The Open University of Sri Lanka
Faculty of Engineering Technology

Study Programme	:	Diploma in Technology/Bachelor of Technology (Engineering)
Name of the Examination	:	Final Examination
Course Code and Title	:	**MEX4230 - Production Technology**
Academic Year	:	2012/13
Date	:	July 23, 2013
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.

Q.01. a. Calibration of a measuring instrument is important and it certifies the confidence in measurements. Define calibration of a measuring instrument and explain the importance of such calibration.

Also list the factors which affect the frequency of calibration.

b. State five (05) requirements to be considered when selecting a measuring instrument and also explain why it is important to consider any selected one (01) of the stated requirements from among the five.

c. Illustrate how to use a sine bar to measure angles of small components.
Also calculate the slip gauge height required to give an angle of 25^{o} when using $200mm$ sine bar.

d. Explain the use of micrometer level quoting an appropriate practical application.

Q.02. a. Explain the behaviour of flow stress (σ_f), during cold and hot working processes.

b. Differentiate hot working and cold working processes. The answer should have at least five (05) courses for your differentiation.
Also give two (02) examples each for hot and cold working processes.

c. Crushing and spring-back are two undesirable effects encountered during bending process. Explain these two effects and describe how these could be minimized.

Q.03. a. Explain what is meant by Primary texture and Secondary texture.

b. Calculate the arithmetical average and root mean square (*rms*) values for surface irregularity for the sampling length shown in Figure.1.

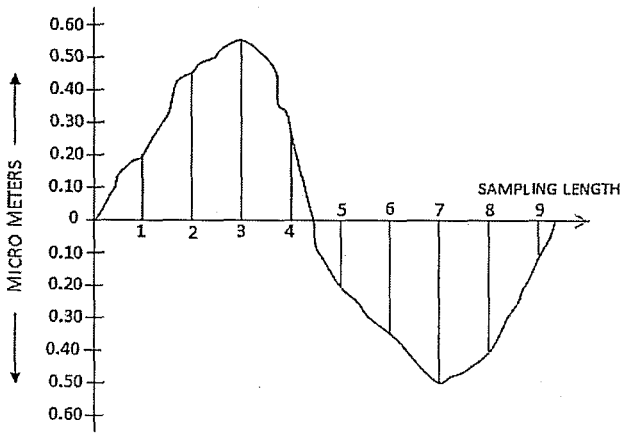


Figure.1

c. Calculate the fundamental deviation and tolerances and hence obtain the limits of size for hole and shaft in the fit specified as $25H8/d9$. The diameter steps are $18mm$ and $30mm$. The respective tolerance grades for number 8 quality and number 9 quality are $25i$ and $40i$.
The fundamental deviation for the shaft diameter D is given as $-16D^{0.44}$ and, the tolerance unit given by, $i = 0.45\sqrt[3]{D} + 0.001D$

Q.04. a. Explain the two main types of spindle speeds.

b. Assuming that the spindle speeds are in geometrical progression, design a six speed gear box to obtain speed variation between $112rpm$ and $624rpm$. The standard values of common ratios (φ) are 1.12, 1.26, 1.41 and 1.58.
Answer should clearly illustrate the Structural diagrams, Kinematic diagram and the speed diagram.

If a $750rpm$ electric motor is used to drive the gear box designed above and the motor pulley diameter is $75mm$, calculate the reduction ratio between the motor shaft and the gear box input shaft and also calculate the pulley diameter of the input shaft of the gear box.

Q.05. a. Explain why discontinuous type of chips are preferred over continuous chips, in machining.

b. Illustrate the **Merchant force circle.**
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	: $2.5m/s$
Feed thrust force	: $295N$
Tangential load on tool (cut force)	: $1130N$
Feed rate	: $0.25\ mm/rev$
Width of cut	: $2.5mm$
Chip thickness	: $0.45mm$

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

Q.06. a. Precision and Productivity are two important parameters that should be considered when designing a machine tool. Quoting an appropriate example of a machine tool, explain the ways and means by which one could increase the Precision and Productivity of the product.
The answer should consist of at least three (3) methods of achieving higher precision and productivity each.

b. Illustrate two (2) types of ribs used in machine tool beds and also explain three (3) advantages of having ribs in machine tool beds.

c. A lathe machine is designed to accommodate work in a range of diameters from $20mm$ to $400mm$ and with 8 spindle speeds. If the operator cuts at a cutting speed of $20m/min$, determine the suitable highest and lowest spindle speeds which can be achieved by the lathe.

Also determine all intermediate spindle speeds assuming that these speeds are in geometrical progression.

Q.07. 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.

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*.

Q.08. Answer any four (04) of the following,

a. Clearly explain the Taylor's principle of limit gauging.

b. Explain what interchangeability is, and explain three types of interchangeability. Discuss their importance in manufacturing.

c. Explain what an involute teeth profile is.

d. Explain what is meant by Hole-basis system and Shaft-basis system within the context of limits and fits.
Also illustrate the lower deviation and upper deviation of a fit.

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

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