-

23 2022

: **4**

):

:

4

7

- 72

:

2022

-7	, .

-

-

. . .

- .

					-
1.		8	2	4	2
2.		8	2	4	2
3.		8	2	4	2

4.		8	2	4	2
5.		8	2	4	2
6.		8	2	2	4
7.		10	2	4	4
8.		9	1	4	4
9.		5	1	2	2
		72	16	32	24

1.

2. .

.

:

.

-

-

. . . -

.

.

.

:

_____

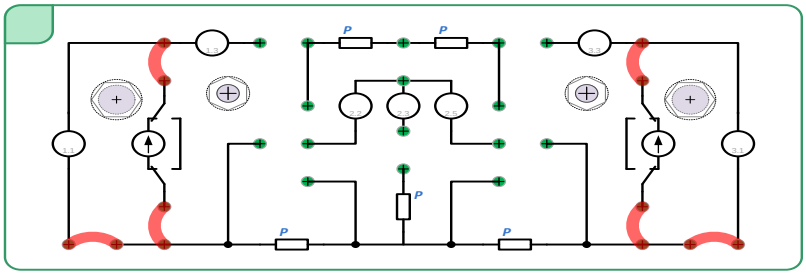
-

_____

_____

.

SA SA



.

A SA

TV

TV SA1

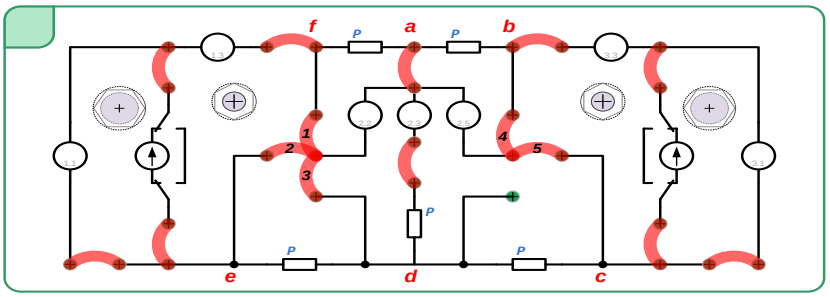
E PV1=PV

TV

A SA

c

A SA



I1 (PA1),I2(PA I3(PA

f (PV PV a.

e (PV b

(PV a.

d (PV a.

A SA

1

E1(PV1)	E2(PV3)	a	b	c	e	f	I1(PA1)	I2(PA2)	I3(PA3)
B	B	B	B	B	B	B			

Uab	Ubc	Ucd	Ude	Uef	Ufa	Uda	R31	Rbc	R32	R33	Ref	R32	R35
B	B	B	B	B	B	B							

SA SA

I I I

SA4 SA

I I I

A SA

I1'	I2'	I3'	I1"	I2"	I3"	I1	I2	I3

A15.

TV

SA

:

$_{ab}$, U_{bc}, U_{cd}, U_{de}, U_{ef}, U_{fa}, U_{da}

$_{31}$, R_{32}, R_{33}, R_{34}, R_{35}

$_{bc}$, R_{ef}

1.

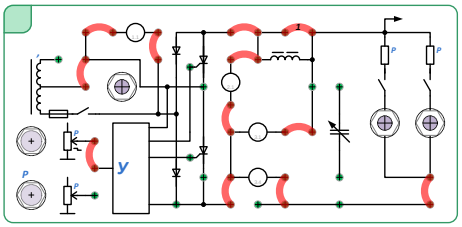
$_{32}$, E_1 R_{31}, R_{34}, E_2, R_{34},

.

2.

.

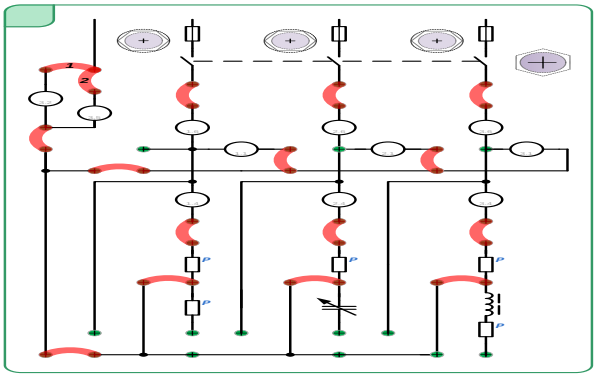
α	U_0	U_1	U_2	U	φ_1	φ_2	φ_3
30	0,594	0,491	0,123	0,0546	83,8	52,7	2.56
45	0,543	0,543	0,121	0,06	73,7	5,91	77,7
60	0,477	0,551	0,110	0,098	60,0	-60,0	-16,1
75	0,401	0,532	0,131	0,124	44,0	45,8	87,8
90	0,318	0,474	0,175	0,111	26,6	-14,0	9,46
105	0,236	0,386	0,201	0,0874	8,15	-62,9	-86,9



