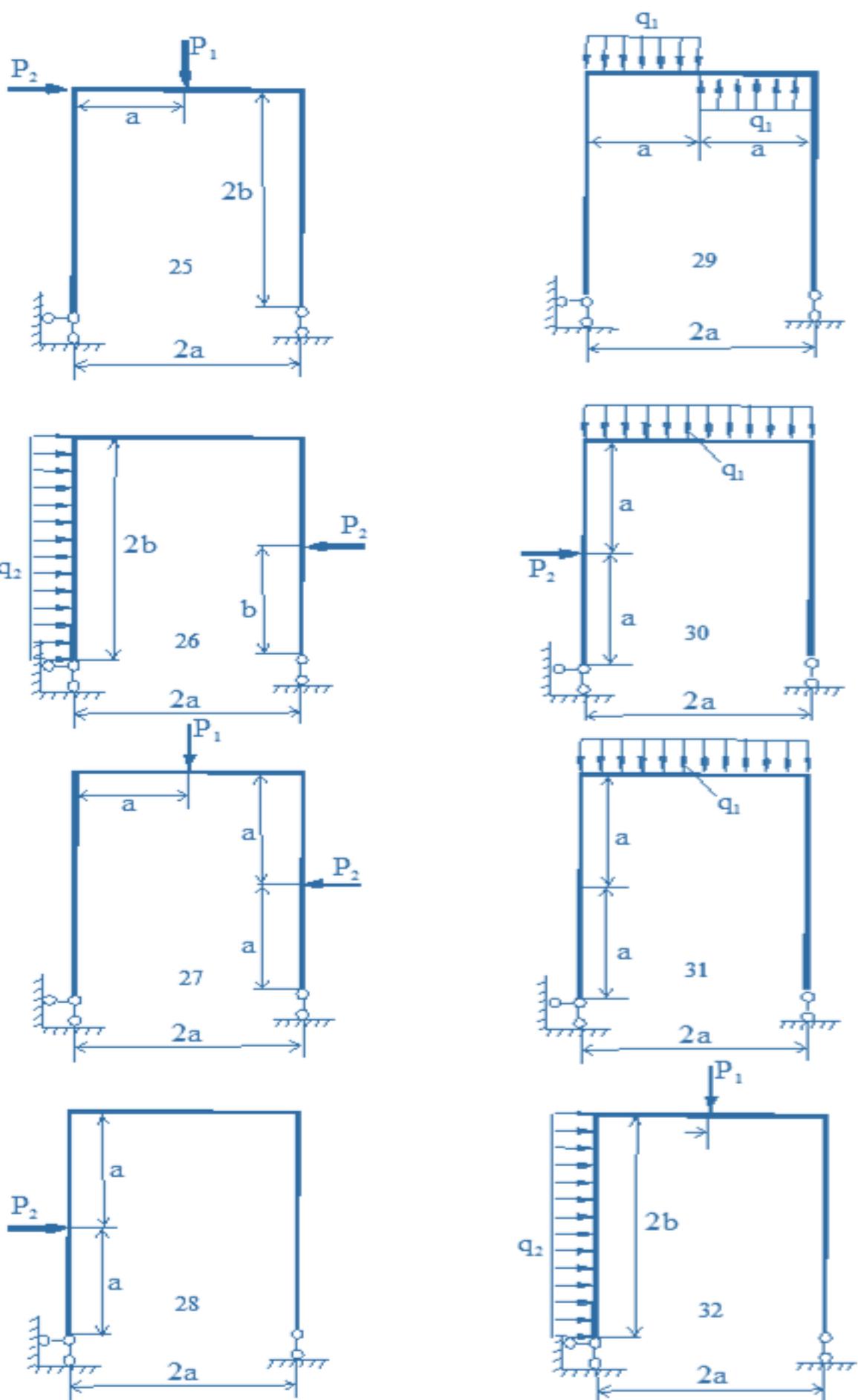
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24



1-rasm (davomi)



1-rasm (davomi)

II – HISOB GRAFIK ISHI

STERJENLI SISTEMALARNI CHO‘ZILISH YOKI SIQILISHGA HISOBLASH.

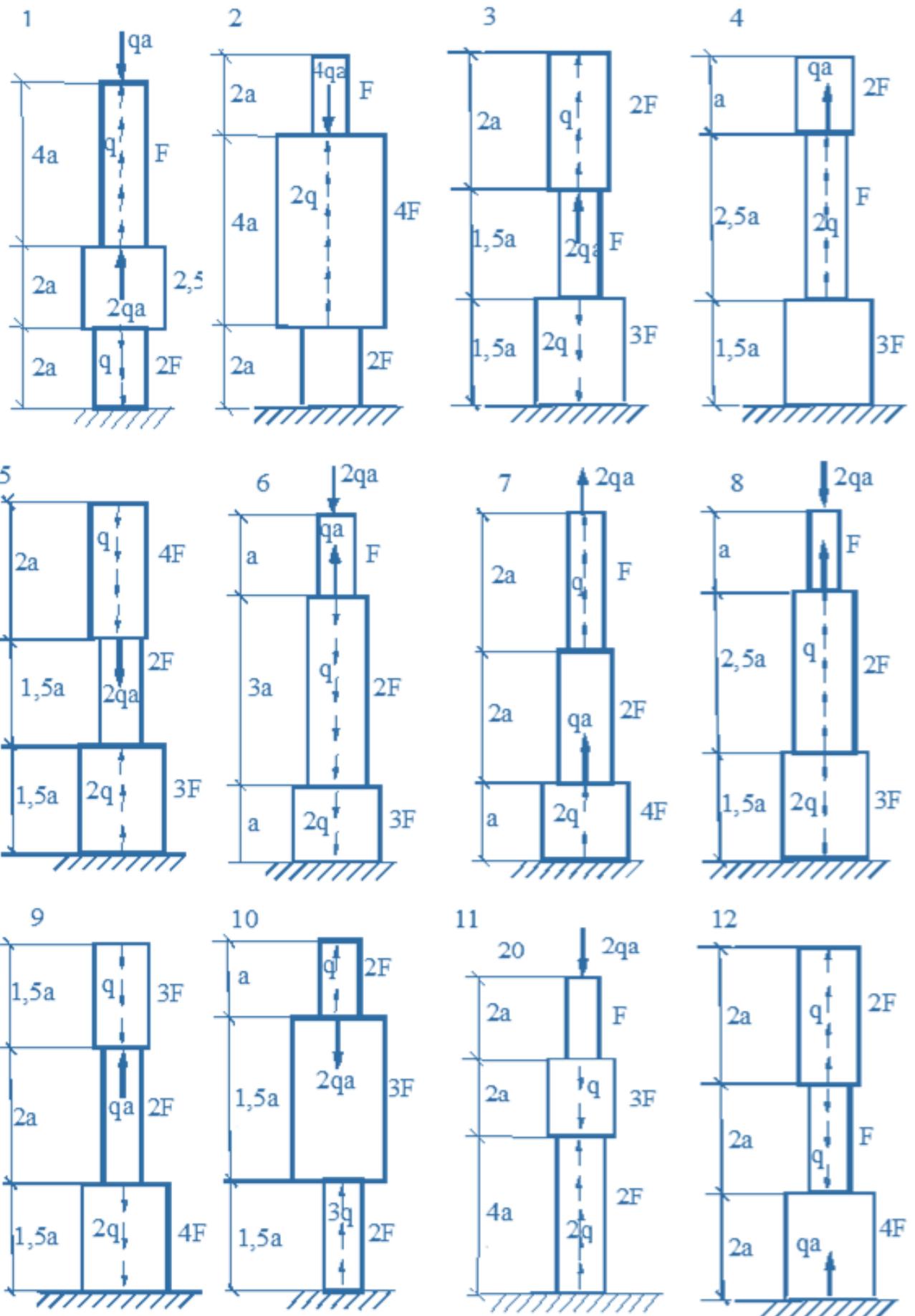
Berilgan pog‘onali sterjen uchun $E=2 \cdot 10^8 \text{ kN/m}^2$, $[\sigma]=160 \cdot 10^3 \text{ kN/m}^2$ deb olinib, quyidagi amallarni bajarish talab qilinadi:

1. Sterjenning tayanch kesimidagi reaksiya kuchi aniqlansin.
2. Sterjen ko‘ndalang kesimlarida xosil bo‘ladigan bo‘ylama kuchlar, normal kuchlanishlar hamda ko‘chishlarning analitik ifodalari tuzilsin.
3. Bo‘ylama kuch, normal kuchlanish va ko‘ndalang kesimning ko‘chish epyuralari qurilsin.
4. Sterjenning umumiy deformatsiyasining absolyut qiymati aniqlansin.

