



National Centre for Maritime Engineering and Hydrodynamics

JEE326
Instrumentation and Process Control
Investigative Study
Control Engineering Lab Exercises

BE (OE & MOS) - Year 2

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JEE326 Instrumentation and Process Control

Investigative Study – Control Engineering Lab Exercises

Introduction

The aims of this unit are to:

- ❑ To introduce students to fundamentals of instrumentation, methods of common measurements in marine and process industries, and Australian standard graphical symbols used in instrumentation and process control engineering.
- ❑ To provide students with basic control theory, knowledge and understanding of control systems and their components and performance.
- ❑ To introduce students to control applications in marine and offshore industries.

Thus, in addition to class lectures, tutorials and assessment, the unit also includes a number of experiments designed to introduce students to the procedures to calibration of a measuring system. In order to successfully complete the unit, the students in addition to passing all assessments, must participate in the designated experiments and complete all relevant reports. Note: the experimental results and the relevant theory will assist the students in completing the formal assessment.

This investigative study focuses on practical aspects of the subject such as identification of measuring devices, calibration of temperature measuring systems, flow measuring system, level measuring system, pressure measuring systems, determination of characteristics of transducers/transmitters and actuators and operation of micro-processor-based controllers, computer-based control systems using data acquisition boards (NI PCI-6036E), MATLAB/Simulink and Data Acquisition Toolbox.

Learning Outcomes and Generic Graduate Attributes

This investigative study is designed to address the following learning outcomes:

- Describe methods to measure temperature, pressure, flow, level
- Explain procedures to calibrate measuring systems;
- List variables in the temperature measuring system, pressure, flow and level measuring systems
- Apply Australian standard graphical symbols in drawing instrumentation and control systems
- Explain open-loop control systems
- Explain On-Off control systems
- Explain PID (closed-loop) control systems.

The following generic graduate attributes are also addressed:

- Ability to apply knowledge of basic science and engineering fundamentals;
- Ability to understand problem identification, formulation and solution.

Occupational Health and Safety

When you are doing exercises/experiments in the Control Engineering Lab, there are some hazards and risks such as electric shock, boiling water burning, and pressured-air exploding, etc.

1. Do not touch or operate any machines other than those for experiments.

2. When doing exercises with the temperature measuring system, because you use ice and boiling water, your hands get wet and there is a risk of burning. There is also a risk of electric shock if you touch any electric devices. Be careful when handling with the boiling water beaker. Dry your hands before handling any electric devices.
3. Pay attention to the lecturer's instructions.
4. Students are required to wear lab-coats or full overalls, safety shoes, and clear safety glasses with side ingress protection, and a full hair restraint if processing long hair.

Laboratory Experiments

Each student is required to complete *all 2 compulsory labs (with 6 experiments)* below:

1. Lab 1 Instrumentation

- 1.1 Calibration a thermocouple temperature transmitter and determination of its time constant
- 1.2 Determination of characteristics of an RTD transducer
- 1.3 Determination of coefficient/s of an RTD

2. Lab 2 Process Control

- 2.1 Open-loop Control Systems
- 2.2 On-Off Control Systems
- 2.3 PID Control Systems

Due Date

Two weeks after commencement of experiments.

Assessment weight

Lab report weights 15% of the unit marks.

Report

The group report *must be typed neatly with Word processor* and consist of (but not limited) the following headings:

1. Cover page with: experiment title, date the lab was conducted, location, names of all group members and signatures. You may use the prescribed form distributed by the Department office.
2. Title and introduction
3. Relevant theory, including sketches
4. Experimental procedure, including sketches
5. Results, calculations, graphs, sketches, etc.
6. Discussions
7. Conclusions
8. References if any
9. Appendix and attachment, if required.

The group report must be completed using the assignment template provided on the web.