6. *L7*
L
L7

7. *SA6.*
8. *PV2* *PA3*
PV .
9. *R36* *R36* 150^0 60^0,
).
10. *PA3, PV3.*
11. *PV1*
PV .
12. *SA6.*
13. *1.*
14. *SA6.*
15.
PA3
PV3-U_0 .
16.
L-
17.
- *QF1, QF2, QF3.*
-
- *SA6, SA8,* *R39*
150^0.;
-

.



PA

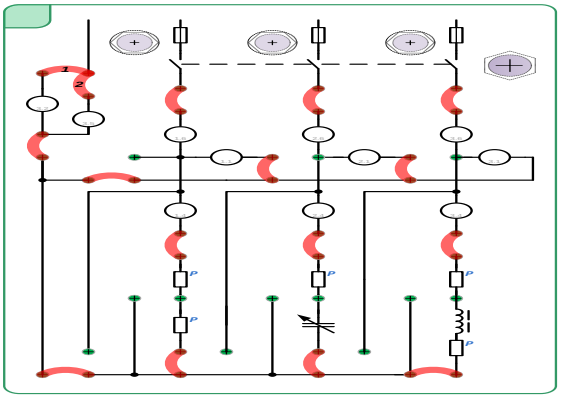
R40 = R41 = R42.

PV1 U_{A1}; PA1-I_{A1}; PV2 U_{B1}; PA2- I_{B1}; PV3 U_{C1}; PA3 I_{C1}; PA4 I_{nN}; PW1 -

SA9.

QF1, QF2, QF3.

.



PV1 U_{A1}; PA1-I_{A1}; PV2 U_{B1}; PA2- I_{B1}; PV3 U_{C1}; PA3 I_{C1}; PV4 U_{nN}; PW1

SA9.

QF1, QF2, QF3.

(

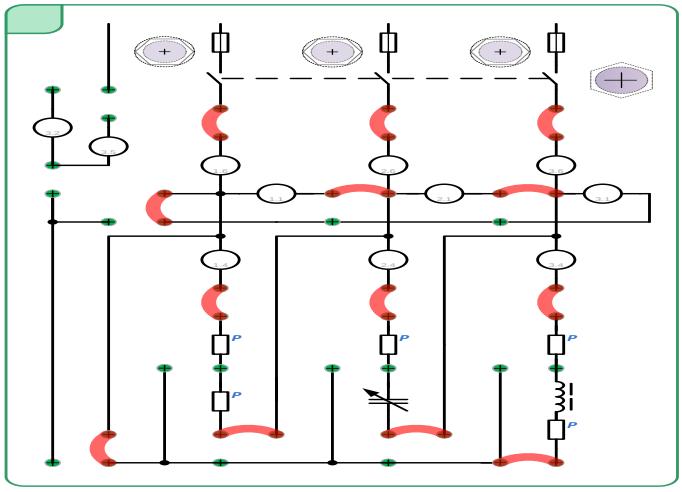
QF1, QF2, QF3.

PV1 U_{A1}; PA1 I_{A1}; PV2 U_{B1}; PA2 I_{B1}; PV3 U_{C1}; PA3 I_{C1}; P 4 I_N; PW1

QF1, QF2, QF3.

C

4.



PA1 = PA2 = PA PV1 U_{A1B1}; PA1-I_{A1B1}; PA5-I_{A1}; PV2 U_{A1C1}; PA2- I_{B1C1}; PA6- I_{B1}; PV3 U_{A1C1}; PA3 I_{A1C1}; PW1

-

C PA7 $I_{C1.}$

QF1, QF2, QF3.

.

-6.

