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# **CHAPTER 1**

## **INTRODUCTION**

Measurement of fluid flow is not only necessary in the research laboratories but is used in almost all types of industries. The need of measuring fluid flow measurement, ranges from biological applications such as measurements of blood flow rate in the human artery to highly advance application such as measurement of the flow of liquid oxygen in a rocket.

Fluid flow measurement techniques and devices can be very simple and cheap or be very sophisticated and technologically advanced, which only specialized research centers would be able to own.

The purpose of this project is for the students to gain as much theoretical knowledge and practical experiences on fluid flow measurements devices and technique as possible, particularly those which are widely used in industries and laboratories. In order to achieve the above objectives, the following course of actions were formulated.

1. Literature search from collections of fluid mechanics and specialized books of fluid flow measurements. The objective is to collect as much information on different devices and techniques of flow measurement. The internet was also used as a source of information.

2. A visit to SIRIM was arranged to collect information pertaining to the guidelines and relevant standards for flow measurement for industrial applications.
3. The importance of calibration of devices prior to its use was addressed by simple calibration exercises using available flow meters, namely orifice plate and venturi flow meters in the lab.
4. Students were exposed to the laser doppler anemometer (LDA) techniques at the Faculty of Mechanical Engineering laser lab. Students have a first hand look at the equipments and able to identify the functions of the important components.
5. Lastly, a visit was arranged to the Connaught Bridge Power Station, Klang. The objective is to acquire practical industrial experience where the needs of reliable means of flow metering is stressed between two parties (buyers and sellers). In this visit, the metering station design and equipment and their operations were studied in details.

In the ensuing pages, definitions of terms related to flow measurement are discussed in Chapter 2.

In Chapter 3, Direct Method/ Standard Method is studied. Restriction Flow meters namely orifice meter, nozzle meter and venturi meter are described in details in the Chapter 4. This is followed by Linear Flow meters in Chapter 5. There are four types of flow meters are discussed which are turbine flow meter, rotameter / float meter, ultrasonic flow meter and electronic flow meter. Their design, the principal operation, advantages and also disadvantages of all this device are mention in this chapter.

Chapter 6 is the chapter that discussed about the Traversing Method of the flow meter. The devices are pitot tube, pitot static tube, hot-wire and hot-film anemometers and also laser doppler anemometer.