BANGLADESH UNIVERSITY OF PROFESSIONALS
Military Institute of Science and Technology
B.Sc. in Environmental, Water Resources, and Coastal Engineering, Term Final (Spring) Examination 2024: Oct 2024 - Nov 2024

Student Group: Earned Credit Hours>108

Subject: EWC 471, Basic Coastal Engineering

Time: 3.00 hours **Full Marks: 180**

INSTRUCTIONS:

a. Use **SEPARATE** answer scripts for each section.
b. **Question-1** in **Section-A** and **Question-5** in **Section-B** are compulsory.
c. Answer any other **TWO** out of the remaining **THREE** questions from each section.
d. Figures in the margin indicate full **marks**.
e. Assume reasonable data if necessary.
f. **Symbols** and **abbreviations** used have their usual meanings.

SECTION-A

Question 1 (Compulsory)

a. Define group velocity. Differentiate between "pure oscillatory waves" and "finite amplitude waves". **06**

b. There are non-breaking waves on both sides of a structure with unequal SWL. **24**
At left side: Incident wave height, H_1=2.2 m
d_1=4.3 m
T_1=8 sec
At right side: Incident wave height, H_2=1.6 m
d_2=3 m
T_2=10 sec
Reflection coefficient, X=1.
For non-overtopping scenario calculate F_c, F_t, $F_{c\ total}$, $F_{t\ total}$ M_c, M_t, $M_{c\ total}$, $M_{t\ total}$ for both side. Also determine the critical conditions.(Symbols indicate their usual meaning)
Related nomographs are given in Figures 1-4.

Question 2

a. Write short note on- (i) Wave refraction **08**
(ii) Shoaling
(iii)Plunging
(iv) Surging

b. A wave with a period, T=11 seconds is propagated shoreward over a uniformly sloping shelf from a depth d= 160 m to a depth d= 2.5 m. Find the wave celerities, C and length, L corresponding to depth, d=160m and d=2.5 m. **10**

c. For a wave with period T=8 sec, in a water depth d= 15m, and a wave height H=5.5 m, find the local horizontal and vertical velocities, accelerations and displacements at an elevation z= -5m below the SWL when $\Theta=\frac{\pi}{3}$. **12**

Question 3

a. Show with necessary sketch that water particle generally move is elliptical paths in shallow or transitional depth and in circular paths in deep water. **08**

b. An average maximum pressure P= 124 KN/m^2 is measured by a **12**

subsurface pressure gauge located in salt water 0.6 meter above the bed in depth d= 12 m. The average frequency, f= 1/15 Hertz. Find the height of the wave assuming that linear theory applies.

c. A wave with period T= 10 sec moves from a water depth of 200m to a depth 3m. Calculate the wave group velocity at both depths. **05**

d. Explain why do wave breaks. **05**

Question 4

a. Write down the Green's law. Apply Green's law to determine Tsunami height at 1m depth, if Tsunami height was 1m at 10m depth. **06**

b. In deep water a wave has a height of 3m and a period of 8 sec. The wave moves into a water depth of 8m.Calculate the wave height at the new depth. The wave does not refract. If the same wave moves from 8m depth to 6m depth, calculate the new wave height assuming deep water wave height is unknown.
Relevant nomographs are given in Figures 4-6. **15**

c. Classify the wave force problems by type of wave action and by type of structures. **03**

d. Sketch a typical cross shore beach profile and identify the salient features. **06**

SECTION-B

Question 5 **(Compulsory)**

a. Write down the names of five different types of coastal structures and state the objective and one principal function of each of the structures. **10**

b. The site and wave conditions along a coastal shore line are as below: **20**
RL of the road level= +20ft MLLW
Storm surge height= 4.5 ft
50 year high water level= +8.5 ft MLLW
MHHW= +6.3 ft MLLW
Bed level at the end of bank slope= +4.0 ft MLLW
Bottom slope of sea bed=1:20
Design wave height= 5.5ft
Design wave period= 5 sec
Check which type(s) of armor unit among riprap and quarrystone is(are) suitable. Design the quarrystone armor layer, crest level of the revetment, filter layer and toe protection. Also show the design section with neat sketch. Use the attached table (Figure 5b). Assume the reasonable value of any data, if not given.

