KELSEY

35 ½ / 100

ITCD 301 – 001 Tool & Equipment Design: Fall 2010
Exam 1: October 11'th, 2010, Monday
Time: 60 minutes, closed book, closed notes

### Part 1: Answer the following questions as either 'True' or 'False' (20 points)

-10

T 1. When more than one locator is placed on a surface, they should be distributed as far as possible on the surface – True ✓

F 2. Integral locators are preferred over assembled locators – False ✓

T 3. When selecting a support surface, select one where there is minimum likelihood for the part to deflect under the action of clamping and cutting forces – True X

T 4. A locating pin is the simplest and most basic form of locating element – True ✓

T 5. Sight location uses lines, slots, and holes in the workholder body to position the workpiece in an approximate position for machining – True ✓

F 6. In a Brinell hardness test, the penetration or depth of the impression in the test piece is measured using a small hand microscope with a lens calibrated in millimeters – False ✓

F 7. Alloy steels are not normally used for most tools due to their increased cost – False X

T 8. Oblique cutting is defined as two-dimensional cutting in which the cutting edge is perpendicular to the direction of motion relative to the workpiece, and the cutting edge is wider than the chip – True X

F 9. Materials that do not form continuous chips promote little if any crater wear – False X

F 10. Welding of asperities between work and tool is one factor in the mechanism of tool wear – False X

Part 2: Pick the correct choice or choices (20 points)

E

-12

1. The holding force for a workholding device may be applied,
   (a) Mechanically only
   (b) Electrically only
   (c) Pneumatically only
   (d) Hydraulically only
   (e) All of the above ✓
   (f) None of the above

C

2. A workpiece in space, free to move in any direction, is designed around three mutually perpendicular planes and has,
   (a) 12 degrees of freedom and 12 directions
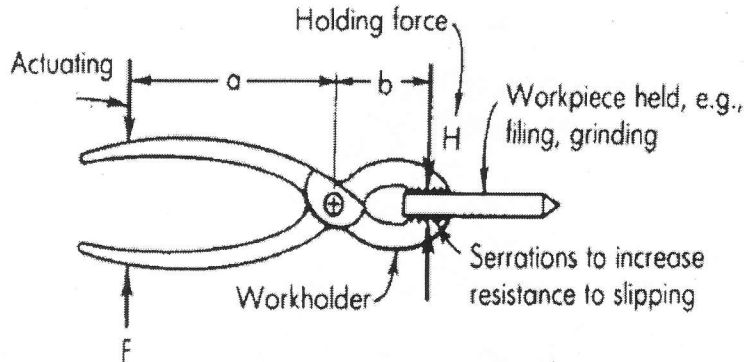   (b) 9 degrees of freedom and 12 directions

(c) 6 degrees of freedom and 12 directions

(d) 3 degrees of freedom and 6 directions

(e) 3 degrees of freedom and 3 directions

(f) None of these

A   3.   The following figure shows a,
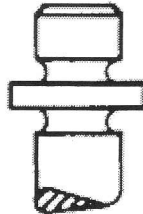
(a) Flat locator

(b) Plain locator

(c) Bullet locator

(d) Shoulder locator

(e) Round locator

(f) None of these

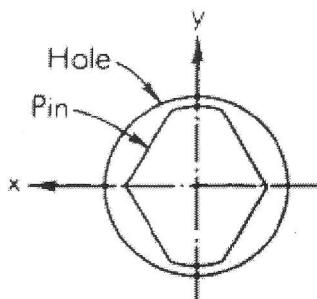4.   The holding force (H) in the figure below is,

(a) $H = \dfrac{a}{b} * F$

(b) $H = \dfrac{b}{a} * F$

(c) $H = \dfrac{a^2}{b^2} * F$
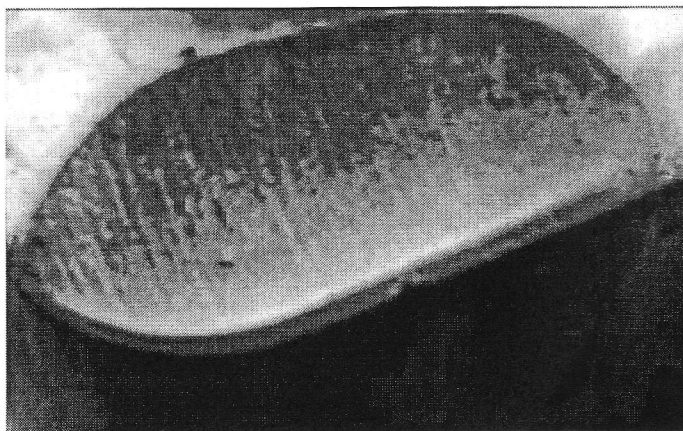
(d) $H = \dfrac{b^2}{a^2} * F$