Berilgan qiymatlar variantga binoan 2-jadvaldan, sxemasi esa 2-rasmdan olinsin.

2-jadval

Variant raqami	Sxema raqami	a, (m)	F, ($\cdot 10^{-4} \text{ m}^2$)	q, (kN/m)
1	1	2,0	12,0	20,0
2	2	2,0	14,0	12,0
3	3	3,0	16,0	18,0
4	4	2,0	18,0	20,0
5	5	3,0	20,0	18,0
6	6	1,0	22,0	16,0
7	7	4,0	24,0	10,0
8	8	4,0	26,0	24,0
9	9	2,0	28,0	22,0
10	10	1,0	30,0	14,0
11	11	2,0	20,0	16,0
12	12	1,0	12,0	20,0
13	1	3,0	20,0	18,0
14	2	1,0	22,0	16,0
15	3	4,0	24,0	10,0
16	4	4,0	26,0	24,0
17	5	2,0	28,0	22,0
18	6	1,0	30,0	14,0
19	7	2,0	12,0	20,0
20	8	2,0	14,0	12,0
21	9	3,0	16,0	18,0
22	10	2,0	18,0	20,0
23	11	3,0	20,0	18,0
24	12	2,0	28,0	22,0
25	1	1,0	30,0	14,0
26	2	2,0	12,0	20,0
27	3	2,0	14,0	12,0
28	4	3,0	16,0	18,0
29	5	4,0	20,0	18,0
30	6	1,0	18,0	20,0



2-rasm

III-HISOB GRAFIK ISHI

NOSIMMETRIK KESIMLARNING INERSIYA MOMENTLARI

Berilgan nosimmetrik tekis kesim uchun quyidagilarni bajarish talab qilinadi:

1. Analitik usulda berilgan kesim og'irlik markazining holati aniqlansin.
2. Kesimning og'irlik markazidan o'tgan o'zaro tik ikkita ixtiyoriy o'qlarga nisbatan inersiya momentlari hamda markazdan qochma inersiya momenti hisoblansin.

3. Bosh inersiya o'qlarining yo'nalishi aniqlansin.

4. Bosh inersiya momentlarining qiymatlari hisoblansin.

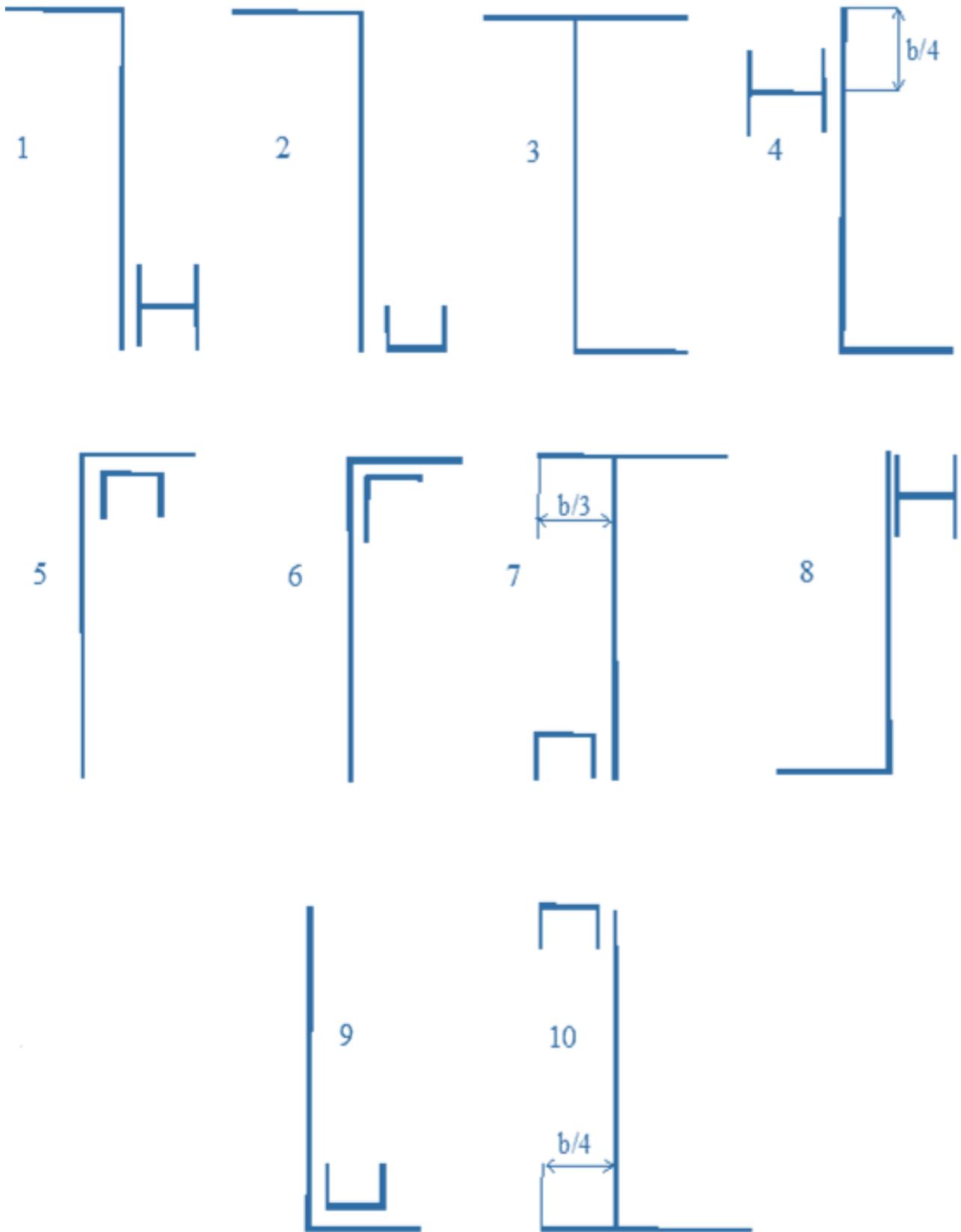
5. Ishni to'g'ri bajarilganligi tekshirilsin.

Berilgan qiymatlar 3- jadvaldan¹, tekis kesim sxemasi esa 3-rasmdan olinadi.

3- jadval

№	Teng yonli burchaklik	Yonlari teng bo'lmagan burchaklik	Qo'shtavr №	Shveller №	Vertikal list ($\cdot 10^{-3}$ m)	Gorizontal list ($\cdot 10^{-3}$ m)
	profil nomeri					
1	90x90x8	100x63x10	24	16	500x10	400x10
2	100x100x10	110x70x10	24a	16a	500x12	400x12
3	110x110x8	125x80x10	27	18a	500x16	400x16
4	140x140x10	125x80x12	27a	22	600x10	400x20
5	140x140x12	140x90x10	30	22a	600x12	400x22
6	160x160x16	160x100x12	36	24	600x16	500x12
7	180x180x12	180x110x12	40	27	600x18	500x16
8	200x200x20	200x125x12	45	30	600x20	500x20
9	220x220x14	200x125x16	50	33	700x16	600x10
10	250x250x20	250x160x20	55	36	800x20	600x20

¹ Izoh: Jadvaldan faqat sxemada mavjud bo'lgan elementlar uchun qiymatlar yozib olinadi.