Question 6

a. Define harbor. List various components of a harbor and write down one main function of each of those components. **12**

b. Discuss the types of daily tidal cycle with graphical representation. **12**

c. Write down the differences between constructive and destructive waves. **06**

Question 7

a. Describe the stages of delta formation with necessary figures. **12**

b. Briefly describe the classification of deltas based on shape with examples. **08**

c. List down the six hotspot areas identified in Bangladesh Delta Plan (BDP) 2100. Discuss the main strategy and the measures mentioned in BDP 2100 for any of the hotspot areas. **10**

Question 8

a. Waves having height of 2.0m break on a flat beach at a wave breaking angle= 4.5°. Calculate the potential immersed weight and volumetric longshore transport rates. Assume the K coefficient is 0.39. **08**

b. Define coastal erosion. Explain the processes involved in coastal erosion. **10**

c. With neat sketches show: **12**
i. typical cross-section and layout of sea dike
ii. typical cross-section of vertical front seawall
iii. rubble-mound breakwater with concrete superstructure

$$u = \frac{H}{2}\frac{gT}{L}\frac{\cosh\left[\frac{2\pi(z+d)}{L}\right]}{\cosh\frac{2\pi d}{L}}cos\theta$$

$$w = \frac{H}{2}\frac{gT}{L}\frac{\sinh\left[\frac{2\pi(z+d)}{L}\right]}{\cosh\frac{2\pi d}{L}}sin\theta$$

$$a_x = \frac{g\pi H}{L}\frac{\cosh\left[\frac{2\pi(z+d)}{L}\right]}{\cosh\frac{2\pi d}{L}}sin\theta$$

$$a_z = -\frac{g\pi H}{L}\frac{\sinh\left[\frac{2\pi(z+d)}{L}\right]}{\cosh\frac{2\pi d}{L}}cos\theta$$

$$\xi = -\frac{H}{2}\frac{\cosh\left[\frac{2\pi(z+d)}{L}\right]}{\sinh\frac{2\pi d}{L}}sin\theta$$

$$\zeta = \frac{H}{2}\frac{\sinh\left[\frac{2\pi(z+d)}{L}\right]}{\sinh\frac{2\pi d}{L}}cos\theta$$

