Mansoura University	**1st Term 2008-2009**	**00/01/2008**
Faculty of Engineering	**Jig & Fixture and Tool Design**	**4th Year**
Dept. of Prod. & Mech. Design	**Total Marks: 110**	**3 Hours**

First Question: (20 marks)

a) Prove analytically that the distance "x" which is the difference between the minor dia. R_1 and the major dia. R_2 of a circular for tool with positive rake angle is in the form:

$$x = R_2 - \sqrt{R_2^{\,2} + (\text{distance}12)^2 - 2(\text{distance}12)R_2\cos(\alpha+\gamma)} \qquad \textbf{(10 marks)}$$

b) For turning a workpiece with minimum diameter of 25 mm and maximum one of 30 mm by using a circular form tool having clearance angle " $\alpha = 10°$ " and rake angle " $\gamma = 5°$ ". When the difference center height " H = 5.21 mm ", calculate the major and minor diameters of the given form tool. **(10 marks)**

Second Question: (20 marks)

In a shaping operation with 2 K.W. electric motor, machine tool effeciency of 70%, 300 mm ram stroke, speed ratio of 0.75, 1.0 mm depth of cut, and 2.0 mm/stroke feed rate. Using the following equation of the main cutting force $F_z = C_F.t^x.s^y.K_z$ Kg.f., where "t" is the deyh of cut, "s" is the feed rate, C_F, x, y, and K_z are constants with the values 220, 1.0, 0.75, and 1 respectively. Calculate the number of full strokes should be used (Note that the number of strokes should be an integer number) **(8 marks)**. Also, calculate the cross-sectional area of a square H.S.S tool; which has $21\text{x}10^3$ Kg.f/mm^2 modulus of elasticity, 30 Kg.f/mm^2 bending stress, 70 mm tool overhang, and 200 μm permissible tool deflection. Note that the available tool cross-secions are 10x10, 20x20, 25x25, 30x30, 40x40, and 50x50 mm^2 **(12 marks).**

Third Question: (15 marks)

A uniform milling operation "K=1" is produced with 9 teeth plain helical-flute cutter, 25° helix angle, 30 mm axial pitch "h_a", and the developing area is 2/3 the circular pitch. It has been found that two teeth were simultaneously in operation and making a full contact angle of 25°, while the depth of cut is 1 mm. Graphically with 3:1 scale find: The workpiece width **(3 marks)**, the circular pitch **(3 marks)**, and the milling cutter diameter **(4 marks)**. Also, find graphically the new helix angle to make three teeth are simultaneuosly in operation **(5 marks)**.

Fourth Question: (20 marks)

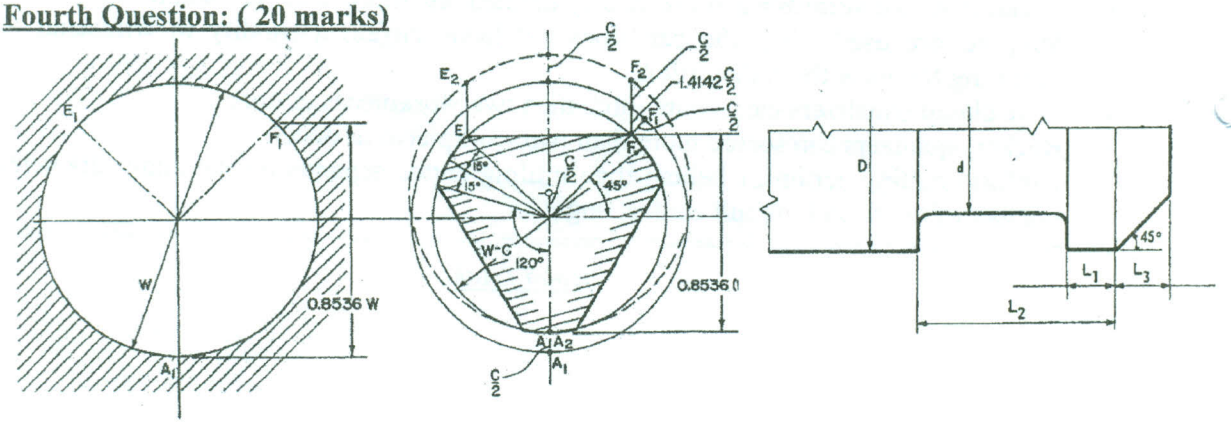
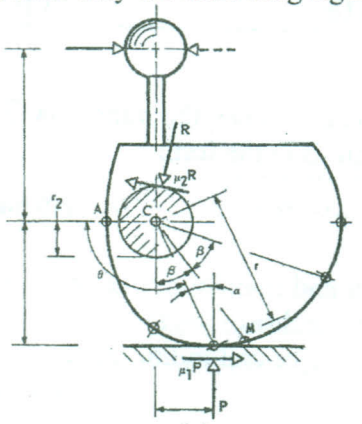