3-rasm

II -QISM

IV-HISOB GRAFIK ISHI

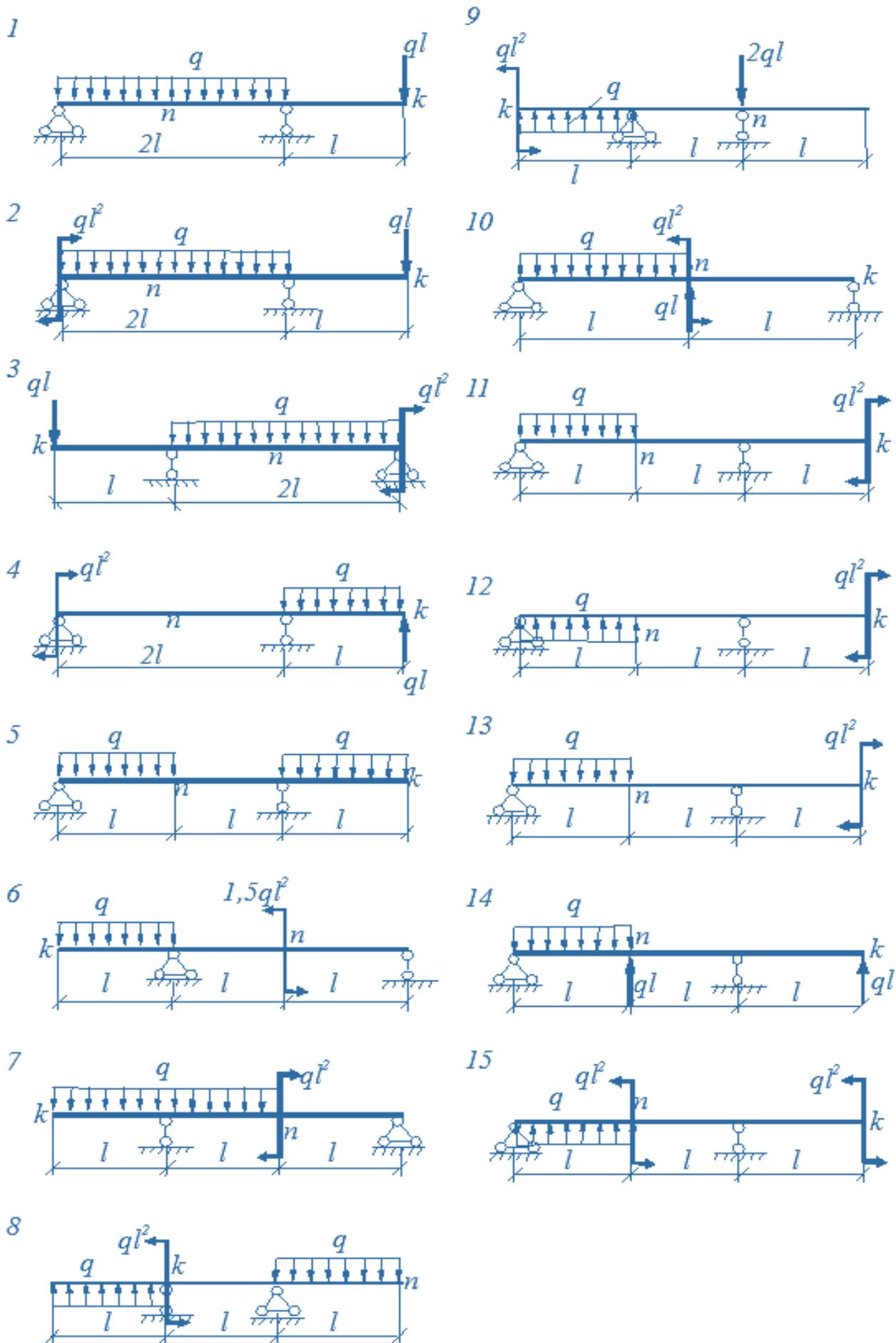
BALKANI MUSTAHKAMLIKKA VA BIKIRLIKKA HISOBLASH

Berilgan variantni 4-jadvaldan olinadi. Yuklanish sxemasi 4-rasmda va ko‘ndalang kesim shakli 5- rasmda ko‘rsatilgan po‘lat balka uchun quyidagilar talab qilinadi:

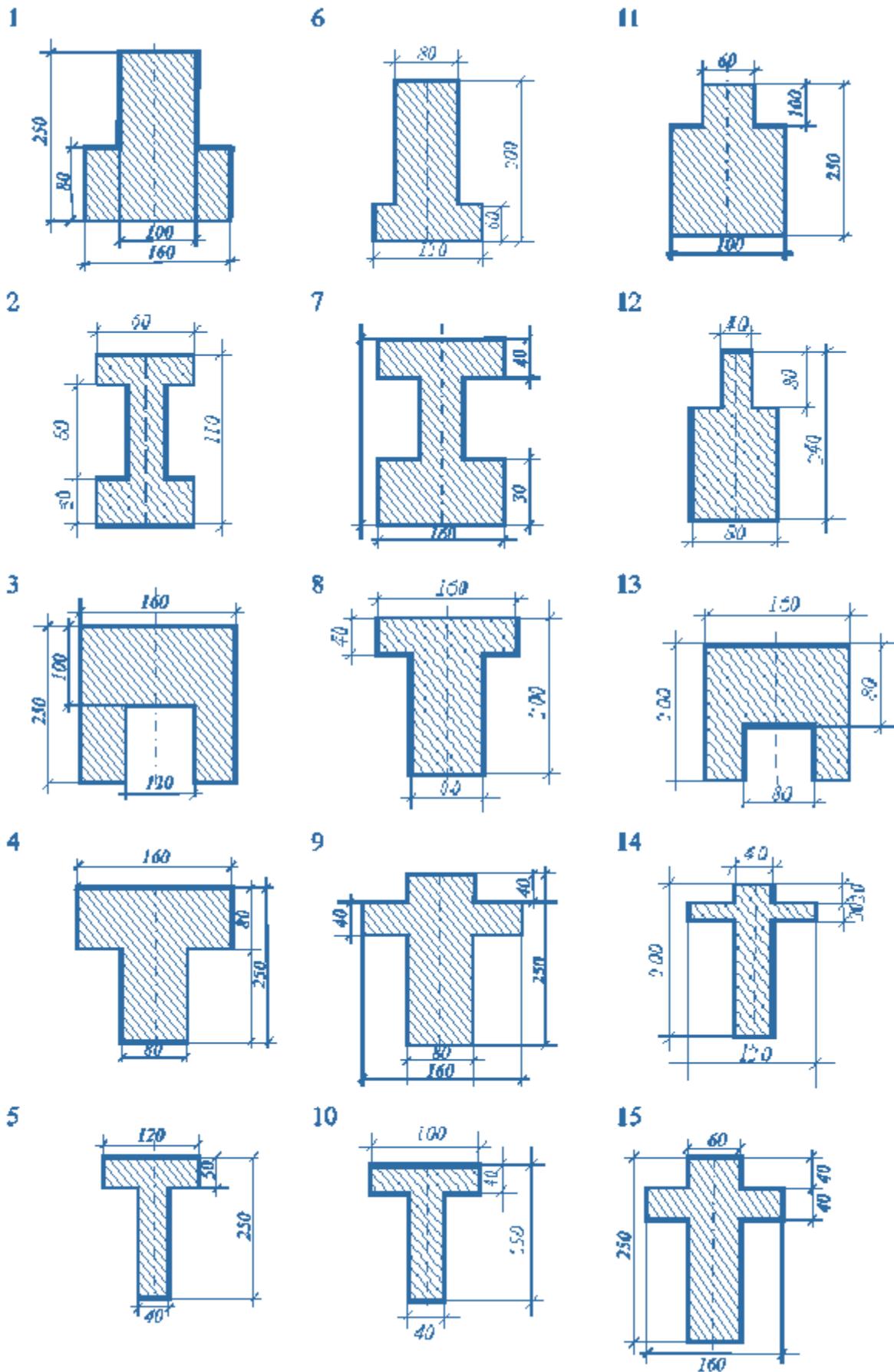
1. Eguvchi moment M va ko‘ndalang kuch Q epyuralari q , ℓ lar bilan ifodalanib qurilsin.
2. Berilgan $\ell = 2$ m va ruxsat etilgan kuchlanish $[\sigma] = 160 \cdot 10^3 \text{ kN/m}^2$ uchun tarqalgan kuch intensivligining ruxsat etilgan qiymati $[q]$ aniqlansin.
3. Bosh kuchlanishlarga nisbatan xavfli kesim aniqlanib, bu kesimdagi normal va urinma kuchlanishlar epyuralari qurilsin.
4. Balka mustahkamligi urinma kuchlanishga nisbatan tekshirib ko‘rilsin. Urinma kuchlanishning ruxsat etilgan qiymati $[\tau] = 0,6 \cdot [\sigma]$ deb qabul qilinsin.
5. Boshlang‘ich parametrlar usuli yordamida balkaning belgilangan “ n ” va “ k ” kesimlarining salqiliklari va og‘ish burchaklari aniqlansin.
6. Balka o‘qining egilish shakli tasvirlansin.
7. Berilgan balkaning kesimi qo‘shstavrdan qayta tanlansin ($[\sigma] = 160 \cdot 10^3 \text{ kN/m}^2$). Qo‘shstavr va berilgan kesimning yuzalari va bikrlilari taqqoslansin.
8. Berilgan va qo‘shstavrli kesim uchun balkaning bikrlilik sharti tekshirib ko‘rilsin. Ruxsat etilgan salqilik $[f] = \ell/300$ deb qabul qilinsin.