(e) None of these

5. A diamond pin shown below is used for the following type of location in conjunction with round locating pins,
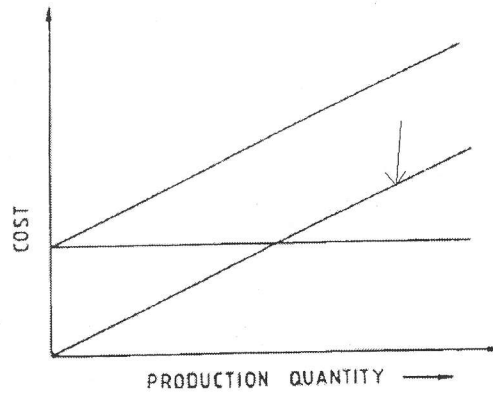
Hole
Pin
x
y

(a) Plane location
(b) Concentric location
(c) Radial location
(d) Combined location
(e) Both (c) and (d) above
(f) All of the above
(g) None of above
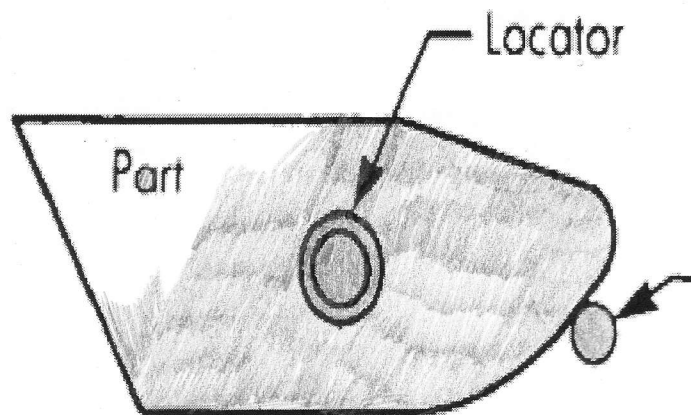
6. The tool wear shown in the figure below is called,

(a) Flank wear
(b) Crater wear
(c) Nose wear
(d) Chipping off
(e) Shank wear
(f) None of the above

7. The inclined line shown with an arrow in the break-even chart below represents,

(a) Total cost

(b) Fixed cost
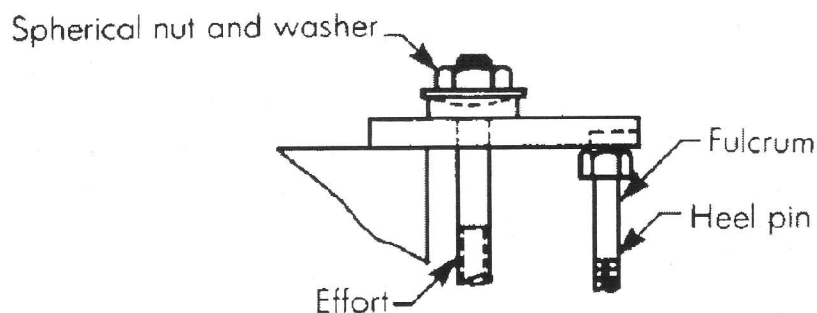
(c) Base cost

(d) Variable cost

(e) None of these

8. Label the unmarked arrow in the picture below,

(a) Locating pin

(b) Locating bush
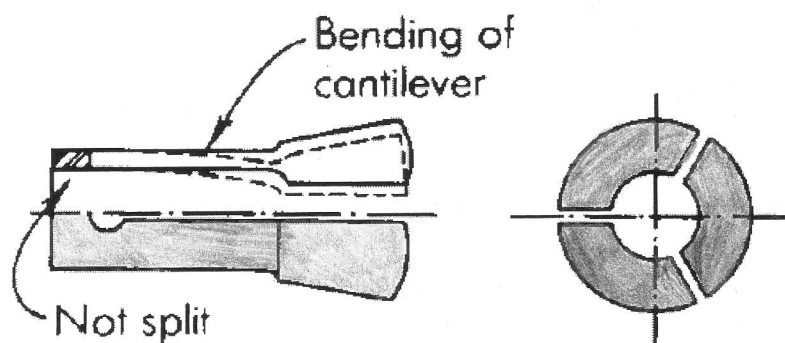
(c) Fool proofing pin

(d) Clamping pin

(e) None of these

9. The following figure shows a,

Spherical nut and washer

Fulcrum

Heel pin

Effort

(a) First class lever action
(b) Second class lever action
(c) Third class lever action
(d) All of these
(e) None of these

