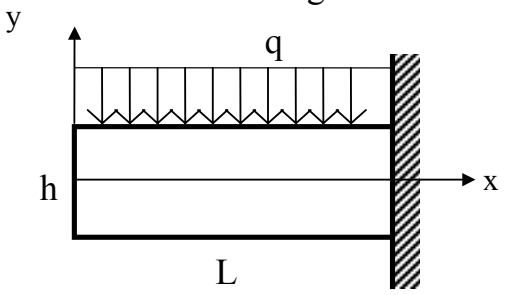
Theory of Elasticity ME 6102 **National University of Singapore**
Prof. Mordechai Perl **Dept. of Mechanical Engineering**

Assignment #6

1. A cantilever beam of length **L** and height **h** is loaded by a uniformly distributed force **q** (see figure below). To solve the problem the following stress function is proposed:

$$\Phi = a\frac{x^2}{2} + b\frac{x^2 y}{2} + c\frac{y^3}{6} + d\frac{x^2 y^3}{6} + e\frac{y^5}{20}$$

(a) Can Φ serve as a stress function and under what conditions?
(b) Derive explicit expressions for the stress components in the beam.
(c) Write the boundary conditions (If necessary use integral boundary conditions).
(d) Determine the constants *a, b, c, d, e* by applying the boundary conditions.
(e) Compare your results with the "Strength of Materials" solution for such a beam.



2. A distributed load q acts on the boundary $y = xctg\alpha$ of a triangular structure as described in the figure below. To solve the problem the following stress function is proposed:

$$\Phi = a\frac{x^3}{6} + b\frac{x^2 y}{2} + c\frac{xy^2}{2} + d\frac{y^3}{6}$$

(a) Determine the conditions under which Φ can be a stress function.
(b) Derive explicit expressions for the stress components in the structure while accounting for its own weight. The structure's density is given as **ρ**.
(c) Write the boundary conditions on the boundaries AB and AC.
(d) Determine the constants *a, b, c, d* by applying the boundary conditions.

