



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2018/2019**

COURSE NAME : METROLOGY AND MEASUREMENT
COURSE CODE : BNM 30203
PROGRAMME CODE : BNM
EXAMINATION DATE : DECEMBER 2018 / JANUARY 2019
DURATION : 3 HOURS
INSTRUCTION : ANSWERS ALL QUESTIONS

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THIS QUESTION PAPER CONSISTS OF SEVEN (7) PAGES

- Q1**
- (a) Micrometer is one of the commonly used measuring instruments in tool making industry. From the **Figure Q1(a)(i)** and **Figure Q1(a)(ii)**, interpret the values shown on the micrometer. Provide answers with appropriate decimal places. (3 marks)
- (b) A comparator is one of the precision instrument employed in the industry. Distinguish **TWO (2)** points between comparator and height gauge. (4 marks)
- (c) You are asked by your superior to determine the electrode gap of a spark plug as shown in **Figure Q1(c)**. Formulate your plan to do the measurement by specifying the instrument to be used, methods to be employed and possible error that may exist. (6 marks)
- (d) Optical flat, a transparent plate with one face finished to near-perfect flatness, is the basic instrument that uses light for measurement. Point out **THREE (3)** primary applications of optics in metrology. (3 marks)
- (e) Profile projector is one example of measuring equipment that uses light. The light is projected onto a screen, which displays the profile of the subject to be measured. Distinguish between translucent and opaque screen. (4 marks)
- Q2**
- (a) Tolerance is classified into unilateral tolerance, bilateral tolerance, compound tolerance and geometric tolerance. By the help of diagram, illustrate the difference between unilateral tolerance and bilateral tolerance if the basic size of shaft is 40mm. (2 marks)
- (b) An ideal fit is required for proper functioning of the mating parts. Distinguish **THREE (3)** criteria of clearance fits and interference fit. (6 marks)
- (c) Evaluate limits and fits for a pair of – Diameter 7 H7/g7. Determine:
[Given value of D is lies between 6 and 10, H7 Hole is 16i, fundamental deviation of Hole H7 is 0, g7 Shaft is 16i and fundamental deviation of g7 shaft is $-2.5D^{0.34}$]
- (i) The value of D.
- (ii) The value of fundamental tolerance, *i*.
- (iii) Limits of tolerance for H7 hole.
- (iv) Limits of tolerance for g7 shaft.
- (v) Sketch the deposition of tolerance zone around the zero line.
- (vi) Maximum and minimum clearance
- (vii) Type of fits. (12 marks)

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- Q3** (a) Give **ONE (1)** benefit of geometric dimensioning and tolerancing (GD&T) to the product design and production. (1 mark)
- (b) They are eight key terms in GD&T that affect the interpretation of a drawing. Differentiate the key terms internal feature of size and external feature of size with the aid of diagram. (4 marks)
- (c) Geometric control structure in GD&T refers to four elements which are flatness, straightness, circularity, and cylindricity. From **Figure Q3(c)(i)** and **Figure Q3(c)(ii)**, analyze the meaning of the symbol. Then, propose a method to assess the respective element. (8 marks)
- (d) Datum is defined as a theoretically exact plane, point or axis from which a dimensional measurement is made. Compare datum feature and simulated datum with the aid of a diagram. (4 marks)
- (e) Construct datum A, B and C for the drawing in **Figure Q3(e)**, with proper labelling and symbol. (3 marks)
- Q4** (a) Interpret repeatability and reproducibility in measurement system. (2 marks)
- (b) Below is a situation given for repeatability and reproducibility during measurement. Illustrate both situations by using graphical method.
- i) Operator 1 measures a single part with gauge A 20 times, and then measures the same part with gauge B. (2 marks)
- i) Operators 1, 2, and 3 measure the same part 20 times with the same gauge. (2 marks)
- (c) Interpret both graphic illustrated in Q4 (b) (i) and (ii). **TERBUKA** (4 marks)
- (d) As a technologist, investigate **TWO (2)** benefits of Gauge Reproducibility and Repeatability in measurement system. (4 marks)

- (e) **Figure Q5 (e)** shows an example a gauge run chart of three operators measuring ten parts, three time each. Interpret the chart of measurement VS 3 operators.
(6 marks)

