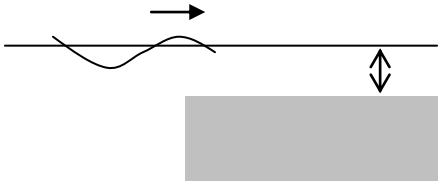
Homework #1

Course: 414.311A

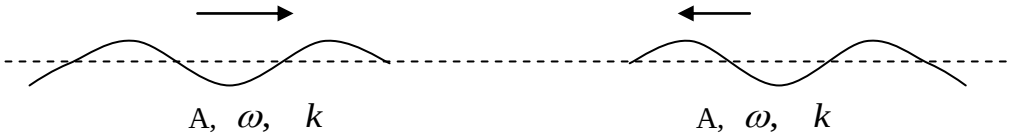
Due on
October 18, 2013

1. (30%) (Modified Problem from Quiz 1, 2012) Our SNU towing tank is the dimension of 110-m length and 3.5-m depth. Let's assume that you need to calibrate the wave maker.
   (1) (10%) You generated waves with excitation frequency of 0.3Hz. Predict the corresponding wavelength at some distance from the wave maker.
   (2) (10%) You dropped a very small floating particle to record the wave motion. At the wave excitation frequency, the buoy showed 0.3-m wave height. What are the maximum horizontal and vertical velocities in wave field?
   (3) (10%) A dynamic pressure sensor is installed at 0.2-m below from still water level. Predict the maximum dynamic pressure that the sensor will record. (Consider linear pressure.)

2. (20%) (Modified Problem from Quiz 1, 2012) A series of regular wave propagate from deep water to a channel of 5m depth. It is observed that wave period is 7sec and wave amplitude is 1m in deep water domain.
   (1) (10%) Find the wave length in the deep water domain.
   (2) (10%) Obtain the wavelength in the channel domain.



3. (20%) Show that standing wave can be obtained by combining two linear progress waves which propagate opposite directions.



4. (30%) When surface tension exists on 2D free surface, the pressure difference across the surface can be written to the following:

$$\Delta p = -T\frac{\partial^2 \eta}{\partial x^2}$$

where T is the surface tension in a unit length and η is wave elevation.

Formulate the boundary value problem in a finite depth of constant depth h. Derive the linear free surface boundary condition.