Second Semester Examination
2023/2024 Academic Session

July/August 2024

EPP 212 – Advanced Manufacturing Technology
(Teknologi Pembuatan Termaju)

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]*

...2/-

1. [a] Figure 1 [a] shows a conventional design of a vertical machining center use for milling process. If YBS International Bhd. which is a machining company wants to invest in high-speed and ultraprecision machining centers, analyse and differentiate THREE (3) design considerations of a machining centre must possess to be utilized under ultraprecision and high-speed machining respectively.

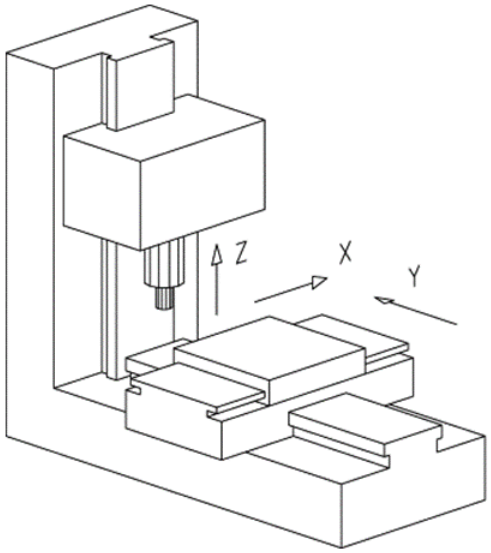

Figure 1[a] : Machining center

(30 marks)

[b] Serrated chips as shown in Figure 1[b] is identified as one of root causes of vibration during machining process.

(i) Identify what type vibration has occurred and elaborate how these serrated chips causing the vibration.

(10 marks)

(ii) Suggest TWO (2) methods to prevent this type of vibration and justify your answers.

(30 marks)

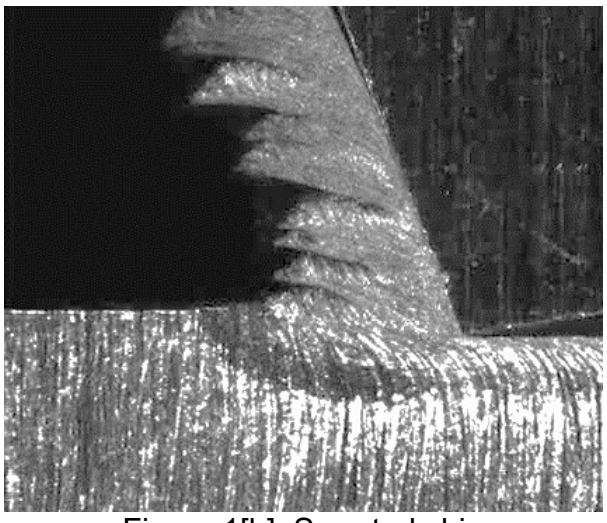

Figure 1[b]: Serrated chip

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[c] In machining operation, minimizing cost per piece and time per piece are very important. However, there are several factors contributed to those values. Based on your judgement by referring to Figure 1[c] below, what is the optimum cutting speed to select if minimizing cost per piece is the main target. Please justify your answer briefly.