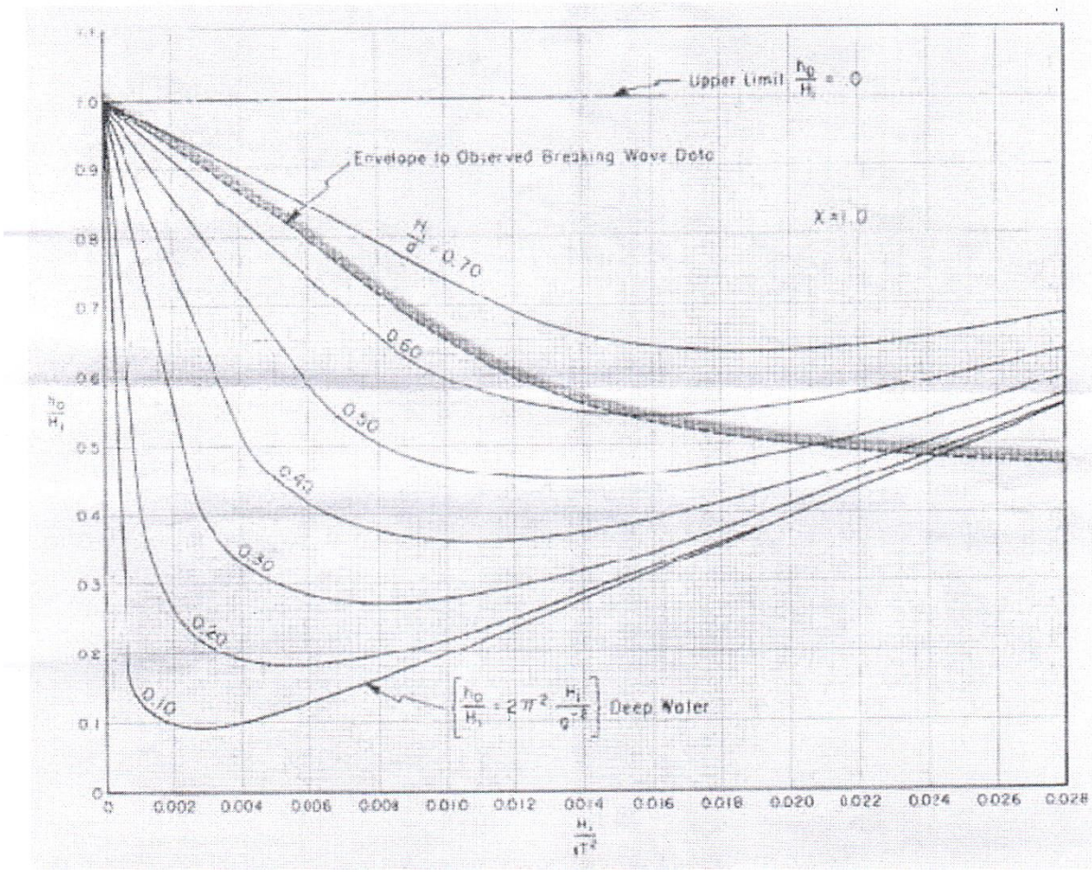


Figure 1: Nonbreaking waves; x= 1.0 (Figure for Question 1(b))

