**MAE5009: Continuum Mechanics B Assignment 03: Stress Strain Relations Due October 22, 2021**

1. Derive the relations between the normal stresses and normal strains by adding the

normal stresses on the cube in the following consecutive order: *z* ,  *y* and *x* .

 *y*



*x*

 *z*

1. For a given *x-y* plane, the normal strains at point *O* in the *O*-1, *O*-2 and *O*-3 directions are respectively *O* 1 = 10-4, *O* 2 = 4×10 -4 and *O* 3 = 6×10 -4. Given the material properties *E* = 30 GPa,  = 0.25, determine the principal stresses and maximum shear stress at point *O* and their directions (only consider the stresses and strains in the *x-y* plane, i.e., a pure 2D problem)

3



30°

30°

*O* 2

1

1. A homogeneous and isotropic square plate is loaded as shown, where *x* = *y*  *xy* =

15 MPa. If *E* = 10 GPa,  = 0.3, determine the change in length of the diagonal *AB*.

 *x*

 *y*

*B* 

*xy*

*A*

1. Prove the following relations among various elastic constants:

 3*K*  *E*

6*K*

  3*K*  2*G*

3

9*K*  *K* 

*E*  3*K* 

*G* 3*KE* 9*K*  *E*



*K*  *EG*

33*G*  *E* 