The Open University of Sri Lanka
Faculty of Engineering Technology

Study Programme	:	Bachelor of Technology Honours in Engineering
Name of the Examination	:	Final Examination
Course Code and Title	:	**DMX4212 MANUFACTURING ENGINEERING**
Academic Year	:	2019/20
Date	:	September 30, 2020
Time	:	0930 hrs. – 1230 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) What are the main objectives of engineering metrology?

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

c) Discuss six (06) factors affecting accuracy of measurements.

Question 02.

a) Briefly discuss what is a sine bar and how it is used for angle measurements.

b) Name four (04) various types of pitch errors found in screw threads.

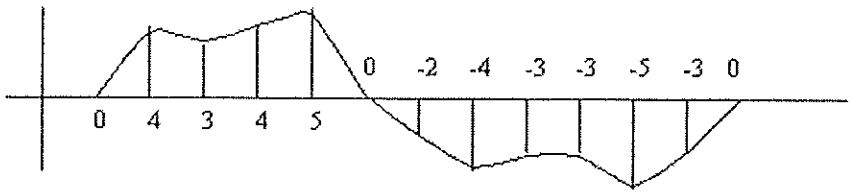
c) Illustrate the types of fits and state clearly under what circumstances each type of fit is used.

Question 03.

a) Explain the importance of the surface texture of a component within the context of engineering failures.

b) Explain, why two different surfaces may have the same roughness value.

c) Calculate the Center Line Average (CLA) and Root Mean Square (RMS) values of roughness for a graph, having 10:1 horizontal and vertical magnification for given sampling length of 1.5 mm. Values of profile peaks and valleys are shown in the graph below.



Question 04.

a) Define tolerance and explain the significance of indicating tolerance in products to be manufactured.

b) For hole and shaft pair in the fit: 20H7f8 given that, the tolerance unit i = $0.45 \times \sqrt[3]{D} + 0.001D$ (microns), the lower deviation for hole H is zero and upper deviation for shaft type f = $-5.5D^{0.41}$, tolerance IT7 = 16i, IT8=25i, 20mm diameter lie in the diameter step of 18 and 30. Calculate the fundamental deviation and tolerances and hence obtain the limits of size for hole and shaft

Question 05.

a) What are the two principal locations on a single point cutting tool where tool wear occurs?

b) In an orthogonal cutting operation, the rake angle = -5°, chip thickness before the cut = 0.2 mm and width of cut = 4.0 mm. The chip ratio 3 = 0.4. Determine the chip thickness after the cut,

(i) shear angle,
(ii) friction angle,
(iii) coefficient of friction, and
(iv) shear strain

Question 06.

a) Briefly explain three (03) modes of tool failure in machining.

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

c) Determine the n and C values in the Taylor tool life equation if tool life tests in turning yield the following data:
when cutting speed is 100 m/min, tool life is 10 min;
when cutting speed is 75 m/min, tool life is 30 min.

Question 07.

a) Explain the various geometrical tests that are to be done to get a better accuracy in the machine tool.

b) 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 (ϕ) 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.
   iii. Construct suitable structural diagram, kinematic diagram and the speed diagram.

   Use the equation $\emptyset = \sqrt[n-1]{R_n}$ to calculate the common ratio.

Question 08.

a) Explain the terms "Engineering stress" and "True stress.

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

c) Describe "Bulk deformation process" and "Sheet metal processes" and give at least three examples for each process.