Faculty:		FACULTY OF ELECTRICAL ENGINEERING			
Course	:	Common Third Year Laboratory	Review	:	4
Course Code	:	SEEE 3732	Release Date	:	13 September 2023
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FACULTY OF ELECTRICAL ENGINEERING
UNIVERSITI TEKNOLOGI MALAYSIA
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SEEE 3732
BASIC POWER LABORATORY

THREE-PHASE AC POWER

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EXPERIMENT: THREE-PHASE AC POWER

LEARNING OBJECTIVES:

After completing this lab, you will be able to:

1. Differentiate the active and reactive power in three-phase circuits consisting different combinations of different loads: R, L and RL loads.
2. Analyze the impact of capacitor connection configuration towards power factor correction.

INTRODUCTION:

In AC circuit there are two types of power, which is the real power and reactive power. The values of these powers depend on the combination of load elements which are resistor, inductor and capacitor. Energy consumption is charged differently for real power and reactive power. Hence, certain combination of load elements is more favorable to the customer.

Recommended references:

(i) ***Alexander & Sadiku***, 'Fundamental of Electric Circuit 7th edition', *McGraw Hill, 2021***.**

(ii) ***Hughes,*** Electrical and Electronic Technology, the 12th Edition, *Pearson, 2016*.

EQUIPMENT:

Power supply module.

R, L, and C load banks.

Three phase Watt-Varmeter module.

Multimeters

Precautions

1. ***Energized electrical circuits are present in this laboratory experiment. Do not make any connections with the power ON.***
2. ***The leads coming from the source must be connected to the 3-phase Watt/Varmeter terminals in the order of their phase sequence.***
3. ***Set the multimeter appropriately before switching ON the power supply. Always ask the supervisor or laboratory technician to check the experiment connection before SWITCHING ON the power supply.***

PROCEDURE:

415 V three phase source, voltmeters, ammeters, three phase Watt/Varmeter, three types of balanced three phase load (R and L); are available for use.

EXPERIMENT 1

1) Set the input AC supply to be fixed 240/415 on the LabVolt Series 8821-2A trainer.
2) Set up a circuit based on the block diagram in Figure 4(b) of the preliminary work.
3) Measure the phase voltages, phase currents, active power and reactive power.
4) Calculate the apparent power and power factor.
5) Repeat step (2) to (3) for different load elements and various combinations of load elements (L).
6) Investigate why there is a real power value in purely inductive load. Justify your answer by doing measurements using a multimeter.
7) Repeat steps (2) to (3) for different load elements and various combinations of load elements (RL). Use the same R-value for all combinations.
8) Analyze the difference in the real power consumption between R and RL circuits.

EXPERIMENT 2

1) Referring to EXPERIMENT 1, choose the worst power factor for RL load as a base case of EXPERIMENT 2.
2) Identify the impacts of different combinations of capacitance values towards power factor correction for the base case selected in (1) using star and delta connection configurations.
3) Suggest the best capacitance value and connection configuration to avoid power factor surcharge.

EXPERIMENT 3

1) Set the input AC supply to be 0-240/415 on the LabVolt Series 8821-2A trainer.
2) Change the load of the system to the three-phase synchronous motor.
3) Measure the phase voltages, phase currents, active power and reactive power.
4) Use the suitable configuration of the circuit element(s) provided in the LabVolt trainer to improve the power factor of the synchronous motor load system.

5) Suggest the best value and connection configuration of the circuit element(s) to avoid power factor surcharge.

RESULT, DATA ANALYSIS AND CONCLUSIONS

1. Complete results of EXPERIMENTS 1, 2 and 3 must be neatly presented in appropriate tables or/and figures.
2. Analyze and discuss the results of EXPERIMENTS 1, 2 and 3. Your analysis and discussion should include the following items:
   i. The difference in real and reactive power for different types and sizes of load.
   ii. Justification for the presence of real power in purely inductive load.
   iii. The difference in capacitance value and connections configuration towards the power factor correction. Draw the circuit diagram of these configurations.
   iv. The power triangle for each case.
3. Answer and conclude the objective of the experiment.

ADDITONAL INSTRUCTION

SHORT REPORT

1. Include all results and the data analysis of all experiments.
2. Follow the general report format and structure that consists of title, introduction, objectives, procedure, results, discussion & analysis and conclusion.
3. Use passive sentences in the report.
4. Please make sure to refer to the provided rubric on the website while preparing the short report.

LONG REPORT

1. Include all results, data analysis and discussions of all experiments.
2. Follow the general report format and structure that consists of cover page, title, theory & background, objectives, procedure, results, discussion & analysis, conclusion, and references.
3. Use passive sentences in the report.

4. Extend your report discussions by relating your findings and discussions (EXPERIMENT 1, EXPERIMENT 2 and EXPERIMENT 3) with the real power system operation.
5. Perform the analysis using **appropriate software** to validate your experimental results of all experiments.
6. Please make sure to refer to the provided rubric on the website while preparing the long report.