



UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020**

COURSE NAME : JIG AND FIXTURE DESIGN
COURSE CODE : BNG 31303
PROGRAMME CODE : BNG
EXAMINATION DATE : DECEMBER 2019 / JANUARY 2020
DURATION : 2 HOURS 30 MINUTES
INSTRUCTION : ANSWER ALL QUESTIONS

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THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

- Q1** (a) Work holding is one of the most important elements of the machining process. The term work holder includes all devices that hold, grip, or chuck a work piece to safely perform a manufacturing operation. To ensure the successful operation of a work holder, the work piece must be accurately located to establish a definite relationship between the cutting tool and some points or surfaces of the work piece. Describe **TWO (2)** locating principle for designing the jig and fixture. (2 marks)
- (b) Fool proofing is the process of positioning locators so a part will only fit in the work holder in its proper position. Analyze **THREE (3)** significance of fool proofing for designing the jig and fixture. (6 marks)
- (c) To make work piece accurately locate at jig or fixture, movements of work piece must be restricted.
- (i) Explain the “3-2-1” locating principles. (3 marks)
- (ii) Analyze **TWO (2)** primary method of locating work from a flat surface. (4 marks)
- (d) The use of ejector devices is important in jig and fixture. Ejector devices is important in **TWO (2)** situations there are when the workpiece is heavy and machining pressure forces the workpiece to the side or base of the jig or fixture.
- (i) Analyze **TWO (2)** advantages of ejector on jig and fixture. (2 marks)
- (ii) **Figure Q1(d)** shows **TWO (2)** methods of positioning the locators. Justify the best positioning method. (3 marks)
- Q2** (a) The type of clamp is depending on the tool designer specification such as the shape and size of the part, the type of jig or fixture being used and the work to be done.
- (i) Construct **THREE (3)** purposes of a clamping device. (6 marks)
- (ii) When clamping a part, the designer must keep these major concern in mind; the position of the clamp, the tool forces acting on the part and controlling and directing the clamping forces. Define the tool force and explain how tool forces can be used to advantages. (4 marks)
- (b) Spherical washers are designed to aid even fastening between parts with irregular alignment. Spherical washers are manufactured from case hardening steel and blackened finish. Justify the purpose of the spherical washer. (4 marks)

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(c) When using the strap clamp, the force generally reacts on the workpiece and always proportional to the position of the fastener with respect to the workpiece. Suggest the method of fastener positioning used for:

- (i) Clamping two parts side by side.
- (ii) Clamping a single part.

(6 marks)

Q3 (a) Illustrate the symbol for the following modifiers.

- (i) Least material condition
- (ii) Regardless of features size
- (iii) Spherical radius
- (iv) Spherical diameter

(8 marks)

(b) Explain **FIVE (5)** basic categories of feature characteristic controlled with geometric dimensioning and tolerancing.

(5 marks)

(c) Identify the maximum material condition and least material condition shown in **Figure Q3(c)**.

(1 marks)

(d) Explain the parts of the feature control symbol shown in **Figure Q3(d)**.

(3 marks)

(e) Construct **SIX (6)** rules for dimensioning SI metric drawings.

(3 marks)

Q4 (a) A preliminary design is a bridges of gap between design conception and detailed design.

(i) Develop a preliminary design for simple jig for the workpiece shown in **Figure Q4(a)**.

(8 marks)

(ii) Suggest step-by-step approach for design all fixtures.

(7 marks)

(b) Explain **THREE (3)** safety factors that must be considered during the design of any tools.

(3 marks)

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- (c) Ergonomics is applied in one form or another to anything that involves people. In the case of tool design, the ergonomic considerations include aspects of anatomy, physiology, psychology, and design.
Describe the meaning of ergonomic in the sentences.

(2 marks)

- Q5** (a) Describe **THREE (3)** principles of economic design.

(6 marks)

- (b) Discuss the importance of economic design principle for tool designer.

(4 marks)

- (c) Performing an economic analysis helps the tool designer consider a variety of tooling alternatives to find most suitable and cost effective design. Based on below, suggest the most efficient and economical alternative for tool designer.

A total 1600 guide plates required to mill at a locating block. The tool designer has determined three possible alternatives:

- (i) Have a tool maker, who earns RM 12.50 per hours; mill the plates at a rate of 50 per hour.
- (ii) Use limited tooling the costs RM 35 in the production department. The machine operator in this department, who earns RM 7.50 per hour, can make a part every 3.5 minutes.
- (iii) Use plate jig, which costs RM 95.50 but is capable of producing a part every 30 seconds. This would be done in the production department, where the machine operators earns RM 8.50 per hour.