SA

TV

TV SA

TV

TV2)

PA1 (I_{10}), PV1 (U), PW1 (P_0), PV2 (U

U_1 (PV1), B	**$I_{10,\ 2}$ (PA1), A**	**P (PW1)**	**U_2 (PV2), B**	**S,**	**Z,**	**XL,**			
220	**(PA1)**								
	0.8 (PA2)		**0**						

TV

SA

TV3).

TV

A TV2)

PA1 (I), PV1 (U), PW1 (P_1

TV

SA

=1.

SA

R49

TV

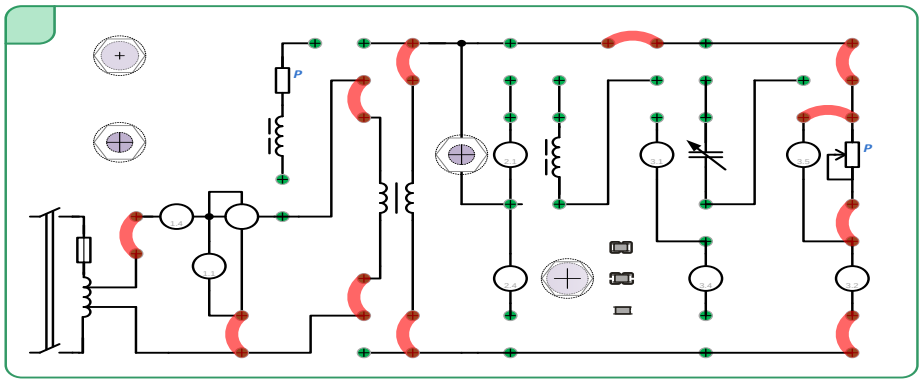
TV SA

TV

TV2)

R

I (1APA2).



TV

SA

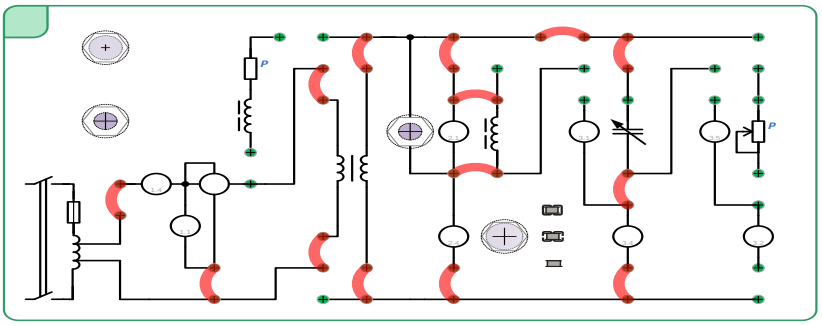
R

R49,	**U_1 (PV1), B**	**I_1 (PA1), A**	**P (PW1),**	**U_2 (PV2), B**	**I_2 (PA2), A**	**U_2%**	
-	**220**				**0**		
220							
198							
176							
154							
132							
110							

R44, L

3

		U2, B
0		
0,1		
0,2		
0,3		
0,4		
0,5		
0,6		
0,7		
0,8		
0,9		
1		



C C

SA

TV

TV SA

TV

TV

TV I_1), PV1 ($U_{1.}$), PW1 (P_1), PV2 (U_2), PA (I_2

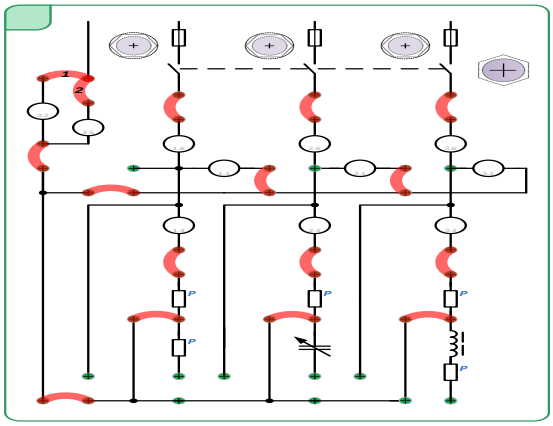
C2.

(I_1), PV1 ($U_{1.}$), PW1 (P_1), PV2 (U_2), PA2(I_2).

TV

SA

.