4-jadval

Variant raqami	Sxema raqami		Variant raqami	Sxema raqami		Variant raqami	Sxema raqami	
1	<i>1</i>	<i>1</i>	11	<i>11</i>	<i>11</i>	21	<i>6</i>	<i>10</i>
2	<i>2</i>	<i>2</i>	12	<i>12</i>	<i>12</i>	22	<i>7</i>	<i>9</i>
3	<i>3</i>	<i>3</i>	13	<i>13</i>	<i>13</i>	23	<i>8</i>	<i>1</i>
4	<i>4</i>	<i>4</i>	14	<i>14</i>	<i>14</i>	24	<i>9</i>	<i>7</i>
5	<i>5</i>	<i>5</i>	15	<i>15</i>	<i>15</i>	25	<i>10</i>	<i>6</i>
6	<i>6</i>	<i>6</i>	16	<i>1</i>	<i>15</i>	26	<i>11</i>	<i>5</i>
7	<i>7</i>	<i>7</i>	17	<i>2</i>	<i>14</i>	27	<i>12</i>	<i>4</i>
8	<i>8</i>	<i>8</i>	18	<i>3</i>	<i>13</i>	28	<i>13</i>	<i>3</i>
9	<i>9</i>	<i>9</i>	19	<i>4</i>	<i>12</i>	29	<i>14</i>	<i>2</i>
10	<i>10</i>	<i>10</i>	20	<i>5</i>	<i>11</i>	30	<i>15</i>	<i>1</i>



4-rasm
14



5-rasm

V-HISOB GRAFIK ISHI

BIKIRLIGI CHEKSIZ USTUNNI NOMARKAZIY SIQILISHGA HISOBLASH.

Temirbeton kolonnaning ko'ndalang kesimi kvadrat yoki to'g'ri to'rtburchak shakldan iborat. Ko'ndalang kesimining o'lchamlari, siquvchi kuchning koordinatalari hamda beton sinfi va uning hisobiy qarshiligi 5-jadvalda berilgan. Talaba mos ravishda jadvalda keltirilgan qiymatlarni olishi lozim. Siquvchi kuch ko'ndalang kesimining koordinatalari x_r va u_r bo'lgan A nuqtada ta'sir qiladi. Berilgan kolonna uchun quyidagilar talab qilinadi:

1. Ko'ndalang kesimining geometrik xarakteristikalarini aniqlansin.
2. Neytral o'qning holati aniqlansin.
3. Ko'ndalang kesimining xarakterli nuqtalaridagi normal kuchlanishlar aniqlansin.
4. Normal kuchlanishlar epyurasi aksonometriyada chizilsin.
5. Mustahkamlik shartidan R kuchning ruhsat etilgan qiymati aniqlansin.
6. Kolonna ko'ndalang kesimining kesim yadrosi chizilsin.

Variant raqami	Ko'ndalang kesimining o'lchamlari		Siquvchi kuchning koordinatalari		Betonning siqilishga bo'lgan sinfi bo'yicha hisobiy qarshiligi (MPa)		
	b, mm	h, mm	X _r , mm	Y _r , mm	Beton sinfi	Siqilishdagi, R _b	Cho'zilishdagi, R _{bt}
1	300	300	100	50	B15	8,5	0,75
2	300	400	100	100	B20	11,5	0,90
3	400	400	150	50	B25	14,5	1,05
4	400	500	150	100	B30	17,0	1,20
5	500	600	150	150	B15	8,5	0,75
6	400	700	150	200	B20	11,5	0,90
7	400	800	150	250	B25	14,5	1,05
8	500	500	200	50	B30	17,0	1,20
9	500	600	200	100	B20	11,5	0,90
10	500	800	200	150	B30	17,0	1,20
11	500	800	200	150	B15	8,5	0,75
12	500	600	200	100	B20	11,5	0,90
13	500	500	200	50	B25	14,5	1,05
14	400	800	150	250	B30	17,0	1,20
15	400	700	150	200	B15	8,5	0,75
16	400	600	150	150	B20	11,5	0,90
17	400	500	150	100	B25	14,5	1,05
18	400	400	150	50	B30	17,0	1,20
19	300	400	100	100	B20	11,5	0,90
20	300	300	100	50	B30	17,0	1,20
21	400	700	150	200	B30	17,0	1,20
22	400	800	150	250	B20	11,5	0,90
23	500	500	200	50	B30	17,0	1,20
24	500	600	200	100	B15	8,5	0,75
25	500	800	200	150	B20	11,5	0,90
26	500	800	200	150	B25	14,5	1,05
27	500	600	200	100	B30	17,0	1,20
28	500	500	200	50	B15	8,5	0,75
29	400	800	150	250	B20	11,5	0,90
30	400	700	150	200	B25	14,5	1,05

VI-HISOB GRAFIK ISHI

QO‘SHMA METALL USTUNNI USTIVORLIKKA HISOBLASH

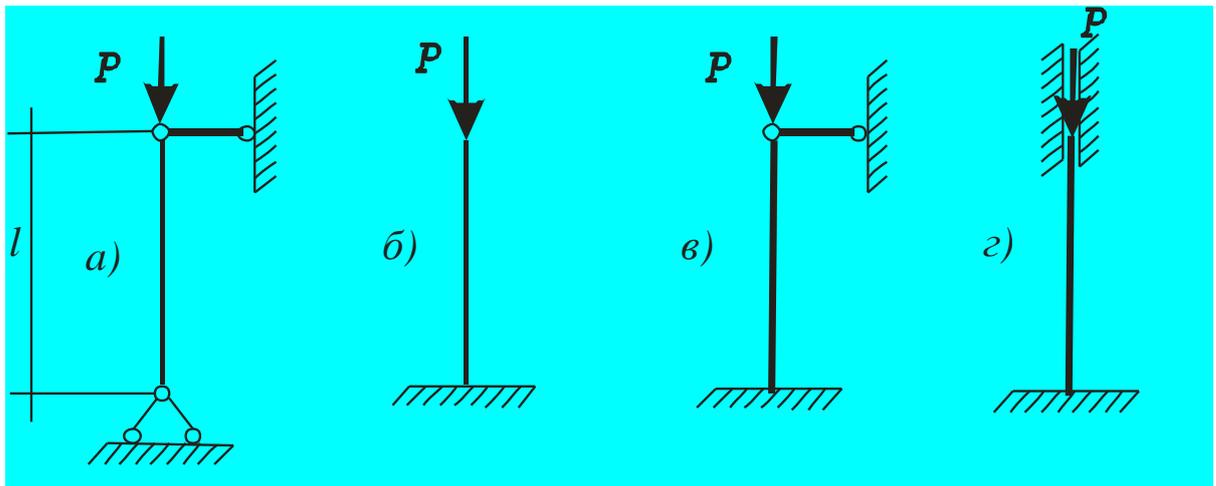
Qo‘shma ustunning yuklanish sxemasi, ustunga qo‘yilgan R kuchining qiymati, hamda ustun ko‘ndalang kesimining shakli variantga binoan 6- va 7- rasmlardan va 6-jadvaldan olinadi. Berilgan ustunni ustivorlikka hisoblashda quyidagi amallarni bajarilishi talab qilinadi:

1. Ustunning ko‘ndalang kesim yuzasini ketma – ket yaqinlashish usuli bilan aniqlansin.
2. Ko‘ndalang kesim tekisligida ustunning tarmoqlari orasidagi masofa “a” ni ustunning teng ustivorlik shartidan foydalanib aniqlansin.
3. Ustun tarmoqlarini birlashtiruvchi plankalarning o‘lchamlari aniqlansin.
4. Ustun uzunligi bo‘ylab plankalar orasidagi masofa, hamda ustunni yig‘ish uchun ishlatiladigan plankalar soni aniqlansin.
5. Ustun tayanch turlari o‘zgartirilib, u qaytadan ustivorlikka hisoblansin va avvalgi natija bilan taqqoslansin.

