THE OPEN UNIVERSITY OF SRI LANKA

FACULTY OF ENGINEERING TECHNOLOGY

DIPLOMA IN TECHNOLOGY – LEVEL 4

FINAL EXAMINATION – 2010/2011

MEX4230 – PRODUCTION TECHNOLOGY

LIBRARY
01 NOV 2011

DATE : *01 MARCH 2011*
TIME : *0930 HRS. – 1230 HRS.*
DURATION : *THREE HOURS*

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

Q.01. a. What is meant by the term calibration of a measuring instrument? State the importance of proper calibration.
What are the factors which decide the frequency of calibration?

b. List the sources of measurement errors.
What is the type of error in measurement that results from the internal friction of the instrument?

c. State clearly the purpose of using slip gauges.
List three out of four grades of slip gauges and state a specific application of each grade.

d. One of the important operation characteristics of length measuring instrument is the Variance. Define the term Variance and briefly explain how you would select an instrument for a particular measurement based on variance.

Q.02. a. What are the advantages and disadvantages of gear drives over other types of drives?

b. Using neat sketches define the following elements of an involute gear,

i. Addendum
ii. Base circle
iii. Backlash
iv. Pitch point

c. What are the advantages and disadvantages of gear hobbing method in comparison with the gear forming method?

b. Classify gears according to the tooth profile and explain one of them clearly.

Q.03. a. Illustrate the terms **Roughness, Waviness** and **Lay** in the context of surface texture.

b. Explain the three types of surface roughness parameters.

'Two machined surfaces produced by two different machining operations give almost similar Centre Line Average (Ra) surface roughness values, but different Maximum Height of Profile (Ry) values.' Is this statement correct? Justify your answer.

c. Quoting appropriate examples, explain the importance of the concept of Interchangeability in mass production.
Clarify the following:

i. Universal interchangeability
ii. local interchangeability
iii. zero interchangeability.

Q.04. a. State three factors that attribute to heat generation between the tool and the work piece in metal removal process. Select one of them and clearly explain how it causes the generation and distribution of heat that elevates the temperature.

c. State three functions of cutting fluids in metal cutting, and clearly explain the importance of **one** of those in a cutting operation.

d. How do you define tool life?

Draw typical curve to show the variation of tool wear against cutting time for a given cutting speed. Illustrate the variation of the curve with speeds and explain the effect of cutting velocity on tool life.

e. A single point tool cutting at $25m/min$ gave a life of $1hour$ between re-grinds when operating on roughening cuts with mild steel. What will be its possible life when engaged on light finishing cuts?
The cutting tool index in Taylor's tool life expression, for roughening is 1/8 and for finishing 1/10.

Q.05. a. What are the essential properties of a cutting tool for its maximum productivity with minimum maintenance?

b. State at least four differences between orthogonal cutting and oblique cutting. Give two examples each for orthogonal cutting and oblique cutting.

c. Starting from the diagram for Ernst and Merchant theory which shows the forces in orthogonal cutting process, show that the force component (Fc) acting in the direction of tool motion to the work piece is given by the expression,

$$Fc = \tau_s A_c \left[\frac{\cos(\beta - \gamma)}{\cos\{\phi + (\beta - \gamma)\}\sin\phi} \right]$$, in usual notations.

Also show that the minimum angle of shear plane (ϕ) is given by,

$$\phi = \frac{\pi}{4} - \frac{(\beta - \gamma)}{2}$$, in usual notations.

Q.06. a. Structural diagrams are used in designing gear drives. Explain what a structural diagram in gear designing is, and list three main information given by such a diagramme.

b. Illustrate how the spindle speed of many machine tools are graded in a geometric progression.

Assume that a lathe should accommodate work in a range of diameters from 20*mm* to 400 *mm* for an average cutting speed of 20 *m/min*. Determine the minimum and maximum spindle speeds required to accommodate the range of diameters.
Also determine spindle speeds, if the above lathe has 8 speeds arranged in a geometrical progression.

c. You have been asked to design a gear box for the specifications stated below.

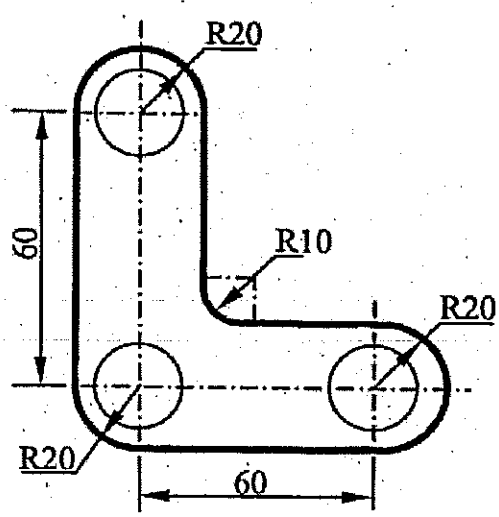
Number of speeds (n),
Common ratio (ϕ),
Minimum speed (n_{min}) and
Motor speed (n_o).

Clearly explain the steps you would follow when designing the gear box. Your answer should cover the methodology and important equations that can be used in the designing process.

Q.07. a. List characteristics of sheet metals those are important in sheet forming operations. Explain why they are important.

b. Rolling reduces the thickness of plates and sheets. It is also possible to reduce the thickness by simply stretching the material. Would stretching be feasible? Explain your answer with flow properties of material.

c. Calculate the blanking and punching forces separately to produce the part shown in Fig.7. Thickness of the part is $5mm$, and ultimate tensile strength of the material $1000N/mm^2$. The punch holes are same size having a radius of $20mm$ each. Assume all holes are punched simultaneously. The shear strength of the material is 60% of UTS.



All Dimensions in mm

Not to scale

Fig.7

Q.08. Answer any <u>five</u> of the following.

(i) Illustrate how a sine bar is used to measure an angle of a large component.
(ii) Explain two advantages and two limitations of hot rolling.
(iii) A fit of a pair of mating components is defined symbolically by 50H8/g7. What information can you extract from the above expression?
(iv) Gears can be categorized according to the toothing system. Illustrate each category.
(v) Name five factors which affect the formation of chips in metal cutting.
(vi) Explain three reasons responsible for losing geometrical accuracy of a machine tool, and also describe how geometrical inaccuracy influences the performance of the machine tool.
(vii) State clearly the Taylor's principle as applicable to gauging.

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