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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	:	2013/14
Date	:	August 05, 2014
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. Quoting examples, explain the different types of measurement errors encountered when taking measurements.
How do you propose to eliminate or minimize these errors?

b. Sensitivity and Variance are two operating characteristics of length measuring instruments. Define Sensitivity and Variance, and explain how you would select an instrument for measurement based on Sensitivity and Variance.

c. Illustrate a sine bar.
Explain clearly how you would use a sine bar to measure an angle of a component which is,
   i. smaller than the size of the sine bar.
   ii. larger than the size of the sine bar.

Q.02. a. What do you understand by 'Machine tool alignment'?
Quoting appropriate examples of machine tools, explain the importance of using properly aligned machines for the respective operations.
List four (04) basic alignment tests conducted for a machine tool.

b. Illustrate the three (03) categories of fits between two mating components.

c. A journal with a nominal or basic size of $75mm$ runs in a bearing with a close running fit which could be defined as $H8/g7$. Find the limits of diameters of the shaft and bearing and the maximum and minimum clearances.
The diameter steps are $50mm$ and $80mm$. The respective tolerance grades for number 8 and number 7 qualities are $25i$ and $16i$ respectively. The upper deviation for the shaft diameter D is given as $-2.5D^{0.34}$ and the tolerance unit is given by, $i = 0.45\sqrt[3]{D} + 0.001D$.

Q.03. a. Methods of surface finish measurements can broadly be divided into two, namely, contacting methods and non-contacting methods. Explain these methods stating clearly the applications and respective instruments used under each method.

b. Explain three (03) parameters of surface roughness.
Illustrate one method each which could be used to find each of the above mentioned parameters.

c. Centre Line Average (CLA) value is a measure of surface roughness. Calculate the CLA value of the surface for which the parameters are given below,

The sampling length is $0.8mm$ and a graph drawn to a vertical magnification of 15,000 and horizontal magnification of 100 indicates the areas above and below the datum line as 160, 90, 180, 50 and 95, 65, 170, 150 respectively in mm^2.

Q.04. a. Illustrate the Merchant force circle which shows the forces in metal cutting.
State the assumptions made in deriving the merchant's relationships in metal cutting.

b. The following data were obtained from a metal cutting test under orthogonal conditions,

Rake angle	: 15^o
Chip thickness ratio	: 0.383
Uncut chip thickness	: $0.5mm$
Width of cut	: $3mm$
Yield stress of material in shear	: $280N/mm^2$
Average coefficient of friction on the tool face	: 0.7

Determine the normal and tangential forces on the tool face.

Q.05. a. Explain the following mechanisms within the context of tool wear.

i. Abrasion wear
ii. Plastic deformation
iii. Thermal cracking

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

c. The useful tool life of a HSS tool machining mild steel at a speed of $18m/min$ is 3 *hours*. Calculate the tool life when the tool operates at a speed of $24m/min$. The cutting tool index is 0.125.

Q.06. Assuming that the spindle speeds are in geometrical progression, design a four (04) speed gear box to obtain speed variation between 100*rpm* and 280*rpm*. The gear box is driven by a motor with a speed of 400*rpm*.
In the design process you are required to,

a. Calculate the common ratio (φ) and select a standard value for the gear box. (Standard common ratio values are 1.12, 1.26, 1.41 and 1.58)
b. Calculate all spindle speeds of the gear box.
c. Propose a suitable structural formula and draw a kinematic diagramme.
d. Construct a suitable structural diagramme and calculate the gear ratios.
e. Construct a suitable speed diagramme assuming that the gear box consists of only spur gears.
f. Calculate the pulley ratio between the motor and the input shaft and the diameters of the pulleys.
g. Calculate the suitable number of teeth for all gears.

Q.07. a. Distinguish between punching and blanking in metal forming.

b. Drawing of sheet metal can be performed 'with the use of a blank holder' and also 'without a blank holder'. Explain clearly the usage of blank holders in drawing operations and also the instances in which drawing can be performed without a blank holder.

c. What do you understand by Hot Working of metals? You should clearly explain the mechanism of Hot Working.

d. Illustrate the Stretch forming process in metals.

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

a. Keeping an accurate Clearance Angle of a cutting tool is important. Explain why?
b. Explain what 'Interchangeability' is, and explain three types of Interchangeability.
c. Define Addendum, Backlash and Base circle in the context of a gear mesh.
d. Explain the 'Abbe Principle' in length measuring instruments.
e. What is 'Spring Back' in bending, and explain how you would minimize or eliminate spring back effect.

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