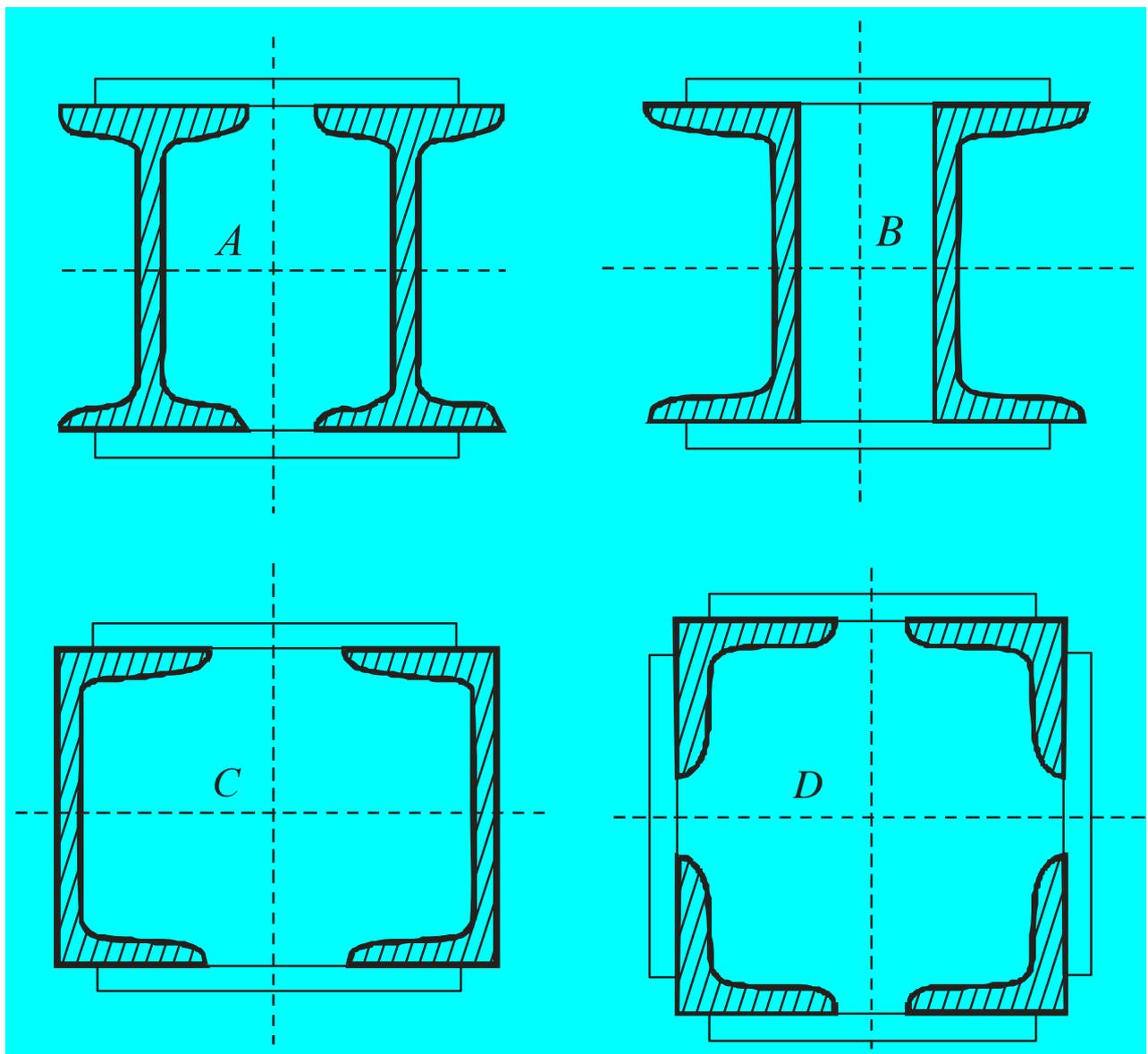
6-jadval

Variantlar	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Kuch qo‘yish sxemasi	a	b	v	g	a	b	v	g	a	b	v	g	a	b	v	g
Ustunning kesimi	A				B				C				D			
Ustun uzunligi (m)	6	8	7	4	6	9	8	5	4	7	9	6	4	5	7	10
Kuch qiymati (kN)	700	400	800	650	600	450	620	750	500	480	520	800	550	720	450	680

Variantlar	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Kuch qo‘yish sxemasi	a	b	v	g	a	b	v	g	a	b	v	g	a	b
Ustunning kesimi	A				B				C				D	
Ustun uzunligi (m)	5	6	4	7	2	4	6	8	6	9	7	8	9	7
Kuch qiymati (kN)	600	200	500	450	400	550	720	700	400	500	720	850	750	250

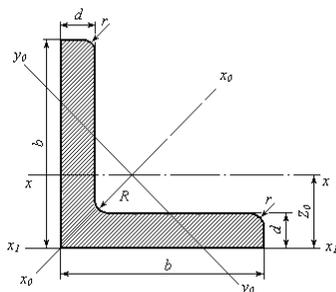


6-rasm



7-rasm

ILOVA



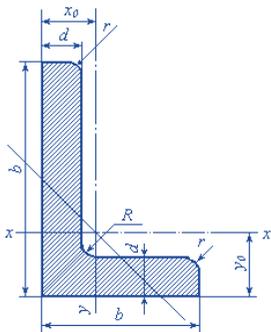
Prokat profillarning sortamentlari
Yonlari teng bo'lgan burchaklilar (GOST 8508 - 57)

O'lchamlari					Profiling yuzi, F_{sm}^3	Ogirligi	O'qlar uchun aniqlangan kattaliklar							
Profillar nomeri	b	d	R	r			X-X		X0-X0		U0-U0		X1-X1	Z0
							J_x	i_x	J_{x_0}	i_{x_0}	J_{y_0}	i_{y_0}	i_{x1}	
mm					Sm^2	Kg	Sm^4	Sm	Sm^4	Sm	Sm^4	Sm	Sm	
2	20	3	3,5	1,2	1,13	0,89	0,40	0,59	0,63	0,75	0,17	0,39	0,81	0,60
		4			1,46	1,15	0,50	0,58	0,78	0,73	0,22	0,38	1,09	0,64
2,5	25	3	3,5	1,2	1,43	1,12	0,81	0,75	1,29	0,95	0,34	0,49	1,57	0,73
		4			1,86	1,46	1,03	0,74	1,62	0,93	0,44	0,48	2,11	0,76
2,8	28	3	4	1,3	1,62	1,27	1,16	0,85	1,84	1,07	0,48	0,55	2,20	0,80
3,2	32	3	4,5	1,5	1,86	1,46	1,77	0,97	2,80	1,23	0,74	0,63	3,26	0,89
		4			2,43	1,91	2,26	0,96	3,58	1,21	0,94	0,62	4,39	0,94
3,6	36	3	4,5	1,5	2,10	1,65	2,56	1,10	4,06	1,39	1,06	0,71	4,64	0,99
		4			2,75	2,16	3,29	1,09	5,21	1,38	1,36	0,70	6,24	1,04
4	40	3	5	1,7	2,35	1,85	3,55	1,23	5,63	1,55	1,47	0,79	6,35	1,09
		4			3,08	2,42	4,58	1,22	7,26	1,53	1,90	0,78	8,53	1,13

