# The Open University of Sri Lanka
# Faculty of Engineering Technology

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| Study Programme | : | Bachelor of Technology Honours in Engineering |
| Name of the Examination | : | Final Examination |
| **Course Code and Title** | : | **DMX4212 MANUFACTURING ENGINEERING** **DMX4530 PRODUCTION TECHNOLOGY** |
| Academic Year | : | 2020/21 |
| Date | : | January 28, 2022 |
| Time | : | 14:00 hrs. – 17:00 hrs. |
| Duration | : | 3 hours |

## General instructions

1) Read all instructions carefully before answering the questions
2) This question paper consists of 08 questions. All questions carry equal marks.
3) Answers any 05 questions only.

## Question 01.

a) Distinguish between a "measurement" and "metrology". Also explain main areas of Metrology.

b) Discuss classification of standards within the context of metrology by giving suitable examples.

c) Explain the different types of measurement errors encountered when measuring. How do you propose to eliminate or minimize these errors?

## Question 02.

a) State requirements to be considered when selecting a measuring instrument.

b) The diameter of a shaft was measured using three different length measuring instruments and the readings are represented graphically as shown in Figure 01. Distinguish between accuracy and precision by using figures below.
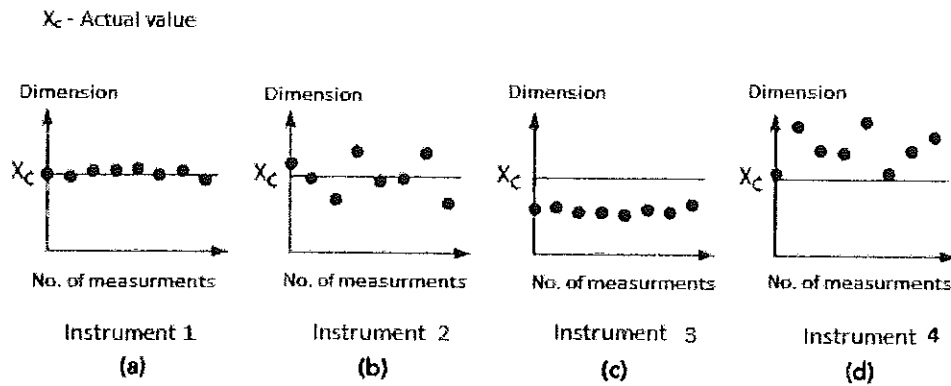
Figure 01

c) Illustrate the types of fits and state clearly under what circumstances each type of fit is used. *(You may use appropriate practical examples)*

## Question 03.

a) Differentiate roughness and waviness in connection with surface texture measurement.

d) Calculate the Center Line Average (CLA) and Root Mean Square (RMS) values of roughness for a graph, having 2:1 horizontal and vertical magnification for given sampling length of 9.5 mm. Values of profile peaks and valleys are shown in the graph below in Figure 02.
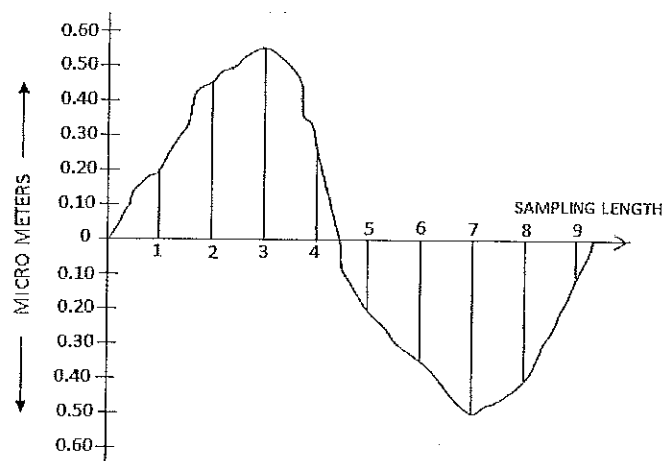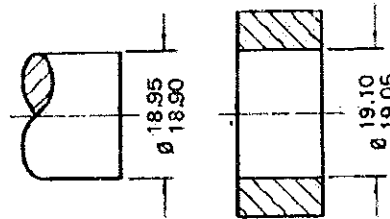


Figure 02

## Question 04.

a) Define tolerance and explain the significance of indicating tolerance and using standard systems of Limits and Fits in the manufacturing industry.

b) What are the systems which describes a class of fit? Explain them briefly by giving examples.

c) Calculate the tolerance and allowance of the shaft and hole given in Figure 03.



*Figure 03*

## Question 05.

a) Name and briefly describe the four types of chips that occur in metal cutting?

b) In a turning operation, the foreman has decreed that a single pass must be completed on the cylindrical workpiece in 5.0 min. The piece is 400 mm long and 150 mm in diameter. Using a feed of 0.30 mm/rev and a depth of cut of 4.0 mm, what cutting speed must be used to meet this machining time requirement?

c) Explain briefly the four (04) types of tool wear mechanisms encountered in metal cutting operations.

## Question 06.

a) Illustrate the variation of cutting speed (V) against the cutting time (T) and derive Taylor's tool life relationship in usual notations.

b) A carbide tool used for machining mild steel work-piece was found to give a tool life of 2 hrs while cutting at 50m/min.

i) Compute the tool life if the same tool is to be used at an enhanced cutting speed of 20% higher than the current speed.

ii) What is the speed at which the tool life will be extended to 3hr?
(*You may assume a value of 0.25 for the Taylor's exponent*)

## Question 07.

a) What are the main tests conducted to check the reliability of machine tools.

a) Design a six speed (06) gearbox to obtain speed variations between 160 and 1000 rev/min. Assume that the spindle speeds are in geometric progression. In the design process you are required to:
   i. Calculate the common ratio ($\phi$) of the series of speeds and select the suitable common ratio for the gearbox from the given standard values, 1.12, 1.26, 1.41 and 1.58
   ii. Calculate the spindle speeds of the gearbox.

## Question 08.

a) Explain what is strain hardening and its importance in manufacturing.

b) Quoting examples, briefly explain bulk deformation process and sheet metal forming process.

c) Distinguish between "hot working" and "cold working" in metal forming processes, your answer should clearly explain the behaviour of flow stress ($\sigma f$).