10. The following figure depicts a,

Bending of cantilever

Not split

(a) Split bushing
(b) Split collet
(c) Split bearing
(d) Split locator pin
(e) Split indexing pin
(f) None of these

Part 3: Explain in a few sentences (40 points)

1. **List** and **explain** at least four functions of a workholding device.

Clamp   Force   -2½

Locate   Compression

2. **List** the four types of location for workholding devices?

Plane locators

Concentric location   Combined location

Radial location

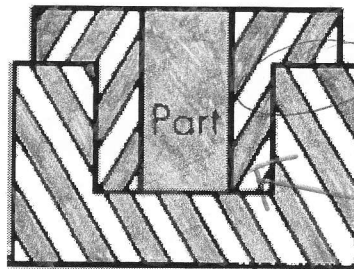3. **Explain** the 3-2-1 method of location with sketches.

Three pins   2 on one side and one on one end. Add 2 to other side and one to other end.

what does it do in terms of DOF & directions?

-2

4. **Pick** the redundant locator position in the figure below and then **explain** what redundant locators are.

-2

Redundant locator position

It is redundant because there is a corner there. ?

5. **What** are carbon steels? **List** the three main types and write down the percentage of carbon in each type. Then **enumerate** at least two applications per type.

Low Carbon : $\frac{0.05}{3} - \frac{0.3}{4}$%

Medium Carbon .4 - $\frac{0.7}{6.7}$%

High Carbon $\frac{-0}{0.7} - \frac{1.4}{1.5}$%

−4

6. The following figure shows a V-locator with a cylindrical workpiece and a stop pin. **List** and **explain** the degrees of freedom and directions that are located and the ones that are not located.

−4

End stop

— directions of freedom ?
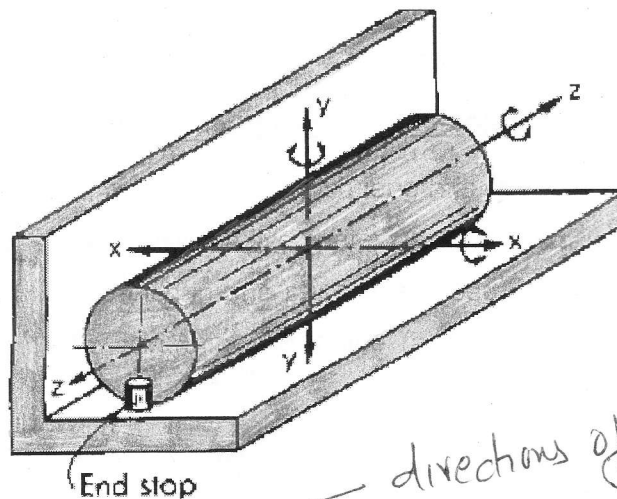
There are 7 degrees of freedom in this picture

?

7. What are locating nests? **Explain** and then **draw** a sketch.

They are where the locating pins are located.

(-5)

8. **List** the six angles and one dimension used in designing cutting tools. Which out of these seven is the most important parameter when it comes to the surface finish of the workpiece?

$X-, X+, Y-, Y+, Z-, Z+$

(-5)

Part 4: Numerical problems (20 points)

1. A work-bar with 4.5 inch diameter and 52 inch length is chucked in an engine lathe and supported at the opposite end using a live center. A 46 inch portion of the length is to be turned to a diameter of 4.25 inch in one pass at a speed of 450 feet/minute. The metal removal rate should be 6.75 in³/min. Determine (a) the required depth of cut, (b) the cutting time.

A) $6.75 = \pi 4.375 d (450)(46)$

$d = 2.3725$ inches

(-8)

B) $\dfrac{46}{(450)(46)} = .00222$ — unit ?

2. Turning tests have resulted in 1 minute tool life at a cutting speed of 4 m/s and a 20 minute tool life at a speed of 2 m/s; (a) Find the n and C values in the Taylor tool life equation. (b) Project how long the tool would last at a speed of 1 m/s.

-10