

# APL 104: Quiz 1 (Set A)

Full Marks: 22 Duration: 1 hrs Date: 27<sup>th</sup> Sep 2016

**Problem 1:** During simple extension of an isotropic circular beam, which stress component is non-zero?

- (a)  $\sigma_{rr}$  (b)  $\sigma_{\theta\theta}$  (c)  $\sigma_{zz}$  (d) none of these (2)

**Problem 2:** During combined extension-torsion of an isotropic circular beam, which of the stress components are non-zero?

- (a)  $\sigma_{rr}$  (b)  $\sigma_{rr}, \sigma_{zz}$  (c)  $\sigma_{r\theta}, \sigma_{\theta z}$  (d)  $\sigma_{\theta z}, \sigma_{zz}$  (2)

**Problem 3:** During torsion of an isotropic hollow circular cylinder (without extension), radial displacement could be non-zero only if

- (a) is always zero (b) is always non-zero (c) more information required (d) None of these (2)

**Problem 4:** The following state of stress exists at a point:

$$\underline{\underline{\sigma}} = \begin{bmatrix} -2 & 4 & 0 \\ 4 & 6 & 0 \\ 0 & 0 & 10 \end{bmatrix}$$

The principal stresses are:

- (a)  $(2+4\sqrt{2}, 2-4\sqrt{2}, 10)$  (b)  $(-2, 6, 10)$  (c) more info required (d) none of these (2)

**Problem 5:** For the state of stress in problem 4, what are the normal and shear components of traction on a plane whose normal lies in (x-y) plane and makes an angle of  $7.5^\circ$  clockwise from x-axis?

- (a)  $2(1+\sqrt{2}), 2\sqrt{6}$  (b) 6, 4 (c)  $2(1+\sqrt{6}), 2\sqrt{2}$  (d) none of these (2)

**Problem 6:** How many independent material constants are required for linear stress-strain relation of most general material?

- (a) 21 (b) 36 (c) 2 (d) 9 (2)

**Problem 7:** What will be the volumetric strain at a point in an isotropic body if it has pure shear state of stress at that point?

- (a) 0 (b) depends on bulk modulus (c) depends on stress and strain (d) none (2)

**Problem 8:** Given compatible field for strain matrix of a body, what more conditions are needed to obtain the displacement field generated in that body?

- (a) material constants (b) knowledge of displacement and rotation matrix at any arbitrary point (c) nothing more required (d) none of these (2)

**Problem 9:** Suppose a body undergoes just rigid rotation (assume rotation is very small), its displacement gradient matrix will be:

- (a) symmetric (b) anti-symmetric (c) can't say (d) none of these (2)

**Problem 10:** During combined extension-torsion of a circular tube, the axial displacement  $u_z$  only depends on  $z$  because:

- (a) can depend on  $\theta$  too (b) depends on both  $r$  and  $\theta$   
(c) plane cross-section remains planar (d) none of these (2)

**Problem 11:** Give the most suitable answer: due to compatibility condition, the strain matrix

- (a) field cannot be chosen arbitrarily (b) at a point does not get restricted  
(c) both (a) and (b) (d) none of these (2)