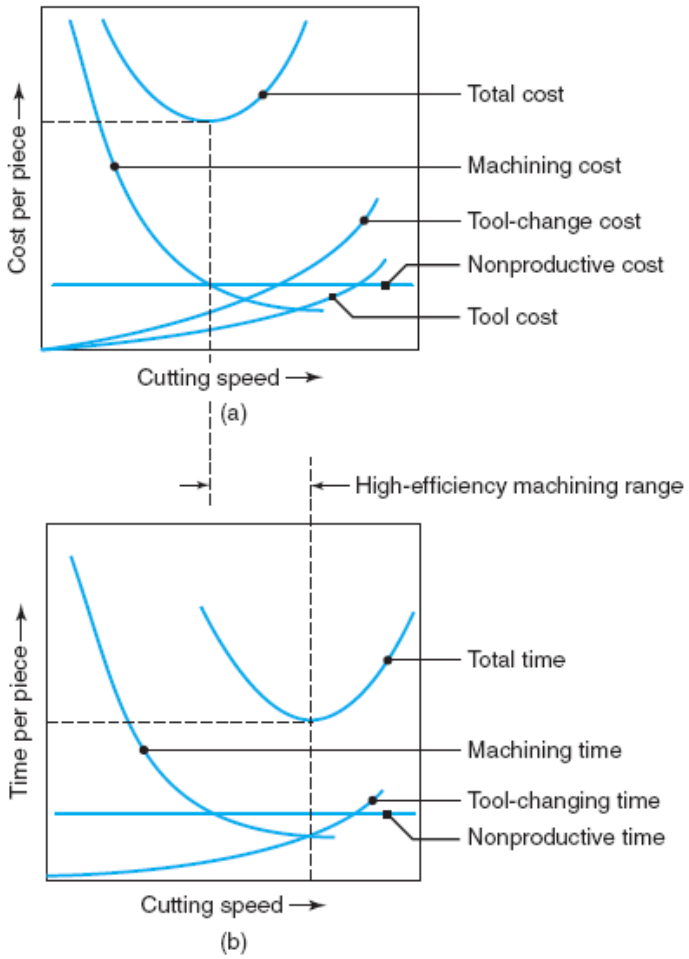

Figure 1[c] : Optimum cost and time per piece curves

(30 marks)

2. [a] Electrochemical machining (ECM) is a well-established process and has many applications because of no thermal stress and surface defects.

(i) Using sketch, briefly explain the working principles of ECM.

(30 marks)

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(ii) Design an electrode appropriate to produce the product shown in Figure 2[a].

Figure 2[a] : ECM machined metal product

(10 marks)

[b] Smart Engineering Corporation Bhd. has won a tender to supply several metal gear products for a batch of motorcycle in a manufacturing plant. Between wire EDM and water jet machining, which one is the most suitable investment to produce those gears? Discuss the process suitability based on their capabilities and limitations.

(40 marks)

[c] Figures 2[c] below shows the common defects on the machined surfaces of carbon fiber reinforced polymer (CFRP) composite laminate samples when cut using abrasive-water jet (AWJ) technique. Based on your judgement, is AWJ still an efficient technique to cut the laminate CFRP composite workpiece? Give TWO (2) reasons to your answers.

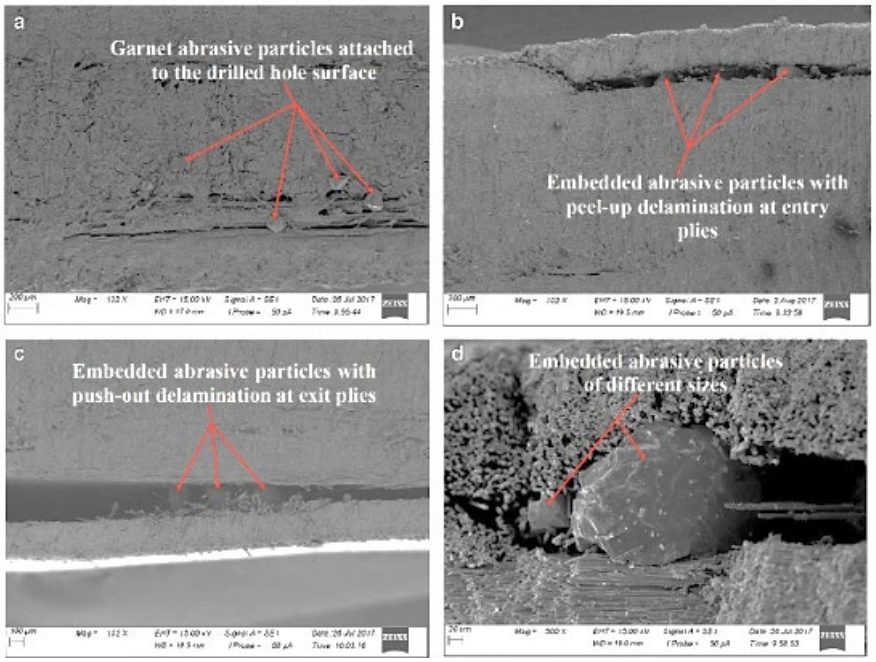

Figure 2[c] : AWJ machined surfaces

(20 marks)

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3. [a] (i) A CNC programme commonly has commands that can be classified as either modal command or block active command. Describe each of them and give an example of CNC code for each type.

(20 marks)

(ii) Differentiate between programming code G00, G01 and G02. Use illustration to show the difference between them.