4,5	45	3	5	1,7	2,65	2,08	5,13	1,39	8,13	1,75	2,12	0,89	9,04	1,21
		4			3,48	2,73	6,63	1,38	10,5	1,74	2,74	0,89	12,1	1,26
		5			4,29	3,37	8,03	1,37	12,7	1,72	3,33	0,88	15,3	1,30
5	50	3	5,5	1,8	2,96	2,32	7,11	1,55	11,3	1,95	2,95	1,00	12,4	1,33
		4			3,89	3,05	9,21	1,54	14,6	1,94	3,80	0,99	16,6	1,38
		5			4,80	3,77	11,2	1,53	17,8	1,92	4,63	0,98	20,9	1,42
5,6	56	3,5	6	2	3,86	3,03	11,6	1,73	18,4	2,18	4,80	1,12	20,3	1,50
		4			4,38	3,44	13,1	1,73	20,8	2,18	5,41	1,11	23,3	1,52
		5			5,41	4,25	16,0	1,72	25,4	2,16	6,59	1,10	29,2	1,57
6,3	63	4	7	2,3	4,96	3,90	18,9	1,95	29,9	2,45	7,81	1,25	33,1	1,69
		5			6,13	4,81	23,1	1,94	36,6	2,44	9,52	1,25	41,5	1,74
		6			7,28	5,72	27,1	1,93	42,9	2,43	11,2	1,24	50,9	1,78
7	70	4,5	8	2,7	6,20	4,87	29,0	2,16	46,0	2,72	12,0	1,39	51,0	1,88
		5			6,86	5,38	31,9	2,16	50,7	2,72	13,2	1,39	56,7	1,90
		6			8,15	6,39	37,6	2,15	59,6	2,71	15,5	1,38	68,4	1,94
		7			9,42	7,39	43,0	2,14	68,2	2,69	17,8	1,37	80,1	1,99
		8			10,7	8,37	48,2	2,13	76,4	2,68	20,0	1,37	91,9	2,02
7,5	75	5	3	3	7,39	5,80	39,5	2,31	62,6	2,91	16,4	1,49	69,6	2,02
		6			8,78	6,89	46,6	2,30	73,9	2,90	19,3	1,48	83,9	2,06
		7			10,1	7,96	53,3	2,29	84,6	2,89	22,1	1,48	98,3	2,10
		8			10,5	9,02	59,8	2,28	94,9	2,87	24,8	1,47	113	2,15
		9			12,8	10,1	66,1	2,27	105	2,86	27,5	1,46	127	2,18
8	80	5,5	9	3	8,63	6,78	52,7	2,47	83,6	3,11	21,8	1,59	93,2	2,17
		6			9,38	7,36	57,0	2,47	90,4	3,11	23,5	1,58	102	2,19
		7			10,8	8,51	65,3	2,45	104	3,09	27,0	1,58	119	2,23
		8			12,3	9,65	73,4	2,44	116	3,08	30,3	1,57	137	2,27

9	90	6	10	3,3	10,6	8,33	82,1	2,78	130	3,50	34,0	1,79	145	2,43
		7			12,3	9,64	94,3	2,77	150	3,49	38,9	1,78	169	2,47
		8			13,9	10,9	106	2,76	168	3,48	43,8	1,77	194	2,51
		9			15,6	12,2	118	2,75	186	3,46	8,6	1,77	219	2,55
10	100	6,5	12	4	12,8	10,1	122	3,09	193	3,88	50,7	1,99	214	2,68
		7			13,8	10,8	131	3,08	207	3,88	54,2	1,98	231	2,71
		8			15,6	12,2	147	3,07	233	3,87	60,9	1,98	265	2,75
		10			19,2	15,1	179	3,05	284	3,84	74,1	1,96	333	2,83
		12			22,8	17,9	209	3,03	331	3,81	86,9	1,95	402	2,91
		14			26,3	20,6	237	3,00	375	3,78	99,3	1,94	472	2,99
		16			29,7	23,3	264	2,98	416	3,74	112	1,94	542	3,06
11	110	7	12	4	15,2	11,9	176	3,40	279	4,29	72,7	2,19	308	2,96
		8			17,2	13,5	198	3,39	315	4,28	81,8	2,18	353	3,00
12,5	125	8	14	4,6	19,7	15,5	294	3,87	467	4,87	122	2,49	516	3,36
		9			22,0	17,3	327	3,86	520	4,86	135	2,48	582	3,40
		10			24,3	19,1	360	3,85	571	4,84	149	2,47	649	3,45
		12			28,9	22,7	422	3,82	670	4,82	174	2,46	782	3,53
		14			33,4	26,2	482	3,80	764	4,78	200	2,45	916	3,61
		16			37,8	29,6	539	3,78	853	4,75	224	2,44	1051	3,68
14	140	9	14	4,6	24,7	19,4	466	4,34	739	5,47	192	2,79	818	3,78
		10			27,3	21,5	512	4,33	814	5,46	211	2,78	911	3,82
		12			32,5	25,5	602	4,31	957	5,43	248	2,76	1097	3,90

16	160	10	16	5,3	31,4	24,7	774	4,96	1229	6,25	319	3,19	1356	4,30
		11			34,4	27,0	844	4,95	1341	6,24	348	3,18	1494	4,35
		12			37,4	29,4	913	4,94	1450	6,23	376	3,17	1633	4,39
		14			43,3	34,0	1046	4,92	1662	6,20	431	3,16	1911	4,47
		16			49,1	38,5	1175	4,89	1866	6,17	485	3,14	2191	4,55
		18			54,8	43,0	1299	4,87	2061	6,13	537	3,13	2472	4,63
		20			60,4	47,4	1419	4,85	2248	6,10	589	3,12	2756	4,70
18	180	11	16	5,3	38,8	30,5	1216	5,60	1933	7,06	500	3,59	2128	4,85
		12			42,2	33,1	1317	5,59	2093	7,04	540	3,58	2324	4,49
20	200	12	18	6	47,1	37,0	1823	6,22	2896	7,84	749	3,99	3182	5,37
		13			50,9	39,9	1961	6,21	3116	7,83	805	3,98	3452	5,42
		14			54,6	42,8	2097	6,20	3333	7,81	861	3,97	3722	5,46
		16			62,0	48,7	2363	6,17	3755	7,78	970	3,96	4264	5,54
		20			76,5	60,1	2871	6,12	4560	7,72	1182	3,93	5355	5,70
		25			94,3	74,0	3466	6,06	5494	7,65	1438	3,91	6733	5,89
		30			111,5	87,6	4020	6,00	6351	7,55	1688	3,89	8130	6,07
22	220	14	21	7	60,4	47,4	2814	6,83	4470	8,60	1159	4,38	4941	5,93
		16			68,6	53,8	3175	6,81	5045	8,58	1306	4,36	5661	6,02
25	250	16	24	8	78,4	61,5	4717	7,76	7492	9,78	1942	4,98	8286	
		18			87,7	68,9	5247	7,73	8337	9,75	2158	4,96	9342	
		20			97,0	76,1	5765	7,71	9160	9,72	2370	4,94	10401	
		22			106,1	83,3	6270	7,69	9961	9,69	2579	4,93	11464	
		25			119,7	94,0	7000	6,65	11125	9,64	2887	4,91	13064	
		28			133,1	104,5	7717	7,61	12244	9,59	3190	4,89	14674	
		30			142,0	111,4	8177	7,59	12965	9,56	3389	4,89	15753	

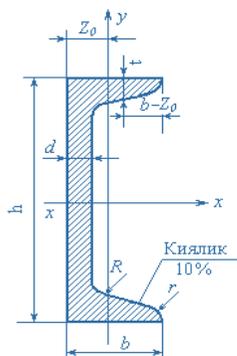


**Yonlari teng bo'lmagan burchakliklar
(GOST 8510-57).**

Profil nomeri	O'lchamlari					Kesim yuzi	1 m uzunasining og'irligi	O'qlarning spravka miqdorlari										
	h	b	d	R	r			x-x		y-y		X1-X1		y1-y1		y-y		O'qning qiyalik burchagi tga
								J _x	i _x	J _y	i _y	J _x	y ₀	J _{y1 min}	X ₀	J _{y min}	i _{y min}	
								sm ⁴	sm	sm ⁴	sm	sm ⁴	sm	sm ⁴	sm	sm ⁴	sm	
2,5\1,6	25	16	3	3,5	1,2	1,16	0,91	0,70	0,78	0,22	0,44	1,56	0,86	0,43	0,42	0,13	0,34	0,392
3,2\2	32	20	3	3,5	1,2	1,49	1,17	1,52	1,01	0,46	0,55	3,26	1,08	0,83	0,4	0,28	0,43	0,382
			4			1,94	1,52	1,93	1,00	0,57	0,54	4,38	1,12	1,12	0,53	0,35	0,43	0,374
4\2,5	40	25	3	4,0	1,3	1,89	1,48	3,08	1,27	0,93	0,70	6,37	1,32	1,58	0,59	0,56	0,54	0,385
			4			2,47	1,94	3,93	1,26	1,18	0,69	8,53	1,37	2,15	0,63	0,71	0,54	0,381
4,5\2,8	45	28	3	5	1,7	2,14	1,68	4,41	1,43	1,32	0,79	9,02	1,47	2,20	0,64	0,79	0,61	0,382
			4			2,80	2,20	5,68	1,42	1,69	0,78	12,1	1,51	2,98	0,68	1,02	0,60	0,379
5\3,2	50	32	3	5,5	1,8	2,42	1,90	6,17	1,60	1,99	0,91	12,4	1,60	3,26	0,72	1,18	0,70	0,403
			4			3,17	2,49	7,98	1,59	2,56	0,90	16,6	1,65	4,42	0,76	1,52	0,69	0,401
5,6\3,6	56	36	3,5	6,0	2,0	3,16	2,48	10,1	1,79	3,30	1,02	20,3	1,80	5,43	0,82	1,95	0,79	0,407
			4			3,58	2,81	11,4	1,78	3,70	1,02	23,2	1,82	6,25	0,84	2,19	0,78	0,406

