THE OPEN UNIVERSITY OF SRI LANKA

FACULTY OF ENGINEERING TECHNOLOGY

DIPLOMA IN TECHNOLOGY – LEVEL 4

FINAL EXAMINATION – 2011/2012

MEX4230 – PRODUCTION TECHNOLOGY

DATE : *FEBRUARY 21, 2012*

TIME : *0930 HRS. – 1230 HRS.*

DURATION : *THREE HOURS*

ANSWER ANY FIVE (05) QUESTIONS. *ALL QUESTIONS CARRY EQUAL MARKS.*

Q.01. a. Define **Accuracy** and **Precision** and distinguish one from the other.

State five (05) requirements to be considered when selecting a measuring instrument, and also explain clearly why each of these requirements is important.

b.

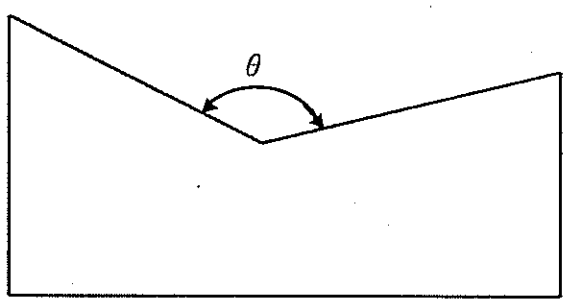


Figure.Q1

Figure.Q1 shows an unsymmetrical V-block (drawn to a reduced scale and the sketch is smaller in size compare to actual v-block) with two upper surfaces making an angle, θ. Illustrate how you measure this angle by using a sine-bar.

c. Explain the **Abbe principle** related to length measuring instruments. Explain with neat sketches the importance of this principle, in relation to accuracy and sensitivity of length measurements.

Q.02. a. Explain the importance of the texture of a surface of a given component in the context of engineering failures.

b. What is Amplitude Parameter that characterizes the texture of a surface? Explain briefly the other profile parameters for surface roughness.
Also explain the method of calculating two amplitude parameters.

c. Explain the function of a **surface roughness measuring instrument of Stylus type** and name its main components.
State clearly the consequences of selecting wrong sized stylus to measure the roughness of a surface

d. The basic size of a fit is 30 *mm* and the maximum and minimum clearances for a hole and a shaft are 0.05 *mm* and 0.01 *mm* respectively. Calculate the limit size for the hole and shaft adopting,
   i. a hole basis system
   ii. a shaft basis system.
Take hole tolerance (= t) is twice as the shaft tolerance (= 2t).

Q.03. a. The clearance angle of a cutting tool is set according to cutting conditions. Explain the importance of setting the clearance angle precisely in metal cutting operation. Illustrate the effects of different cutting conditions on tool clearance angle.
Note: You should select at least four (04) cutting conditions.

b. Distinguish orthogonal cutting from oblique cutting.

c. In an orthogonal cutting test conducted using a dynamometer, the following observations have been recorded,

Rake angle	: 15^{o}
Depth of cut	: 2.5 *mm*
Cutting speed	: 30 *m/min*
Feed rate	: 0.125 *mm/rev*
Tangential load on tool	: 3440 *N*
Normal load on tool	: 1560 *N*

Determine:
   i. Efficiency of the machine tool if the input power to the driving motor was found to be 3 *kW* with an operational efficiency of 85%.
   ii. Specific cutting energy.
   iii. Power dissipated as friction if the chip thickness was found to be 2.5*mm*.

Q.04. a. Explain the relationship between cutting temperature and the thermal conductivity of the tool material.
Also explain the **variation of properties of the material being machined** and **variation of the cutting forces** due to the abstraction of heat.

b. State three (03) main functions of cutting fluids
Give five (05) factors that influence in the selection of a suitable cutting fluid.
Discuss the importance of two (02) of such factors in metal cutting process.

c. Illustrate the variation of cutting speed against the cutting time and derive Taylor's tool life relationship.

Q.05. Design a 4 speed gear box to obtain speed variation between 100 *rpm* and 280 *rpm*. The spindle speeds can be assumed as in geometric progression. The input shat of the gear box is driven by an electric motor rotating at 400 *rpm* and through an open belt drive system. In the designing process you are required to,

a. calculate the common ratio (ϕ) of the series of speeds and select the appropriate standard ϕ value for the gear box.
Note: Standard common ratio values – 1.12, 1.26, 1.41, 1.58

b. calculate all the spindle speeds of the gear box.

c. propose a suitable structural formula and draw a kinematic diagram for the gear drive system.

d. construct a suitable structural diagram and calculate the gear ratios.

e. construct a suitable speed diagram.
Note: Gear box consists of spur gears only.

f. calculate the pulley ratio and the diameter of the input shaft pulley, if the pulley diameter of the motor is 75 *mm*.

Q.06. a. Explain the **Precision** of a machine tool. State four (04) factors which the precision of a machine tool depends upon.

b. The carrier on which the cutting tool or work piece normally mounted travels along the machine bed on slide ways. State at least four (04) requirements to be satisfied by a pair of mating parts of a machine slide.

c. Briefly explain hobbing and forming methods in the manufacture of gear wheels.
What are the advantages and disadvantages of hobbing method in comparison with forming method?

Q.07. a. *When a material is subjected to cold working, it is said to have occurred strain hardening.*
State what strain hardening of a material is, and explain how it occurs in the cold working process

b. What is the spring back effect in bending? State under what circumstances this effect tends to increase, and discuss the ways that this spring back effect may be neutralized.

c. Distinguish **Blanking** from **Punching**. Use clear sketches to explain your answer.

Q.08. Write short notes on any four (04) of the following topics. Use neatly drawn sketches wherever relevant.

a. Taylor's principle as applicable to gauging.

b. Method of measuring the pitch of internal threads.

c. The necessity of machine tool alignment, and the basic alignment tests.

d. Main cutting angles of a single point cutting tool.

e. Abrasion wear of cutting tools.

f. Four (04) methods used to transmit motion between shafts. Discuss two advantages of one of the methods.

ALL RIGHTS RESERVED