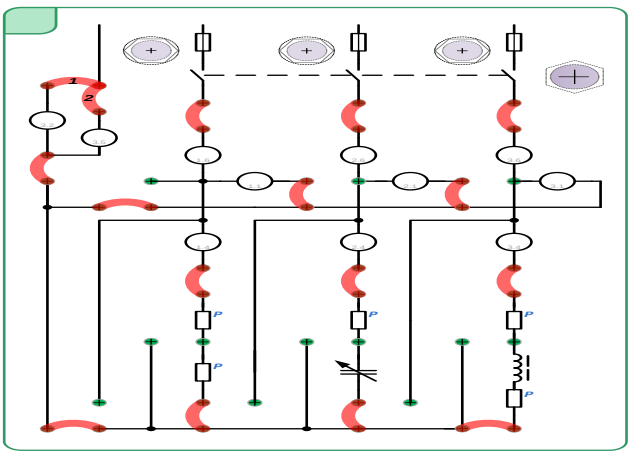
PA

R40 = R41 = R42;.

PV1 U_{A1}; PA1-I_{A1}; PV2 U_{B1}; PA2- I_{B1}; PV3 U_{C1}; PA3 I_{C1}; PA4 I_{nN}; PW1 -

SA9.

.



PV1 U_{A1}; PA1-I_{A1}; PV2 U_{B1}; PA2- I_{B1}; PV3 U_{C1}; PA3 I_{C1};

PV4 U_{nN}; PW1

SA9.

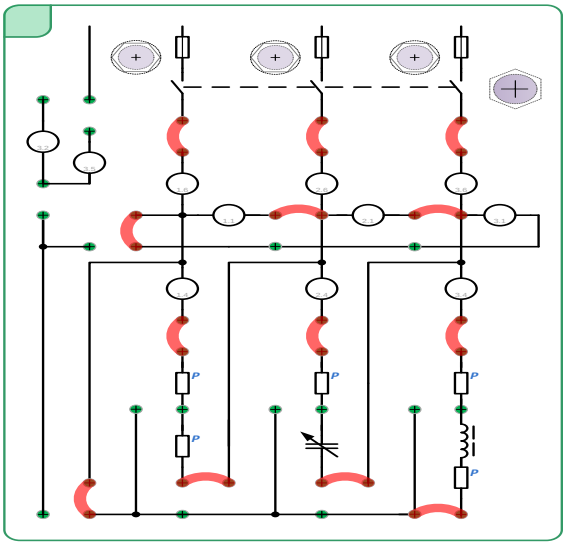
PV1 U_{A1}; PA1 I_{A1}; PV2 U_{B1}; PA2 I_{B1}; PV3 U_{C1}; PA3 I_{C1}; P 4 I_N; PW1

QF1, QF2, QF3.

C2

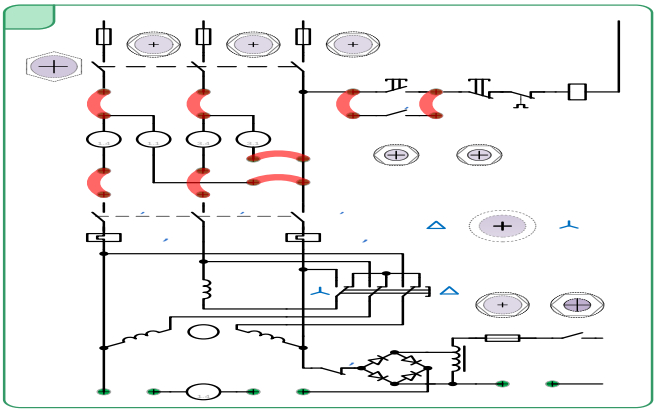
.

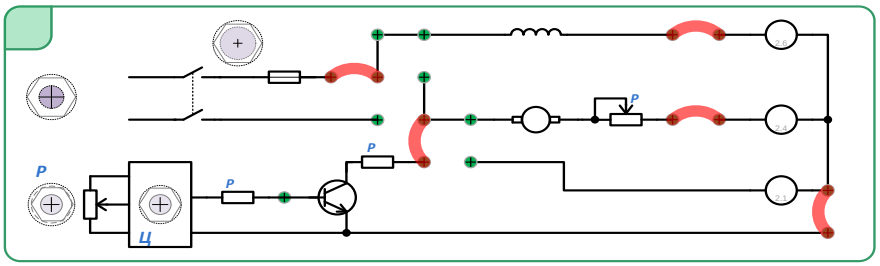
.