Q5 (a) Differentiate telescopic gauge and small hole gauge with the aid of a diagram.
(4 marks)

(b) **Figure Q5(b)** shows one type of gauge commonly used in industry. List **FOUR (4)** basic principles of the gauge.
(4 marks)

(c) Surface metrology refers to the geometry and texture of surface, such as roughness, waviness, and roundness. With regards to surface texture, discover how the differences in surface texture affects the selection of material for certain application.
(4 marks)

(d) There are two approaches in measuring surface texture, which are by comparison and by direct measurement. Direct measurement by means of stylus measurement system, is preferred due to its reliability. List **FOUR (4)** features of stylus in measuring surface texture.
(8 marks)

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-END OF QUESTION-

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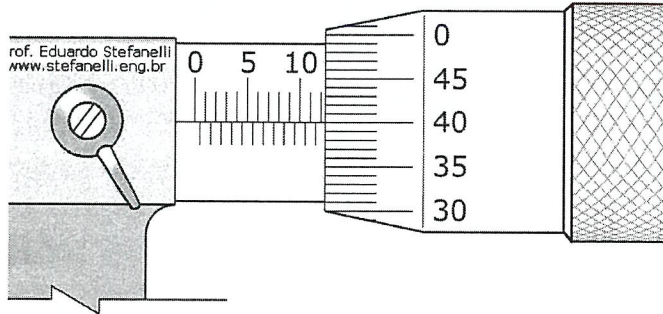


Figure Q1 (a) (i): Reading of micrometer

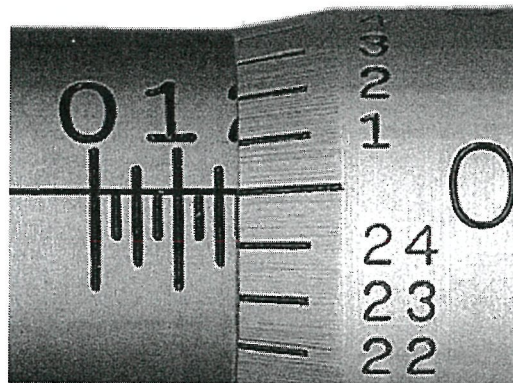


Figure Q1 (a) (ii): Reading of micrometer

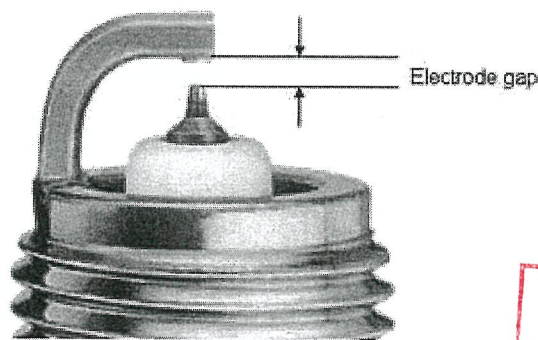


Figure Q1 (c): Electrode gap of a spark plug

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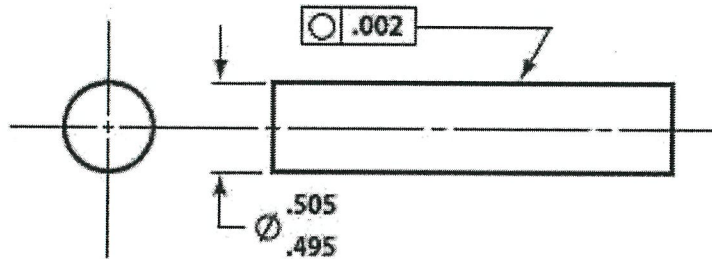


