CE623 Advanced Mechanics of Solids Quiz-1 29/8/06

- Each question worth **20** marks
- Show all working.
- Attempt all parts of a question in a contiguous manner, i.e., dont scatter parts of the same question all over the answerbook.
- **Only one attempt per question will be graded**. So cancel out any attempt you do not want graded. The first not-cancelled attempt will be graded by default.
- **Formula sheet** not really required**.** If you have one, it **must be submitted with the answer book. No solved examples allowed on formula sheet.**

1. The principal stresses at point *P* are 4, 5, 6. Determine the unit normal for the plane upon which the normal stress is 5 and shearing stress is $\frac{1}{2}$.

(Hint: use a convenient coordinate system)

2. Given the displacement field

$u_x = k(x^2 + 2z);$ $u_y = k(4x + 2y^2 + z);$ $u_z = 4kz^2$

where $k = 0.001$ can be assumed as very small. Determine:

(a) The engineering extensional strains at the point $P \equiv$ (2, 2, 3), along the directions $\vec{n}(1) \equiv \left(0,\ 1/\sqrt{2},\ 1/\sqrt{2}\right)$, $\vec{n}(2) \equiv (1,\ 0,\ 0)$, $\vec{n}(3) \equiv (0.6,\ 0,\ 0.8)$

(b) The change in angle after deformation between two line elements *PQ* lying along $\vec{n}(1)$ and *PR* lying along $\vec{n}(2)$ before deformation.

(c) The change in angle after deformation between two line elements *PQ* lying along $\vec{n}(1)$ and *PR* lying along $\vec{n}(3)$ before deformation.

3 A body is subject to <u>uniform</u> pressure such that the state of stress is $\sigma_{xx} = \sigma_{yy} = \sigma_{zz} = -p,\ \ \sigma_{xy} = \sigma_{yz} = \sigma_{zx} = 0$. Assume the elastic constants as *E* and ν. Given that the displacement and the rotation at the origin are zero, determine the displacements as a function of x, y, z.

(Hint: start with the constitutive law, obtain all 6 strain components, integrate the strain displacement equations to find the displacements, use the conditions at the origin to obtain the constants of integration)