The Open University of Sri Lanka
Faculty of Engineering Technology

Study Programme	:	Bachelor of Technology (Engineering)
Name of the Examination	:	Final Examination
Course Code and Title	:	**MEX4230- Production Technology**
Academic Year	:	2014/15
Date	:	August 04, 2015
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 8 questions. All questions carry equal marks.
3. Answer any 5 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. What is strain hardening? Explain the importance of strain hardening in manufacturing.

d. Explain the terms "Engineering stress" and "True stress". Also show that the true strain (ε) is given by the expression

$$\varepsilon = ln\left({}^{A_0}/_{A}\right)$$

where, A_0 = Initial cross sectional area
A= Instantaneous cross sectional area

Question 02.

a. State five (05) requirements to be considered when selecting a measuring instrument and explain why it is important to consider above stated requirements.

b. Quoting examples, explain the different types of measurement errors encountered when taking measurements. How do you propose to eliminate or minimize these errors?

c. Explain what is meant by Primary texture and Secondary texture, in defining surface finish. What are the factors which cause primary and secondary textures?

Question 03.

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

b. The maximum and minimum clearances for a hole and shaft with a basic size of 50mm are 0.05mm and 0.01mm respectively. The shaft tolerance is one third of the hole tolerance. Calculate the limit size for both hole and the shaft.

c. Classify gears according to the position of their shafts and discuss methods of gear teeth forming.

Question 04.

a. Explain why discontinuous type of chips arepreferred over continuous chips, in machining.

b. Illustrate the **Merchant theory** for metal cutting.
Note: your answer should include neat sketch and must clearly explain the forces involved in cutting and usage of the Merchant force circle.

c. During an orthogonal turning operation of *C*-40 steel, the following data were obtained,

Rake angle	: 10^{o}
Cutting speed	: 2.5*m*/s
Feed thrust force	: 295*N*
Tangential load on tool (cut force)	: 1130*N*
Feed rate	: 0.25 *mm/rev*
Width of cut	: 2.5*mm*
Chip thickness	: 0.45*mm*

Determine:

i. Force of shear at the shear plane.
ii. Kinetic coefficient of friction at the chip tool interface.

Question 05.

a. How does geometrical accuracy of machine tool parts influence the performance of a machine tool?

b. Explain with suitable examples, the main types of spindle speeds available in machine tools.

c. A lathe machine is to be designed having ten (10) spindle speeds. It should be able to accommodate machining of work-pieces from 20mm up to 500mm in diameter at a cutting speed of 20 m/min.

   i. Show that the range ratio (R_n) of spindle speed variation depends only on the ratio of maximum to minimum work-piece diameters and the cutting speeds involved.

   ii. Find the spindle speeds, when it is graded according to arithmetic progression and geometric progression.

   iii. By using the above calculated data, explain the reasons for preferring geometric progression to arithmetic progression when designing spindle speed variation for machine tools.

Question 06.

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

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

c. In a cutting operation the following observations have been made on cutting speed (V) and cutting time (T).

Cutting speed (*m/min*) - V	25	35
Cutting time (*min*) - T	90	20

The feed of the cutting tool is 0.2*mm* and the depth of cut is 2*mm*.

Calculate;

i. The cutting tool index (n) and the constant (C) of Taylor's tool life relationship.
ii. The recommend the cutting speed for an expected tool life of 60 *minutes*.

Question 07.

a. Distinguish "hot working" and "cold working" metal forming processes, your answer should clearly explain the behaviour of flow stress (σf). Also give at least 3 examples for each process.

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

c. Explain the laws governing in cold working and hot working, naming all parameters in expressions.

Question 08.

Answer any four (04) of the following,

a. Explain what an involute teeth profile and methods use to check gear tooth profiles.

b. Explain the importance of accurate adjustment of clearances in machine tool slideways. Also explain any two (2) methods used to adjust a clearance.

c. What do you understand by "spring back" in bending and explain the methods used to eliminate the drawbacks of bending?

d. Write a short note on computer aided measuring instruments and explain what is meant by uncertainty in measurement?

e. What is a dynamometer and explain the various types of dynamometers.

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