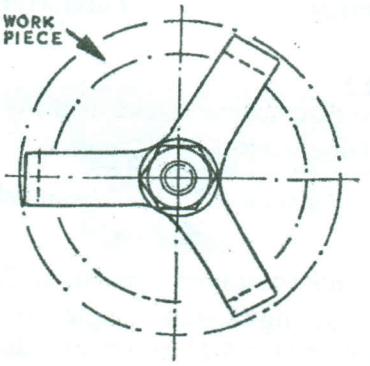
Figure shows a cylindrical locator with triangle relief. If the hole diameter"W" is 82±0.005 mm analytically calculate the dimensions of the required free jam locator **(10 marks)**. Then graphically with suitable scale draw this locator (take the nearest integer number of your calculations in the locator's drawing) **(10 marks)**. Given are, $\mu = 0.3$, $L_1 = 0.036\ D$, $L_2 = 0.8536\mu W$, $L_3 = 1.55\sqrt{D}$, and $d = 0.95\ D$.

Fifth Question: (15 marks)

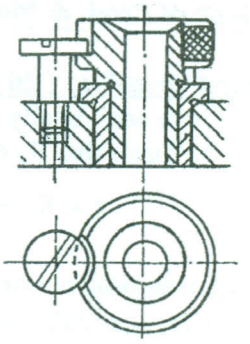
Name only the following figures with their suitable locating or clamping system.(3 marks each)



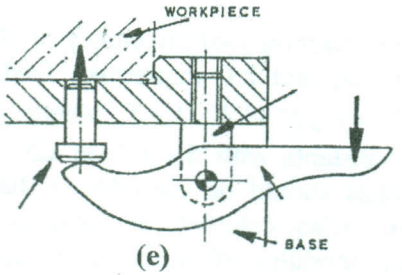
(a)



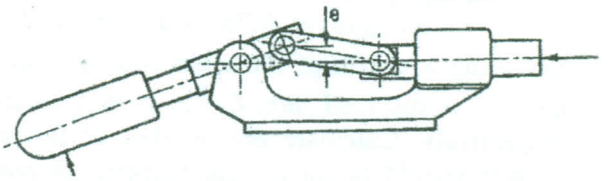
(b)



(c)



(e)



(f)

Sixth Question: (20 marks)

Answer with Yes or No the following statements

1. Direct clamps have fewer parts and not simpler operation.
2. Standard twist drill has a constant rake angle with straight lips.
3. For a single-point tool with insert held by the cutting forces, the angle between the resultant component and the main cutting direction should not be smaller than the clearance angle, and not be greater than the cutting edge angle.
4. Planing and shaping tools should have an offset with radius of curvature less then the tool overhang.
5. Increasing the approach angle of a single-point tool increases the feed force component.
6. Locating with centralizer is more closely defined and more accurate than nesting.
7. Supports are used when the part does not have sufficient rigidity to withstand the operating forces without distortion.
8. Plate clamp equalizers can secure more than two workpieces at once.
9. Rocker equalizers can secure more than two workpieces at once.
10. Uniform cutting action of helical-flute milling cutter depends on the cutter diameter, total number of teeth, and the full contact angle.

Good Luck