PA1 = PA2 = PA PV1

U_{A1B1}; PA1-I_{A1B1}; PA5-I_{A1}; PV





I), PV1 (U), PW1 (P1), PA6(I), PA2(I) BR1(n,

min

M_0 I (PA R

I $_1$), PV1 (U), PW1 (P1), PA6(I), PA2(I),BR1 (n

	n (BR1),	**I**	**P1 (PW1),**	**U** $\frac{PV1}{\sqrt{3}}$	**I PA1), A**
1	1490				
2	1350				
3	1200				
4	1050				
5	900				
6	750				
7	600				

B2.

SA10

min

M_0

P

2.

	S					

,

η = f φ1 = f(P2).

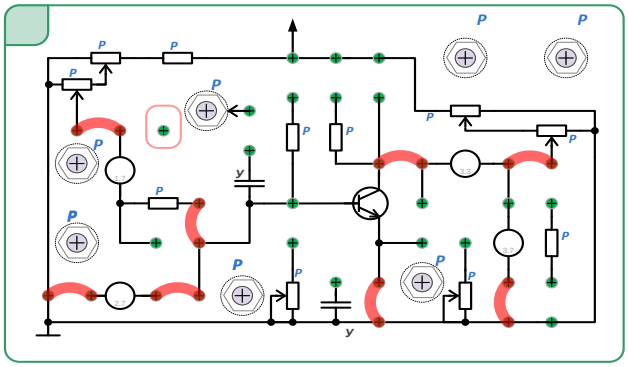
.

-

.

-

.



SA SA
R3, R4, R10, R R

U

R11 R
U PV3.
U I =f(U U
PV I PA U
R R

U U
R R PV

U PV2)	U PV3)	U =5 PV3)	U =10 PV3)
	I		

R3, R4, R10, R R

I I R R
I PA2.
U I =f(U U
PV I PA U
R R

U (PV3)	I (PA2)	I =100 (PA2)	I =1 (PA2)	I =200 (PA2)
	I			

I I
R R I PA

R3,R4, R R

R

-P-

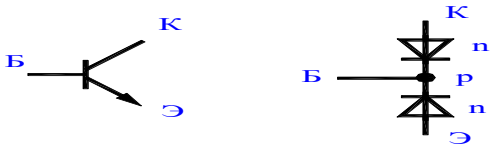
f21 = 100 M h -

R R R

-

n- p-

.



I

I

$$h_{FE} = \frac{\Delta I_K}{\Delta I_B}$$

U

I U

s: $S = \frac{\Delta I_К}{\Delta U_{БЭ}}, U_{КЭ} = const$

$$I = I_S \cdot (T, U_{КЭ}) \cdot e^{U_{БЭ}/U_T},$$

$$S = \frac{I_К}{U_T}$$ I_S - T - U

- 5,5m

-

: $r_{КЭ} = \frac{\Delta U_{КЭ}}{\Delta I_К}$

$$r_{БЭ} = \frac{\Delta U_{БЭ}}{\Delta I_Б} = \frac{h_{FE}}{S}$$

I_{KMAX} - U_K ,

- U

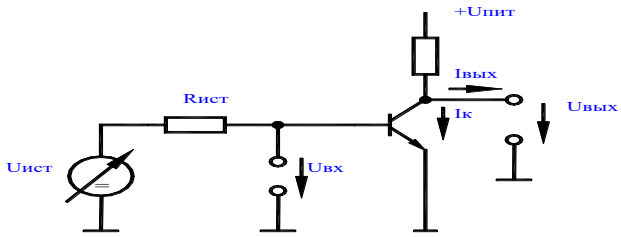
- U_{MAX} f .

.

U =

ΔU

$$\Delta I_К = S \cdot \Delta U_{ВХ}$$



R

R U :

$$\Delta U_{ВЫХ} = -\Delta I_К \cdot R_К = -S \cdot R_К \cdot \Delta U_{ВХ}$$

:

$$K_U = \frac{\Delta U_{ВЫХ}}{\Delta U_{ВХ}} = -S \cdot R_К$$

:

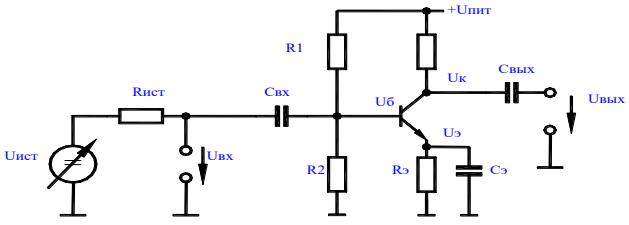
$$r_{БЭ} = \frac{\Delta U_{БЭ}}{\Delta I_Б} = \frac{h_{FE}}{S} = h_{FE} \cdot \frac{U_T}{I_К}$$