6,3\4,0	63	40	5	7,0	2,3	4,41	3,46	13,8	1,77	4,48	1,01	29,2	1,86	7,91	0,88	2,66	0,78	0,404
			4			4,04	3,17	16,3	2,01	5,16	1,13	33,0	2,03	8,51	0,91	3,07	0,87	0,397
			5			4,98	3,91	19,9	2,00	6,26	1,12	41,4	2,08	10,8	0,95	3,72	0,86	0,396
			6			5,90	4,63	23,3	1,99	7,28	1,11	49,9	2,12	13,1	0,99	4,36	0,86	0,393
			8			7,68	6,03	29,6	1,96	9,15	1,09	66,9	2,20	17,9	1,07	5,58	0,85	0,386
7\4,5	70	45	4,5	7,5	2,5	5,07	3,98	25,3	2,23	8,25	1,28	51	2,25	13,6	1,03	4,88	0,98	0,407
			5			5,59	4,39	27,8	2,23	9,05	1,27	56,7	2,28	15,2	1,05	5,34	0,98	0,406
7,5\5	75	50	5	8	2,7	6,11	4,97	34,8	2,39	12,5	1,43	69,7	2,39	20,8	1,17	7,24	1,09	0,436
			6			7,25	5,69	40,9	2,38	14,6	1,42	83,9	2,44	25,2	1,21	8,48	1,08	0,435
			8			9,47	7,43	52,4	2,35	18,5	1,40	112	2,52	34,2	1,29	10,9	1,07	0,430
8\5	80	50	5	8	2,7	6,36	4,99	41,6	2,56	12,7	1,41	84,6	2,6	20,8	1,13	7,58	1,09	0,387
			6			7,55	5,92	49,0	2,55	14,8	1,40	102	2,65	25,2	1,17	8,88	1,08	0,386
9,5\6	90	56	5,5	9	3	7,86	6,17	65,3	2,88	19,7	1,58	132	2,92	32,2	1,26	11,8	1,22	0,384
			6			8,54	6,70	70,6	2,88	21,2	1,58	145	2,95	35,2	1,28	12,7	1,22	0,384
			8			11,18	8,77	90,9	2,85	26,1	1,56	194	3,04	47,8	1,36	16,3	1,21	0,380
10\6,3	100	63	6	10	3,3	9,59	7,53	98,3	3,2	30,6	1,79	198	3,23	49,9	1,42	18,2	1,38	0,393
			7			11,1	8,70	113	3,19	35,0	1,78	232	3,28	58,7	1,45	20,8	1,37	0,392
			8			12,6	9,87	127	3,18	39,2	1,77	266	3,32	67,6	1,50	23,4	1,36	0,391
			10			15,5	12,1	154	3,15	47,1	1,75	333	3,40	85,8	1,58	28,3	1,35	0,387
11\7	110	70	6,5	10	3,3	11,4	8,98	142	3,53	45,6	2	286	3,55	74,3	1,58	26,9	1,53	0,402
			8			12,3	9,64	152	3,52	48,7	1,99	309	3,57	80,3	1,6	28,8	1,53	0,402
			7			13,9	10,9	172	3,51	54,6	1,98	353	3,61	92,3	1,64	32,3	1,52	0,400

12.5\8	125	80	7	11	3,7	14,1	11,1	227	4,01	73,7	2,29	452	4,01	119	1,8	43,4	1,76	0,407
			8			16	2,5	256	4	83,0	2,28	518	4,05	137	1,84	48,8	1,75	0,406
			10			19,7	15,5	312	3,98	100	2,26	649	4,14	173	1,92	59,3	1,74	0,404
			12			23,4	18,3	365	3,95	117	2,24	781	4,22	210	2	65,5	1,72	0,400
14\9	140	90	8	12	4	18	14,1	364	4,49	120	2,58	727	4,49	194	2,03	70,3	1,98	0,411
			10			22,2	17,5	444	4,47	146	2,56	911	4,58	245	2,12	85,5	1,96	0,409
16,10	160	100	9	13	4,3	22,9	18	606	5,15	186	285	1221	5,19	300	2,23	110	2,2	0,391
			10			25,3	19,8	667	5,13	204	2,84	1359	5,23	335	2,28	121	2,19	0,390
			12			30	23,6	784	5,11	239	2,82	1634	5,32	405	2,36	142	2,18	0,388
			14			34,7	27,3	897	5,08	272	2,82	1910	5,40	477	2,43	162	2,16	0,385
18/11	180	110	10	14	47	28,3	22,2	952	5,8	276	3,12	1933	5,88	444	2,44	165	2,42	0,375
			12			33,7	26,4	1123	5,77	324	3,1	2324	5,97	537	2,52	194	2,40	0,374
20/12,5	200	125	11	14	4,7	34,9	27,4	1449	6,45	446	3,58	2920	6,5	718	2,79	264	2,75	0,392
			12			37,9	29,7	1568	6,43	482	3,57	3189	6,54	786	2,83	285	2,74	0,392
			14			43,9	34,4	1801	6,41	551	3,54	3726	6,62	922	2,91	327	2,73	0,390
			16			49,8	39,1	2026	6,38	617	3,52	4264	6,71	1061	2,99	367	2,72	0,988
25\16	250	160	12	18	6	48,3	37,8	3147	8,07	1032	4,62	6212	7,97	1634	3,53	604	3,54	0,410
			16			63,6	49,9	4091	8,02	1333	4,58	8308	8,14	2200	3,69	781	3,50	0,408
			18			71,1	55,8	4545	7,99	1475	4,56	9358	8,23	2487	3,77	866	3,49	0,407
			20			78,5	61,7	4987	7,97	1613	4,53	10410	8,31	2776	3,85	949	3,48	0,405



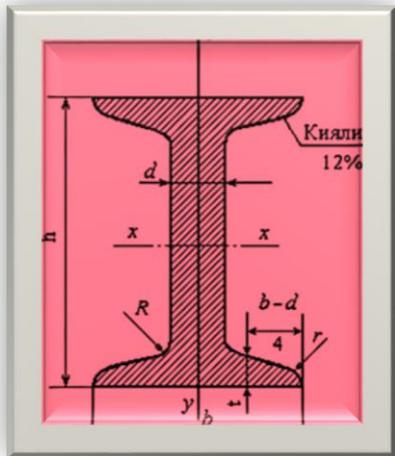
Shvellerlar (GOST 8240-56)

Profil nomeri	1 m uzunasining og'irligi, kg	O'lchamlari, m,m				Kesim yuzi, F sm ²	O'qlarning spravka miqdorlari							Z ₀ cm
		h	b	d	t		x-x				y-y			
							J _x sm ⁴	W _x sm ³	i _x sm	S _x sm ³	J _y cm ⁴	W _y cm ³	i _y cm	
5	4,84	50	32	4,4	7,0	6,16	22,8	9,10	1,92	5,59	5,61	2,75	0,954	1,16
6,5	5,90	65	36	4,4	7,2	7,51	48,6	15,0	2,54	9,00	8,70	3,68	1,08	1,24
8	7,05	80	40	4,5	7,4	8,98	89,4	22,4	3,16	13,3	12,8	4,75	1,19	1,31
10	8,59	100	46	4,5	7,6	10,9	174	34,8	3,99	20,4	20,4	6,46	1,37	1,44
12	10,4	120	52	4,8	7,8	13,3	304	50,6	4,78	29,6	31,2	8,52	1,53	1,54
14	12,3	140	58	4,9	8,1	15,6	491	70,2	5,60	40,8	45,4	11,0	1,70	1,67
14a	13,3	140	62	4,9	8,7	17,0	545	77,8	5,66	45,1	57,5	13,3	1,84	1,87
16	14,2	160	64	5,0	8,4	18,1	747	93,4	6,42	54,1	63,3	13,8	1,87	1,80
16a	15,3	160	68	5,0	9,0	19,05	823	103	6,49	59,4	78,8	16,4	2,01	2,00
18	16,3	180	70	5,1	8,7	20,7	1090	121	7,24	69,8	86,0	17,0	2,04	1,94
18a	17,4	180	74	5,1	9,3	22,2	1190	132	7,32	76,1	105	20,0	2,18	2,13
20	18,4	200	76	5,2	9,0	23,4	1520	152	8,07	87,8	113	20,5	2,20	2,07
20a	19,8	200	80	5,2	9,7	25,2	1670	167	8,15	95,9	139	24,2	2,35	2,28