(20 marks)

[b] An engineering component made of aluminum as shown in Figure 3[b] need to be machined using CNC machine by Company A. Using standard G-code programming, prepare a complete code for machining the part to get optimum toolpath. Use absolute coordinate in your G-code programming. You need to justify your approach and answer. State all conditions and assumptions you have used.

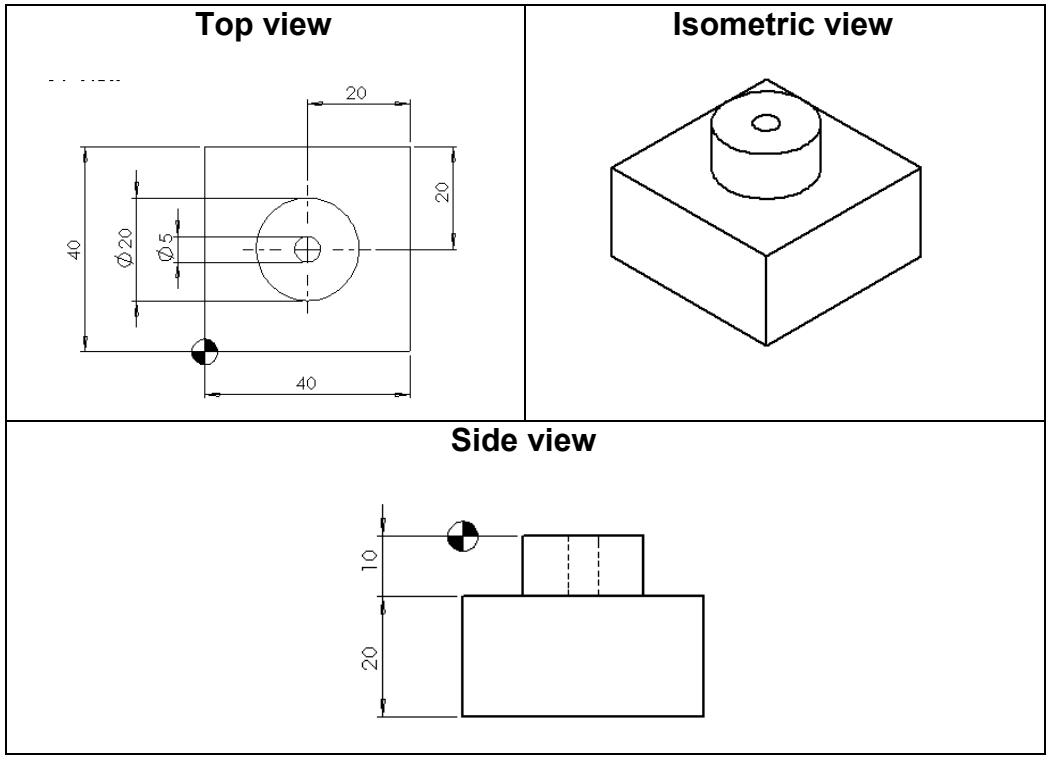

Figure3[b]

(60 marks)

4. [a] Define the following terminologies from manufacturing perspective:

(i) Computer Aided Design (CAD),
(ii) Computer Aided Manufacturing (CAM),
(iii) Enterprise Resource Planning (ERP)

(30 marks)

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[b] Give THREE (3) advantages of applying CAD/CAM in manufacturing industry

(30 marks)

[c] Using illustration, describe step by step process using CAD/CAM software for obtaining CNC code that can be used on a 5-axis CNC machine for machining a part.

(40 marks)

5. [a] Since 1986, 3D printing has evolved from a technology that caters for just prototype for fabrication into wide range of applications across many fields including direct manufacturing, medical, aerospace, automotive, arts, architecture and construction. From your observation, give FIVE (5) factors that contribute to this rapid change and diversification of the technology. Please show how each factor contribute to the evolution and justify your answer.

(50 marks)

[b] An archeologist is discovering an exciting artifact with valuable historical value that could potentially change the narrative of how and when dinosaur really began to extinct in the past. The artifact is however very fragile, with some parts already fragmented, some parts are missing too. Further study and experimentation is needed in order to form clear judgement and to come to more accurate conclusions. Come up with your strategy in order to fully utilize 3D printing technology to help scientist discover more valuable information from the artifact.

(50 marks)

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