R r

$$R_{ВЫХ} = \frac{\Delta U_{ВЫХ}}{\Delta I_{ВЫХ}} = \frac{R_К}{r_{КЭ}}$$

R

$$K_U = \frac{\Delta U_{ВЫХ}}{\Delta U_{ВХ}} = \frac{-R_К}{R_Э}$$



: $r_{ВХ} = h_{FE} \cdot (S + R_Э)$

R .

R

-

$$r_{БЭ} = h_{FE} \cdot \frac{U_T}{I_К}$$, R1, R

r_U .

- r R1, R

R1, R r .

R U U

U

U U U

U

-

U

R

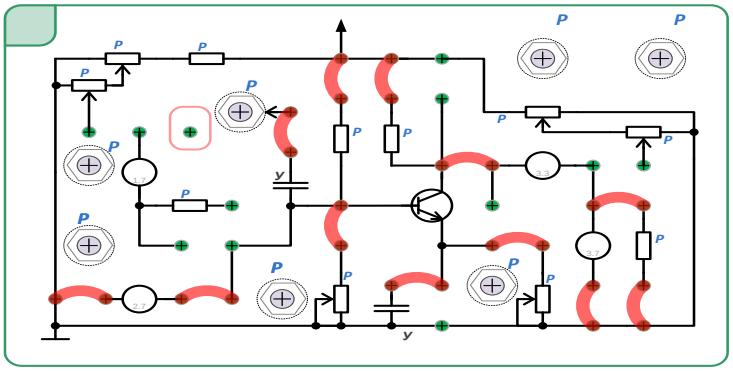
ΔU :

$$U_К = U_Э + U_{КЭН} + |\Delta U_{ВЫХ}|$$

R

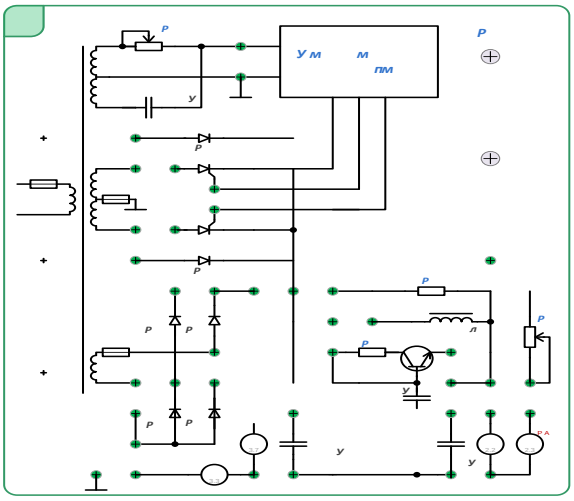
f = S/2π

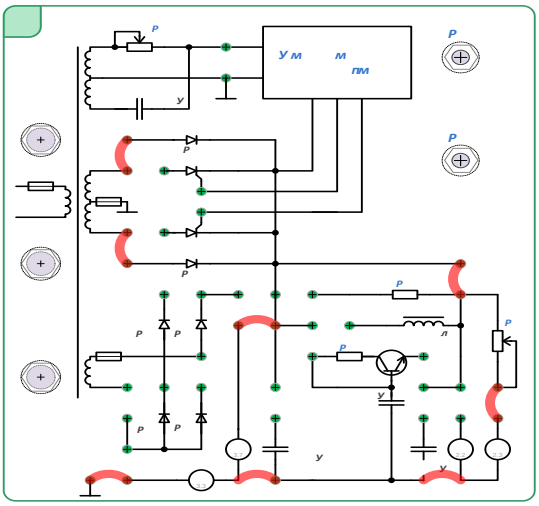
S R R .

