7 pm.

First Mid-term Test
Fall 2010
b
ENCE 4723
Coastal Engineering

Duration 2 hours

Open-book including calculator, notes and texts.

Attempt all questions

Give your answers on the sheets provided.

Question # 1 9 /10

Question # 2 9 /10

Question # 3 8½ /10

Question # 4 10 /10

TOTAL 36½ /40

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Last Name

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H=2 T=5.5s d=5 L=? C=? H_b=? C_g=? Type=?

1. Given: a 2-m high wave with a period of 5.5 seconds in a water depth of 5-m.
Circle the closest answer:
Determine:

a) The wave length based on linear wave theory is: [155, 50, 47, (34) 25] m

b) The wave celerity is: [28, 8.6, (6.2) 5.1, ≥30, ≤ 4.5] units ___

c) The group velocity is: [9.1, 7.3, (6.0) 5, ≥10, ≤ 4.5] units ___

d) The equivalent deep water wave height is:
[2, (2.15) 1.85, 2.10, ≥2.2, ≤ 1.8] units ___

e) Classify the wave. Stokes 3rd order Transitional

Show your calculations here!

$L_0 = \frac{g(5.5)^2}{2\pi} = 47.23m$ $\frac{d}{L_0} = 0.1059$ From Appx I $\frac{d}{L} = 0.1462$

$\rightarrow L = 34.2m$ $C = \frac{L}{T} = 6.22$

$C_g = C_n = 6.22 \left\{ \frac{1 + \left(\frac{4\pi(5)}{34.2}\right)}{\sin\left(\frac{4\pi d}{L}\right)} \right\}^{1/2} = 6.22 \left(\frac{2.837}{3.059}\right)^{1/2} = 5.99$

$\uparrow 3.059$

$K_r K_s$

0.94 $\frac{L}{0.94} = 2.11$

$\frac{d}{gT^2} = 0.0168$

$\frac{2}{gT^2} = 0.00674$

$H = 1.4m$ $T = 5s$ $\alpha_0 = 45^\circ$

2. Given: a 1.4-m wave with a period of 5 seconds in deep water with an angle of 45° between the wave crest and the shoreline.

Circle the closest answer:

Determine:

a) The wave height at d = 2 m: [1.43, **1.37, 1.58** 1.25, ≤1.22, ≥1.6] m

b) The wave length at d= 2 m: [39, 34, 21, **≤19, ≥40**] m

c) The angle at d = 2 m: [45, 43, 33, 23, ≤20, ≥46] degrees

d) Will the wave break at or before this location? [Yes, No]

Show your calculations here!

$L_0 = 39.03$ $\frac{d}{L_0} = 0.0512$ From App>

$\frac{d}{L} = 0.09520$ ~~$\frac{H}{H_0} = 1.19$~~ $L = 21.01$

~~$K_s = 0.9444$~~ $H = H_0 K_s$ →

$\frac{d}{gT^2} = 0.00815$ using C-6 $K_r K_s = 0.868$

$H = H_0 K_r K_s = 1.215$

$\frac{H}{d} = \frac{1.215}{2} = 0.6075 < 0.78$

$H_i = 2$ $T = 6$ $d = 11\,m$

3. Given: A 2-m deep water wave with a period of 6 seconds that encounters a 500 m long rock rubble breakwater in a water depth of 11 m. The angle between the wave crest and the breakwater is 0° as shown the sketch below.

Circle the closest answer:

Estimate:

a) The maximum wave height at point A:
[0.45, 0.43, 0.40, 0.31, ≤0.25, ≥0.5] m

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b) If the incident wave is partially reflected at the breakwater (slope 1H:1V), estimate the maximum wave height on the seaward side of the breakwater. Assume the breakwater is a rubble mound type (rough porous):
[≤2, 2.2, 2.4, 2.6, 2.8, 3, ≥4] m

(a) ~~$K_r = 0$~~
(b) $K_r = 0.3$

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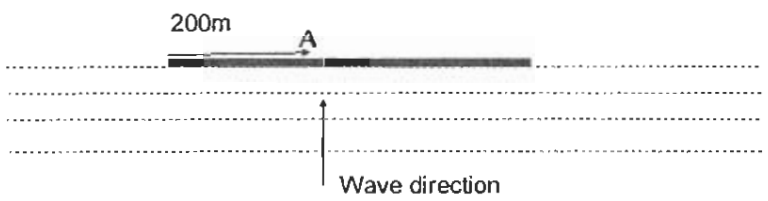

Show your calculations here!

$L_o = 56.21$ $\frac{d}{L_o} = 0.1957 \rightarrow \frac{d}{L} = 0.2218$

$\rightarrow L = 49.59\,m$

$r_{LA} = 200\,m$ $\frac{r_{LA}}{L} = 4.03$ @ $\theta = \emptyset$

$K_L = 0.118$

$H_i = H_o K_s$

$r_{BA} = 300\,m$ $\frac{r_{BA}}{L} = 6.05$ @ $\theta = \emptyset$ $K_B = 0.093$

$K = K_B \times K_L = 0.211$ $\therefore \beta = 45^o \cdot \left(\frac{\pi}{180}\right) = 0.78\,rad$

$H = H_i K = 0.422\,m$ $\left(\frac{H_o}{L_o}\right)_{max} = 0.1109$

$\frac{H_o}{L_o} = \frac{2}{56.21} = 0.0355 < max \therefore K_r = 1$

$\therefore K_r = 0.3$ $H_r = H_i K_r = 0.6\,m$ for max + $H_i = 2.6\,m$

T=

(1:20)

4. Given: Ho'= 8.6-m with a period of 25 s. There is a shelf that has a 5% slope.

Circle the closest answer:

Estimate:

a) the breaking wave height: [≤12, (14.5,) 16.5, 18, ≥20] m

b) the breaking depth: [≤9, 9.5, 11, (13.5) 14.6, ≥15] m

c) the Breaker type Plunging.

Show your calculations here!

$$\frac{H_o}{L_o} = \frac{H_o}{5.12\,T^2} = \frac{8.6\,m\left(\frac{1ft}{0.3048\,m}\right)}{5.12\,(25^2\,s^2)} = 0.0088$$

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$$\frac{H_b}{H_o'} = 1.7 \qquad H_b = 14.62$$

$$\frac{H_b}{gT^2} = 0.00236 \qquad \frac{d_b}{H_b} = 0.94$$

$$d_b = 13.74$$