Menofiya University Faculty of Engineering Tim Allowed: 3 hours Second Semester Examination, 2015-2016 Date of Exam: 4/ 6 /2016		Diploma (500 Level) Subject : Stress Analysis . Code: PRE 508 Total Mark: 100 Marks Production Eng. Dep.

Answer all the following questions

QUESTION NO. 1

(25 Mark)

A) For the indicated stress distribution, determine what the conditions of equilibrium are satisfied in the absence of body forces. If the stress distribution does not satisfy the equilibrium conditions, calculate the body forces per unit volume required to achieve equilibrium.

$$\sigma_x = x \sin\frac{2\pi y}{L} \qquad \sigma_y = -y \sin\frac{2\pi x}{L} \qquad \sigma_z = 0$$

$$\tau_{xy} = \frac{L}{2\pi}\cos\frac{2\pi y}{L} + z \qquad \tau_{yz} = 0 \qquad \tau_{zx} = 0$$

B) In a metal hot forming operation, the state of stress is given by

$$[\sigma]_{xyz} = \begin{vmatrix} -80 & -60 & 0 \\ -60 & -80 & 0 \\ 0 & 0 & -80 \end{vmatrix}$$

Calculate the normal stress acting on the plane whose direction cosines are 2/3, 2/3, –1/3. Find the hydrostatic pressure and the maximum shear stresses; also obtain the principle stress deviations and direction cosines of the maximum principle stress.

QUESTION NO. 2

(25 Mark)

A) The displacement components in a strained body are:

$u = 0.01\,x + 0.002\,y^2$ mm , $v = 0.02\,x^2 + 0.02\,z^2$ mm , $w = 0.001\,x + 0.005$ mm.

i) **Calculate the displacement of the point (1,1,1).**

ii) **Calculate the strain tensor in the matrix form at the point (2,1,2).**

iii) **What is the change in distance between two points which, before deformation, have coordinates (3,2,0)mm and (–1,14,5)mm ?**

B) Three strain gauges are symmetrically arranged at 120° on the free surface of a machine. The gauge readings gave strains: $\square_{\theta 1}$= - 0.001, $\square_{\theta 2}$ =0.02, $\square_{\theta 3}$=0.003. The strain normal to the surface is $\square_z$=- 0.00156. Determine the magnitude of principle and volumetric strains

QUESTION NO. 3

(25 Mark)

A) Drive the volumetric infinitesimal strain is the sum of the three normal strains.

B) The parallepiped in the following Fig.1 is deformed in to the shape indicated by the dashed straig lines. The displacements are give $u=c_1xyz$, $v=c_2xyz$, $w=c_3xyz$, find i) the state of strain at point E in the matrix form when E′ has the coordinates (1.503, 1.001, 1.997), ii) The Dilation at point E.

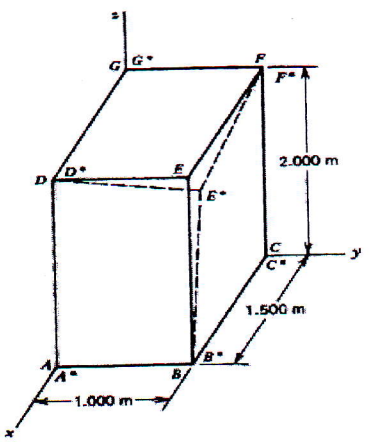

Fig.1

QUESTION NO. 4

(25 Mark)

A) A brass sheet 20 mm x 30 mm x 2 mm is clampled in a very rigid frame whose coefficient of thermal expansion is almost zero. Given that the temperature drops by 100 °C, calculate the resulting stresses in the sheet. If the element is free in the z–direction, determine the change in sheet thickness. For brass, E=120 GPa, ν=0.33, and $\alpha=16\times10^{-6}\ C^{-1}$.

B) A flat steel plate 200x400x20 mm is compressed by forces in the plane of the plate so that the new lateral dimensions are 199.98 x 399.975 mm. Assuming that the plate is free in the thickness direction and that it is uniformly stresses (Take E=200GPa and υ =0.3), determine:

- The change in thickness.
- If the plate thickness was constrained to remain constant, what stress would be applied in the thickness direction?
- Calculate the strain energy stored in the plate.

Question number	Q1	Q2	Q3	Q4	Q2	Q3	Q4	Q4	Q2	Q3	Q4	Q4
Skills	a-1-1	a-2-2	a-3-1	a-4-1	b-1-1	b-2-4	b-4-1	b-4-3	c-1-1	c-2-2	c-4-3	c-4-4
	Knowledge& understanding skills				Intellectual skills				Professional Skills			

******** GOOD LUCK**********

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