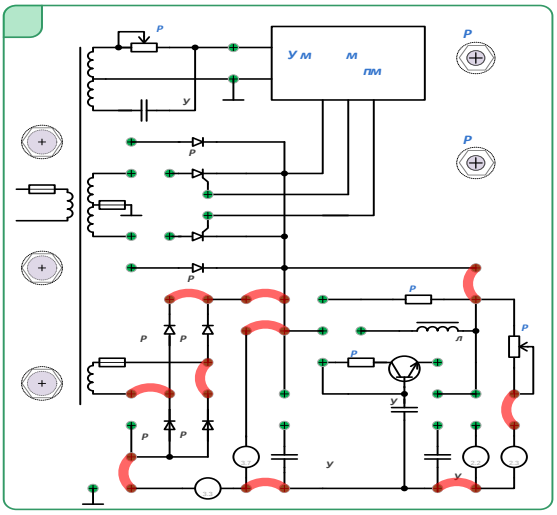


14-15

.







Laboratory work number

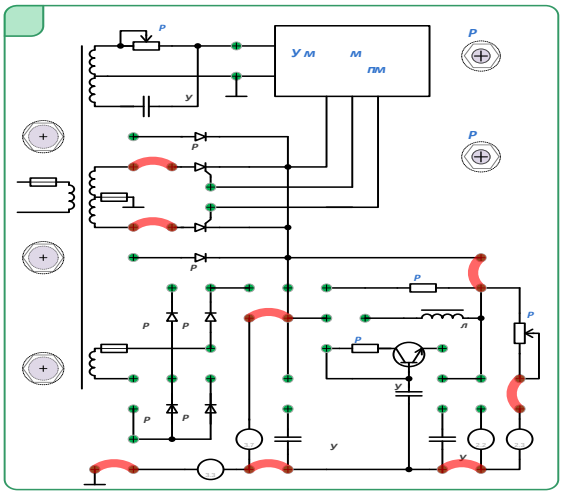
R

PV PA

U=f(I).

R max

.



Laboratory work number

R

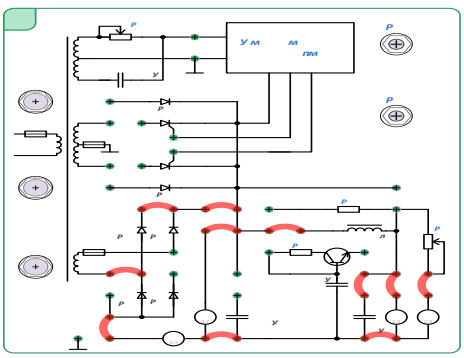
PV PA

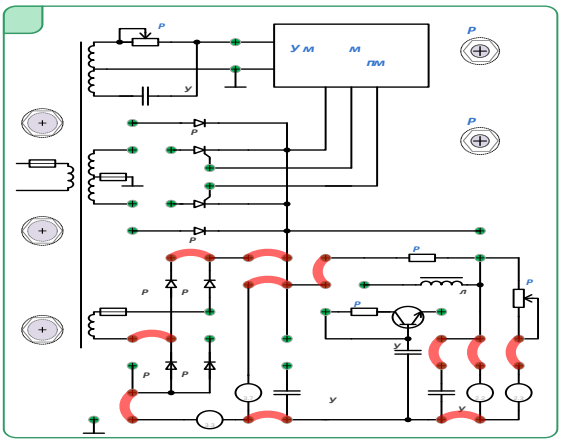
R19.

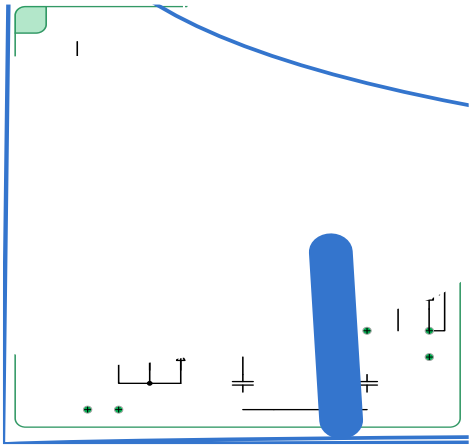
R max

.

.







-

-

1

(

	1
	1
	1
	1
	1
	- 5

2

1)

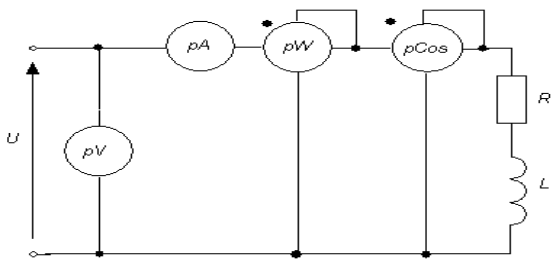
.