22	21,0	220	82	5,4	9,5	26,7	2110	192	8,89	110	151	25,1	2,37	2,21
22a	22,6	220	87	5,4	10,2	22,8	2330	212	8,99	121	187	30,0	2,55	246
24	24,0	240	90	5,6	10,0	30,6	2900	242	973	139	208	31,6	2,60	2,42
24a	25,8	240	95	5,6	10,7	32,9	3180	265	9,84	151	254	37,2	278	267
27	27,7	270	95	6,0	10,5	35,2	4160	308	10,9	178	262	37,3	2,73	2,47
30	31,8	300	100	6,5	11,0	40,5	5810	387	12,0	224	327	43,6	2,84	2,52
33	36,5	330	105	7,0	11,7	46,5	7980	484	13,1	281	410	51,8	2,97	2,59
36	41,9	360	110	7,5	12,6	53,4	10820	601	14,2	350	513	61,7	3,10	2,68
40	48,3	400	115	8,0	13,5	61,5	15220	761	15,7	144	642	73,4	3,23	275

**Qo'shtavrli balkalar
(GOST 8239 - 56)**

Profil nomeri	O'lchamlari							O'qlarning spravka miqdorlari			
	h	b	d	t	R	r	x-x		y-y		



	1m uzuna- sining og'irligi kg	mm						Kesim yuzi, F sm ²	J _x sm ⁴	W _x sm ³	i _x sm	S _x sm ³	J _y sm ⁴	W _y sm ³	i _y sm																																																							
		100	120	140	160	180	200	220	12,0	14,7	17,4	20,2	23,4	25,4	26,8	28,9	30,6	198	350	572	873	1290	1430	1840	2030	2550	39,7	58,4	81,7	109	143	159	184	203	232	4,06	4,88	5,73	6,57	7,42	7,51	8,28	8,37	9,13	23,0	33,7	46,8	62,3	81,4	89,8	104	114	114	131	17,9	27,9	41,9	58,6	82,6	114	115	155	157	6,49	8,72	11,5	14,5	18,4	22,8	23,1
10	9,46	100	55	4,5	7,2	7	2,5	12,0	198	39,7	4,06	23,0	17,9	6,49	1,22																																																							
12	11,5	120	64	4,8	7,3	7,5	3	14,7	350	58,4	4,88	33,7	27,9	8,72	1,38																																																							
14	13,7	140	73	4,9	7,5	8	3	17,4	572	81,7	5,73	46,8	41,9	11,5	1,55																																																							
16	15,9	160	81	5,0	7,8	8,5	3,5	20,2	873	109	6,57	62,3	58,6	14,5	1,70																																																							
18	18,4	180	90	5,1	8,1	9	3,5	23,4	1290	143	7,42	81,4	82,6	18,4	1,88																																																							
18a	19,9	180	100	5,1	8,3	9	3,5	25,4	1430	159	7,51	89,8	114	22,8	2,12																																																							
20	21,0	200	100	5,2	8,4	9,5	4	26,8	1840	184	8,28	104	115	23,1	2,07																																																							
20a	22,7	200	110	5,2	8,6	9,5	4	28,9	2030	203	8,37	114	155	28,2	2,32																																																							
22	24,0	220	110	5,4	8,7	10	4	30,6	2550	232	9,13	131	157	28,6	2,27																																																							

22a	25,8	220	120	5,4	8,9	10	4	32,8	2790	254	9,22	143	206	34,3	2,50
24	27,3	240	115	5,6	9,5	10,5	4	34,8	3460	289	9,97	163	198	34,5	2,37
24a	29,4	240	125	5,6	9,8	10,5	4	37,5	3800	317	10,1	178	260	41,6	2,63
27	31,5	270	125	6,0	9,8	11	4,5	40,2	5210	371	11,2	210	260	41,5	2,54
27a	33,9	270	135	6,0	10,2	11	4,5	43,2	5500	407	11,3	229	337	50,0	2,80
30	36,5	300	135	6,5	10,2	12	5	46,5	7080	472	12,3	268	337	49,9	2,69
30a	39,2	300	145	6,5	10,7	12	5	49,9	7780	518	12,5	292	436	60,1	2,95
33	42,2	330	140	7,0	11,2	13	5	53,8	9840	597	13,5	339	419	59,9	2,79
36	48,6	360	145	7,5	12,3	14	6	61,9	13380	743	14,7	423	516	71,1	2,89
40	56,1	400	155	8,0	13,0	15	6	71,4	18930	947	16,3	540	666	85,9	3,05
45	65,2	450	160	8,6	14,2	16	7	83,0	27450	1220	18,2	699	807	101	3,12

koeffitsientini topish jadvali

Egiluvchanlik λ	Po'latlar St. 2, St.3, St 4	Po'lat St. 5	Maxsus po'lat $\sigma_{oq} = 32 \cdot 10^4$ N/sm ²	Cho'yan	Yog'och
0	1,00	1,00	1,00	1,00	1,00
10	0,99	0,98	0,97	0,97	0,99
20	0,96	0,95	0,95	0,91	0,97
30	0,94	0,93	0,91	0,81	0,93
40	0,92	0,89	0,87	0,69	0,87
50	0,89	0,86	0,83	0,57	0,80
60	0,86	0,82	0,77	0,44	0,71
70	0,81	0,76	0,72	0,34	0,60
80	0,75	0,70	0,65	0,26	0,48
90	0,69	0,62	0,55	0,20	0,38
100	0,60	0,51	0,43	0,16	0,31
110	0,52	0,43	0,35	-	0,25
120	0,45	0,39	0,30	-	0,22
130	0,40	0,33	0,26	-	0,18
140	0,35	0,29	0,23	-	0,16
150	0,32	0,26	0,21	-	0,14
160	0,29	0,24	0,19	-	0,12
170	0,26	0,21	0,17	-	0,11
180	0,23	0,19	0,15	-	0,10
190	0,21	0,17	0,14	-	0,09
200	0,19	0,16	0,13	-	0,08

TAVSIYA ETILGAN ADABIYOTLAR RO‘YXATI:

1. **Saidiy S.A.** “Qurilish mexanikasi”. Uslubiy qo‘llanma va nazorat topshiriqlari.- Toshkent-2022. 71 b.
2. **Z.S.Shadmanova.** Materiallar qarshiligi. O‘quv qo‘llanma. T.:2018. -169 b.
3. **Saidiy S.A.** Kolonnani nomarkaziy siqilish va cho‘zilishga hisoblash. – Tashkent: 2018. – 28 b.
4. **Ismayilov K., Toshev S.K., Amanov S.S., Xoliqov D.S.** Materiallar qarshiligi. O‘quv qo‘llanma. Toshkent.: “Mashhur-press”, 2019. – 320 bet.
5. **Usmanqulov A.Q., Ismayilov K., Adilov O.K., Yaxshiboyev Sh.R.** Materiallar qarshiligi. O‘quv qo‘llanma 1-qism. Toshkent.: “Mashhur-press”, 2018. – 344 bet.
6. **Shadmanova Z.S., Raxmanov B.K.** Materiallar qarshiligi fanidan misol va masalalar. O‘quv qo‘llanma. – Toshkent.: 2018. – 164 bet.
7. **Maksudova G.A., Xoltayeva A.K.** “Qurilish mexanikasi (Materiallar qarshiligi)” fanidan hisob-grafik ishini bajarish bo‘yicha o‘quv-uslubiy ko‘rsatma va nazorat topshiriqlari –Toshkent:, 2022. – 36-b.
8. **Ibragimov N.M., Xoltayeva A.K.** “Qurilish mexanikasi (Materiallar qarshiligi)” fanidan hisob-grafik ishini bajarish bo‘yicha O‘quv-uslubiy ko‘rsatma va nazorat topshiriqlari –Toshkent:, 2021. – 36-b.