

CIRCUITS AND SYSTEMS LABORATORY

EXERCISE 3

WYE-CONNECTED, THREE-PHASE CIRCUITS

1. PROGRAM OF EXPERIMENTS

1.1. DEVICES AND PANELS USED IN EXERCISE

The following devices are to be used in this exercise:

- 3-phase power supply panel, signed “Zasilacz trójfazowy”,
- 3-phase resistance panel, signed “Odbiornik trójfazowy – R”,
- 3-phase inductance panel, signed “Odbiornik trójfazowy – L”,
- 3-phase capacitors panel, signed “Odbiornik trójfazowy – C”,
- moving iron ammeters, voltmeters and wattmeters.

1.2. ELEMENTS CONFIGURATION

Examined 3-phase load is composed of R , L and C elements which are to be coupled in pairs for individual phase. Each element type can be configured to represent one of three resultant values as shown in figure 1. Such flexibility allows number of various balanced and unbalanced load configuration.

The teacher running the class is to assign elements configuration variant (a, b or c) in accordance with figure 1. The particular elements configuration choice should result in similar impedance module. Chosen configuration variant should be indicated in table 1 together with approximate value of elements and individual phase impedance value and it's configuration diagram.

Table 1

Elements' parameters for wye-connected load

R	a	b	c	$R =$
L	a	b	c	$X_L =$
C	a	b	c	$X_C =$
<i>(Load phase configuration diagram)</i>				$Z_A =$

1.3. WYE-CONNECTED CIRCUITS

Examination of wye (star) connected 3-phase circuits is conducted with use of measuring configuration shown in figure 2.

The results of voltages, currents and powers measuring for particular 3-phase circuits should be written in table 2.

The power supply allows selection of 11, 22, 33 and 44 V input for single phase.

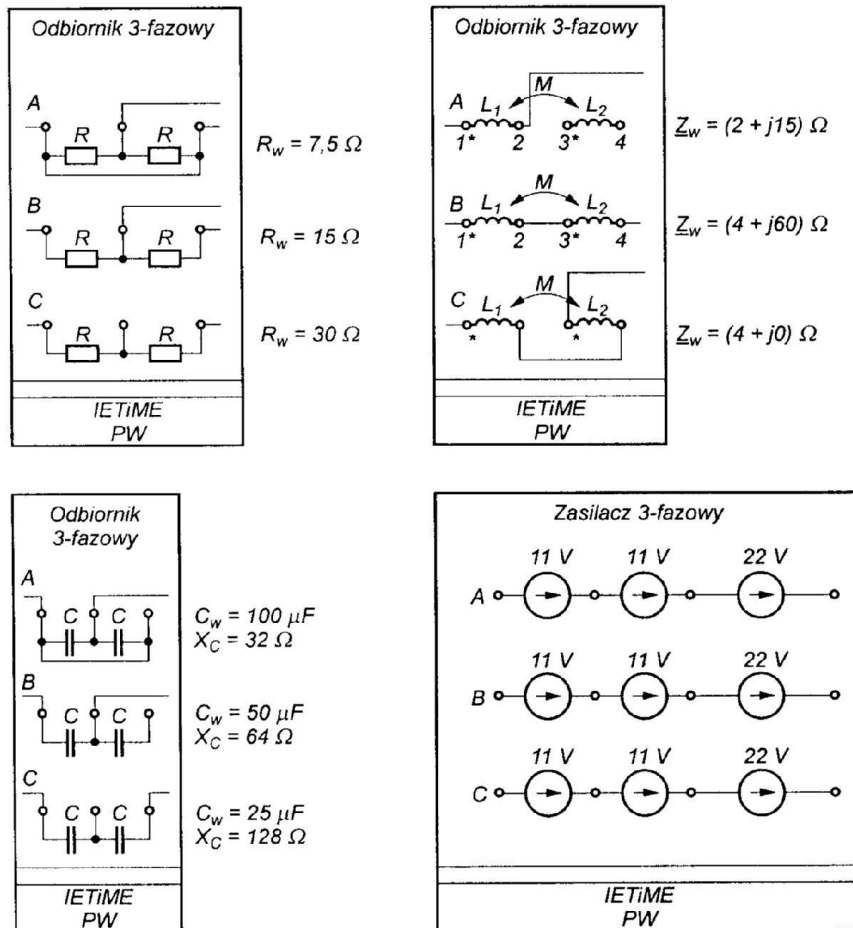


Fig. 1 Panels of elements and power supply with its values and configuration

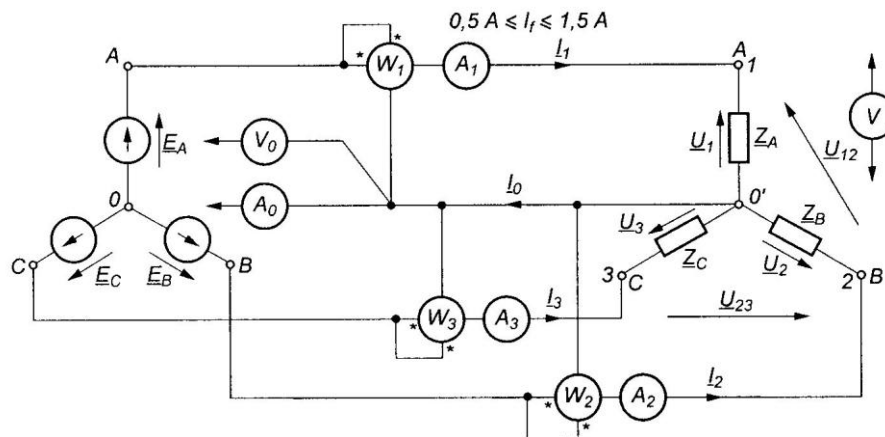


Fig. 2 Wye-connected circuit diagram used for examination

2. RESULTS PROCESSING

On the basis of the results gained in the exercise, one should draw a scaled vector graphs using graph paper for each of examined 3-phase circuit. Knowing the input voltages and load phases impedance, the theoretical graphs should be drawn and compared with the analogue experimental graphs.

The example calculations for two variants from table 2 should be included in the report. The calculations should be proceeded as for a 3-phase unbalanced circuit problem, where phase impedances and input voltages are known.

The report should also include one's own conclusions of measuring, calculations and graphs made in the exercise.

Table 2

Examination results for wye-connected load

–	Measurements															Calculations										
	E	P_1	P_2	P_3	I_1	I_2	I_3	U_1	U_2	U_3	U_{12}	U_{23}	U_{31}	U_N	I_N	Z_A	Z_B	Z_C	\underline{Z}_A	\underline{Z}_B	\underline{Z}_C	P_{3f}	Q_{3f}	S_{3f}	$\cos\phi$	
	V	W	W	W	A	A	A	V	V	V	V	V	V	V	A	Ω	Ω	Ω	Ω	Ω	Ω	W	var	VA	–	
a																										
b																										
c																										
d																										
e																										
f																										
g																										

where:

- a – balanced load with neutral wire
- b – balanced load without neutral wire
- c – unbalanced load (R shorting in phase A , B or C) with neutral wire
- d – unbalanced load (R shorting in phase A , B or C) without neutral wire
- e – unbalanced load (A , B or C phase break of balanced load) with neutral wire
- f – unbalanced load (A , B or C phase break of balanced load) without neutral wire
- g – unbalanced load (A , B or C phase shorting of balanced load) without neutral wire, $E = 11$ V