3.

U =

R =

L = 2

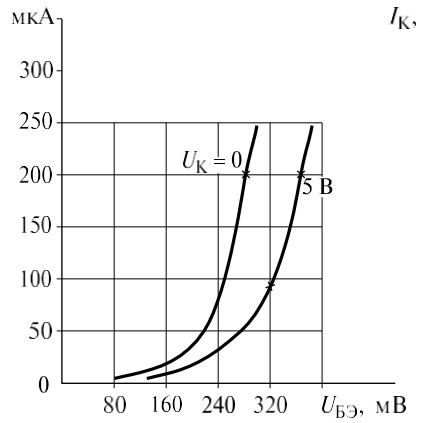


2. $p = 5$

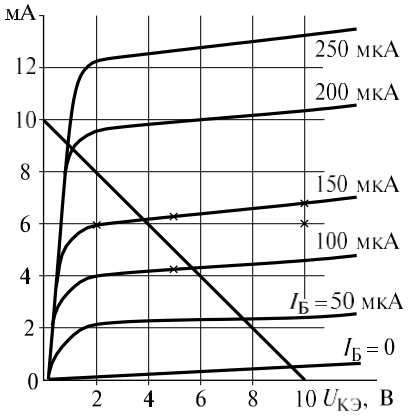
$f = 40$, $s = 4$ %.

h-

$= 5$ $l =$.



$I_К$,

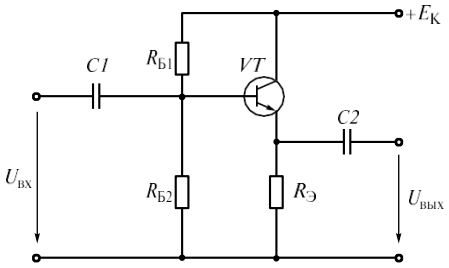


l,

R R

h_{11} $h_{21} = 46$,

h_{22} 4 $R = 1$



		*)
1		

(*)

1		3,75-4
2		2,75-3,5
3		2-2,5
4		

-
-
-

7.

1. /

2021. 266 URL: https://urait.ru/bcode/469947.

2. 285 URL: https://urait.ru/bcode/468830.

3. URL: https://urait.ru/bcode/470336.

4.]. URL: https://urait.ru/bcode/470337.

5. URL.

1. 2010. 344 c. - URL: https://www.iprbookshop.ru/18444.html .

2. 360 c. - URL: https://www.iprbookshop.ru/18445.html .

3. 162 c. - URL: https://www.iprbookshop.ru/23864.html.

4. 268 URL: https://urait.ru/bcode/479061.

5. / 228 URL: https://urait.ru/bcode/471059.

6. URL: https://urait.ru/bcode/450784.

7. URL: https://urait.ru/bcode/468614.

8. URL: https://urait.ru/bcode/469887.

9.

URL: https://urait.ru/bcode/470590.
10.

URL: https://urait.ru/bcode/451677.
11.

2021. URL: https://urait.ru/bcode/470589.
12.

URL: https://urait.ru/bcode/473182.

-

1. http://window.edu.ru/.
2. http://www.intuit.ru/.
3. -

URL: https://iprbookshop.ru/.
4. -

https://cxem.net/software/electronics_workbench.php.

1. https://internet-law.ru/gosts/2814/.
2. https://radio-komplekt.ru/handbook.php.
3. https://radiosvod.ru/.
4. https://www.radioman-portal.ru/sprav/microcontrollers/.
5. - http://radionet.com.ru/.
6. https://www1.fips.ru/registers-web/.
7. : http://www.chipinfo.ru/.
8. QRZ.RU https://www.qrz.ru/beginners/.
9. LAN: https://www.osp.ru/lan
10. http://xn----8sbnaarbiedfksmiphlmncm1d9b0i.xn--p1ai/.

-

,

- -01
-

.

9.

Microsoft Open License (Windows XP, 7, 8, 10, Server, Office 2003-2016), 66975477 03.06.2016 ( ).

IPRbooks

-

ДОКУМЕНТ ПОДПИСАН
ЭЛЕКТРОННОЙ ПОДПИСЬЮ

Сертификат: 03B6A3C600B7ADA9B742A1E041DE7D81B0
Владелец: Артеменков Михаил Николаевич
Действителен: с 04.10.2021 до 07.10.2022