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# e-SPeDIP2021

6-SEMINAR PENYELIDIKAN DAN INOVASI DALAM PENDIDIKAN 2021

## PERINGKAT KEBANGSAAN

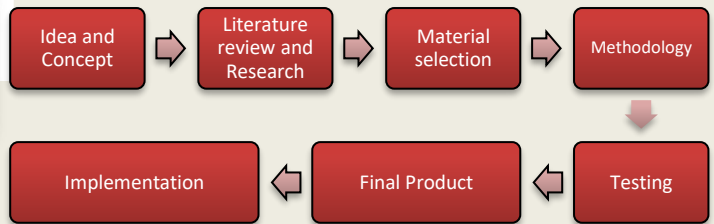
*Kelestarian Penyelidikan Pendidikan Dan Inovasi Ke Arah Revolusi Industri 4.0 Dalam Mendepani Pandemi Covid-19*

## DIP IMMERSION PROBE (DIP) FOR MELTING AND POURING PRACTICE IN CASTING TECHNOLOGY

### OBJECTIVES

- 1 To design a durable, user friendly and ergonomic device to measure the temperature of molten aluminium accurately for the best quality of casting products.
- 2 To fabricate an L-Shape to ensure the comfort of the user with a longer length of 915 mm for the safety factor, which is vital in the teaching and learning process.

### METHODOLOGY



### INTRODUCTION

Foundry Workshop is a compulsory practical task to be completed by the students of the Mechanical Engineering Department in Polytechnic Malaysia. There are few activities to be carried out including Pattern Making, Sand Moulding and Casting. Casting is one of the earliest metal shaping methods and is implemented by pouring the molten metal into a cavity of the shape to be made in the refractory mould. The purposes of remelting pre-alloyed ingot or clean heavy scrap in casting industries are to avoid melting losses and gas contamination. Nonetheless, the accuracy of the molten metal temperature is essential to produce a good casting product.

Aluminium is one of the large numbers of casting alloys in use worldwide in major industrial countries. It is notable as a ductile and low-density metal, good resistance to corrosion and its melting point is about 660°C. Generally, the solubility of hydrogen in solid Aluminium is very low, compared to liquid Aluminium. However, the overheating of molten Aluminium could cause high solubility of harmful Hydrogen gas and consequently leads to the formation of the oxide layer. This may potentially cause defects such as shrinkage, gas porosity and oxide inclusions which eventually contributes to drawbacks of mechanical properties in casting. Hydrogen gas has a high solubility in liquid Aluminium as the melting temperature increases from 660°C (Brown, 2000).

Traditionally, the temperature of molten metal in the furnace is exhibited by its indicator device. However, it cannot be assumed as the exact temperature of the molten metal. Hence, the temperature is commonly measured by a probe known as Laser Gun. The ability of the gun is limited and the temperature of molten metal is inaccurate and always misinterpreted. This is due to a difference between the temperature of the molten metal at the immersion and at the surface of the furnace. Therefore, an immersion type probe known as Dip Immersion Probe is designed to measure the temperature of molten aluminium accurately for the best quality of casting products.



### COMMERCIALIZATION POTENTIAL

#### 1. Practical & usability:

- The products can be used in casting industries and temperature measurement for kilns, gas turbine exhaust and diesel engines in oil and gas industries.

#### 2. Durable and corrosion resistance:

- The probe made of Inconel 600 as a sheath material which it's more durable and superior to corrosion at higher temperatures.

### IMPACT

#### 1. For society :

- A cost-effective probe due to its superior corrosion resistance at higher temperatures. More economic than conventional thermocouple probe materials such as mild steel and chrome iron.
- Reduce energy and power consumption by avoiding overheating of metal.
- Minimize casting defects especially gas porosity caused by absorption of hydrogen gas due to excessive melting temperature.

#### 2. For students and education:

- Provides more ergonomic and safer handling during casting activities.
- Ensures a better casting quality to improve assessment marks of students activities.