Figure Q3 (c) (i): Drawing symbol

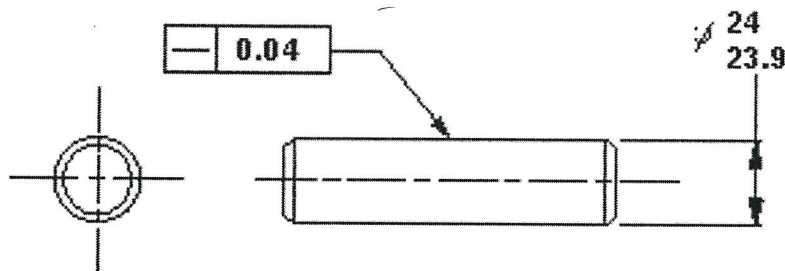


Figure Q3 (c) (ii): Drawing symbol

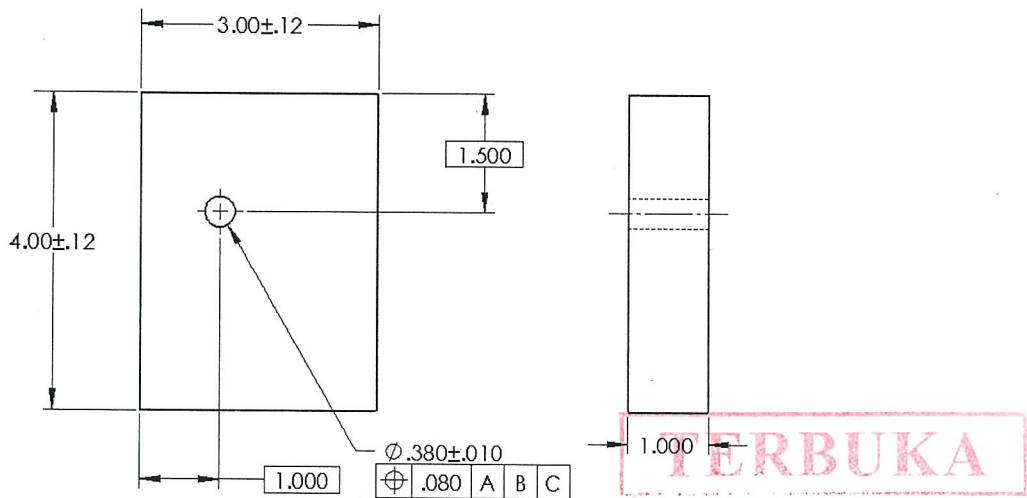


Figure Q3 (e): Drawing

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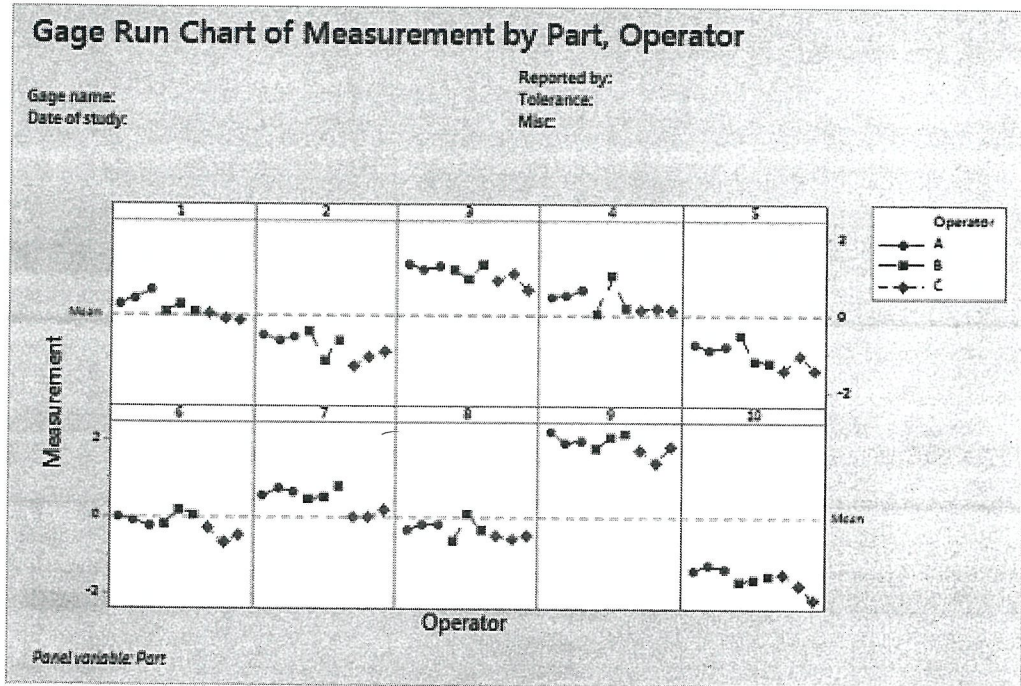


Figure Q5 (e): Gauge Run Chart



Figure Q5 (b): Gauge

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