First Semester Examination
2023/2024 Academic Session

Februari 2024

EPP 201 – Manufacturing Technology I
(Teknologi Pembuatan I)

Duration: 3 hours
(Masa: 3 jam)

Please check that this examination paper consists of SIX (6) pages of printed material before you begin the examination.

[Sila pastikan bahawa kertas peperiksaan ini mengandungi ENAM (6) muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]

Instructions : Answer **ALL FIVE (5)** questions.

*[**Arahan** : Jawab **LIMA (5)** soalan]*

1. [a] Figure 1[a] shows an image of a cross sectional work piece after a welding process of joining two pieces of metals for high accuracy.

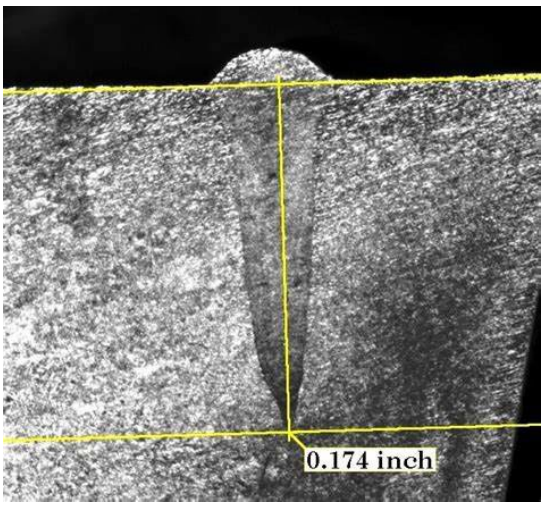

Figure 1[a]

(i) Identify the welding technology used in this work. Justify the selection of this welding technique.

(20 marks)

(ii) Discuss ONE (1) advantage and disadvantage of this welding technique.

(20 marks)

[b] Figure 1[b] shows two pieces of Aluminium thin plates with different thicknesses joined together. Suggest ONE (1) appropriate joining technique for this work and its working method. Justify the selection of that joining technique.

Figure 1[b]

(30 marks)

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[c] Figure 1[c] shows a small metal structure. Suggest an appropriate technology in manufacturing of this object with competitive unit cost and small-batch production. Describe how does the technology works.

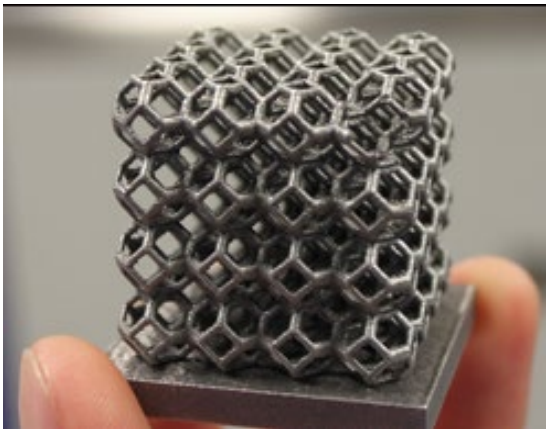

Figure 1[c]

(30 marks)

2. In a machining operation that approximates orthogonal cutting, the cutting tool has a rake angle of -5°. The chip thickness before the cut is 0.50 mm and the chip thickness after the cut is 1.5 mm. The cutting force and the thrust force are measured during this orthogonal cutting operation as 1810 N and 1578 N, respectively. The width of the orthogonal cutting operation is 5.0 mm. Based on the available data:

[a] Calculate the shear plane angle (∅) and the shear strain (γ) in the operation.

(30 marks)

[b] Find the shear strength (τ_s) of the work material.

(35 marks)

[c] Determine the friction angle (β) based on the formulation of Merchant's equation as well as the friction coefficient (μ) between the tool and work material.

(35 marks)

You may use the following equations:

$$r = t_0/t_c$$

$$tan\emptyset = \frac{rcos\alpha}{1 - rsin\alpha}$$

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$\gamma = tan(\emptyset - \alpha) + cot\emptyset$

$F_s = F_c cos\alpha - F_t sin\emptyset$

$A_s = t_0 w / sin\emptyset$

$\tau_s = F_s / A_s$

$\emptyset = 45 + \frac{\alpha}{2} - \frac{\beta}{2}$

$\mu = tan\beta$

$\alpha = rake\ angle$

$A_s = \ shear\ plane\ area$

3. [a] Figure 3[a] shows a schematic diagram of sand casting mould. Label the components of sand casting mould as pointed by the arrows.

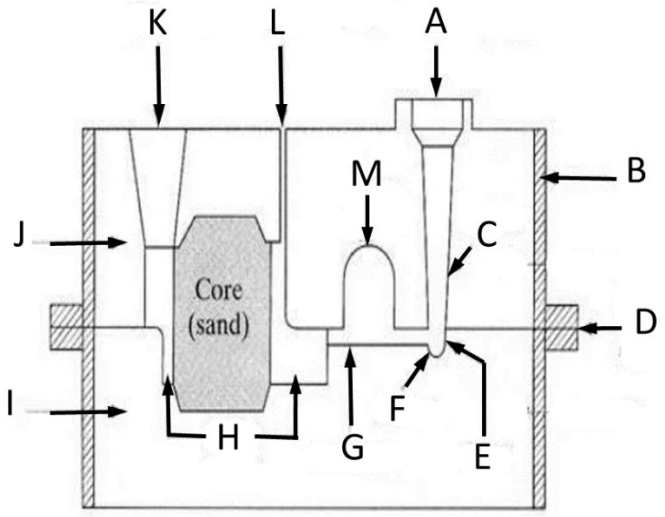

Figure 3[a]

(30 marks)

[b] Which casting process is also called lost waxing method? Why?

(30 marks)

[c] Figure 3[b] shows one-piece valve housing for oil and gas industry which is made of nickel based alloy. The outer flange dimension is about 1.0 m in diameter. Suggest a method of making this cast and describe the processes involved.

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Figure 3[b]

(40 marks)

4. [a] Solid material can be broadly categorized into metals, polymer and ceramic material. Each category represents a distinct type of arrangement at the atomic or molecular level, leading to unique properties and mechanical behaviours.

(i) Name ONE (1) material for each category.

(15 marks)

(ii) For each category in [a](i) sketch the generic Stress-Strain Curve and explain the differences between each category.

(35 marks)

(iii) Based on your answer in 4a[ii], discuss why metals are suitable for forming.

(20 marks)

[b] Explain how temperature affects mechanical properties of a material and how engineer utilises heat treatment for metal forming.

(30 marks)

5. [a] Forging is one of the oldest metalwork and still relevant partly because forged part is very reliable for highly stresses application due to its toughness. There are mainly two types of forging which are cold forging and hot forging. Explain the differences of these methods and give ONE (1) disadvantage and advantage of these forging method in comparison to each other.

(30 marks)

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[b] Figure 5[b] is an aluminium part commonly used in automation application. What is the fabrication method to produce such component and explain the working concept of the process? Use sketch to help with your explanation.

Figure 5[b]

(30 marks)

[c] Rolling is a metalwork process that involves passing metal trough roller for the purpose of reducing thickness, altering cross section or achieve uniform thickness across the material. There are many rolling methods specific to desired product. For each of the product below, state the types of rolling method used:

(i) Knives
(ii) Ball-bearing
(iii) Flanges
(iv) Threaded fastener

(40 marks)

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