(10 marks)

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-END OF QUESTIONS -

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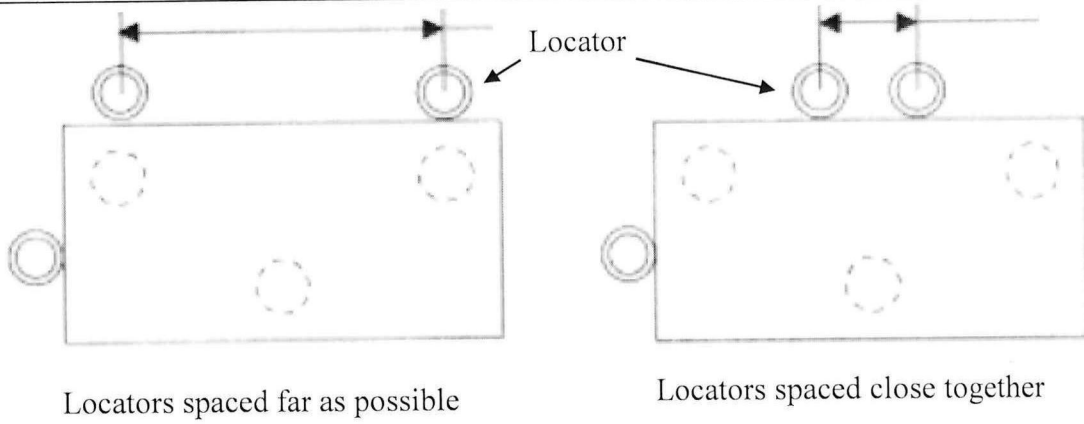


Figure Q1(d)

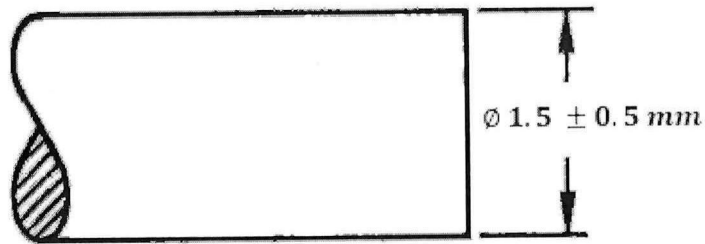


Figure Q3(c)

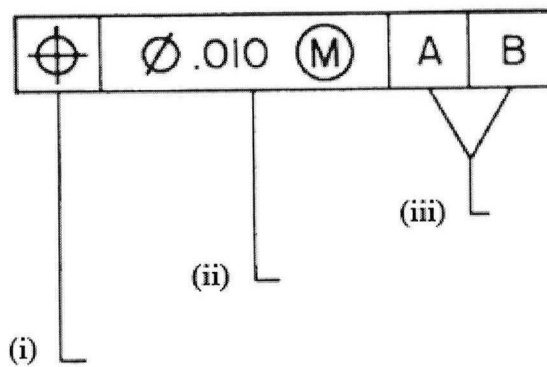


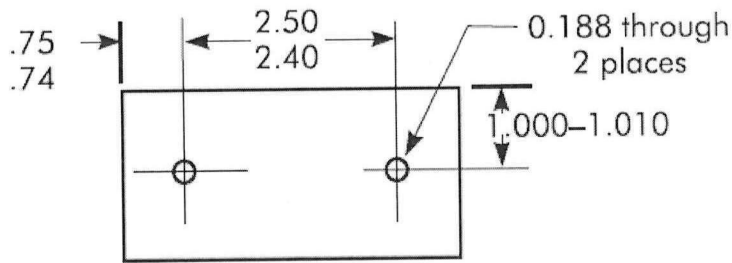
Figure Q3(d)

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Material: AISI 1030 steel
Quantity: 600 pieces

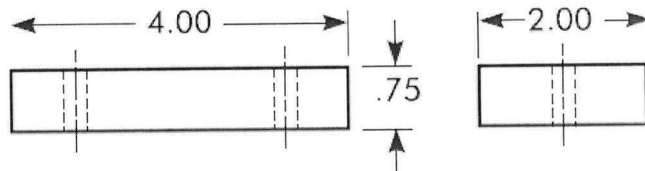


Figure Q4(a)

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