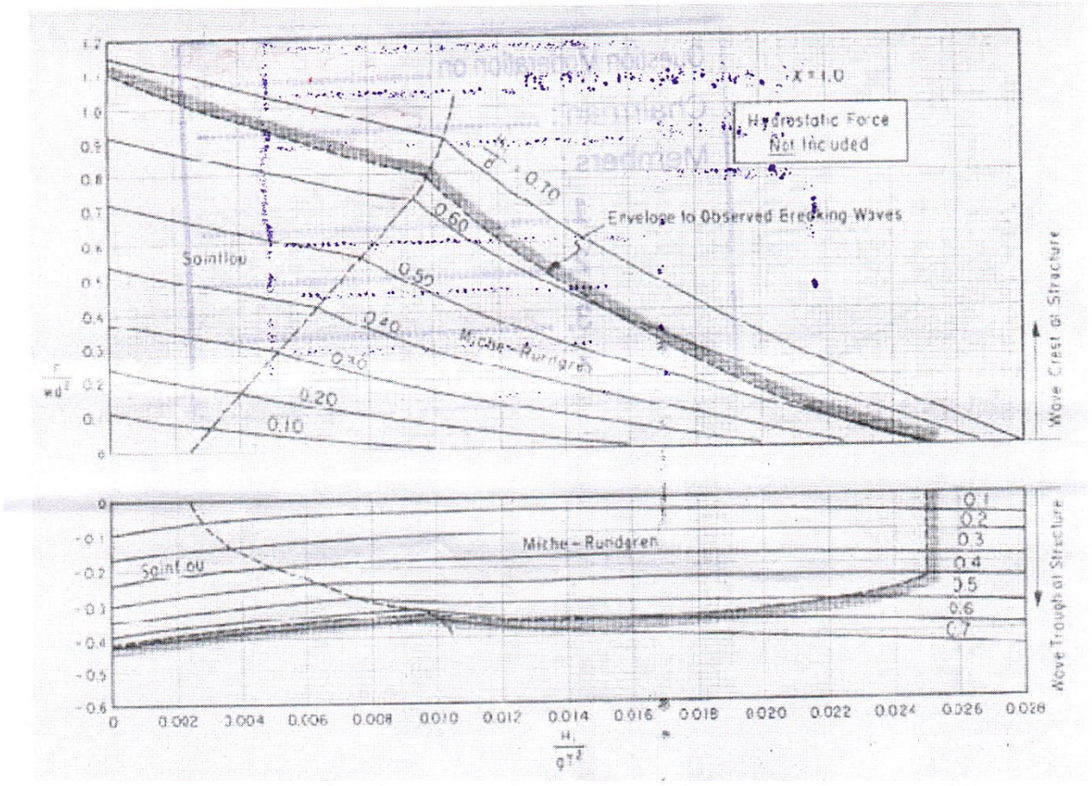


Figure 2: Nonbreaking wave forces; x= 1.0 (Figure for Question 1(b))

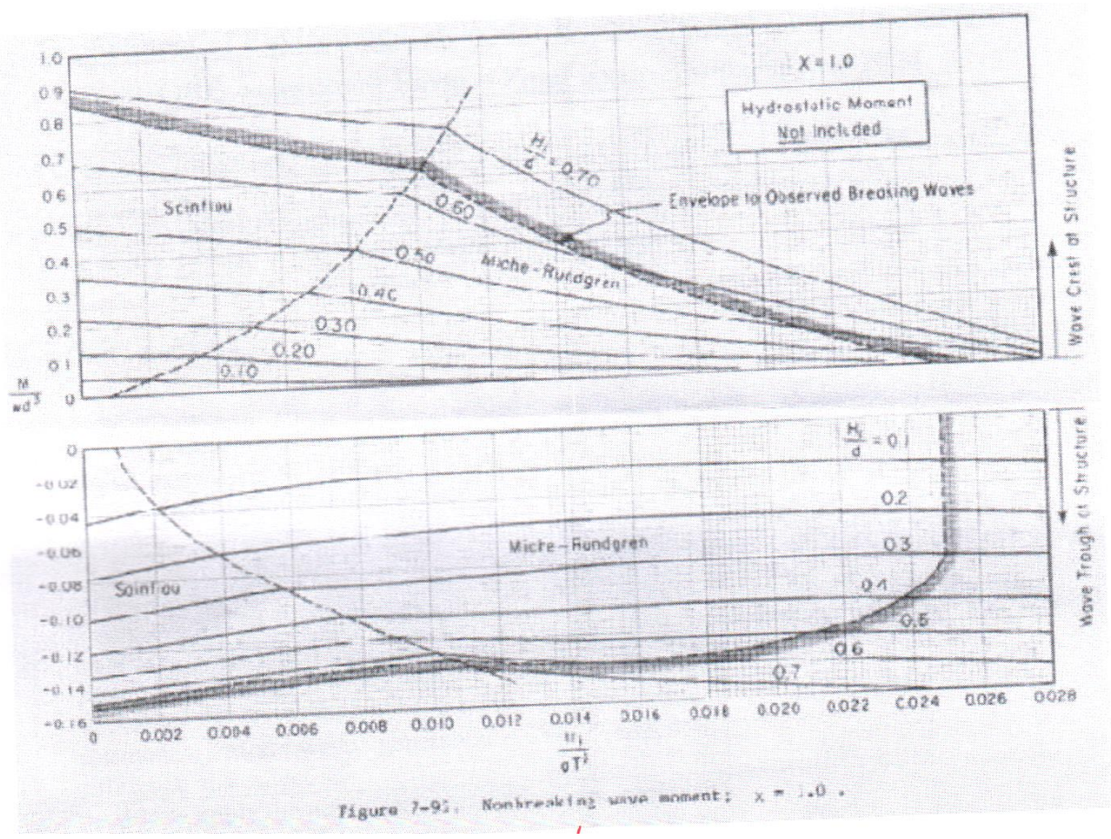


Figure 3: Nonbreaking wave moment; x= 1.0 (Figure for Question 1(b))

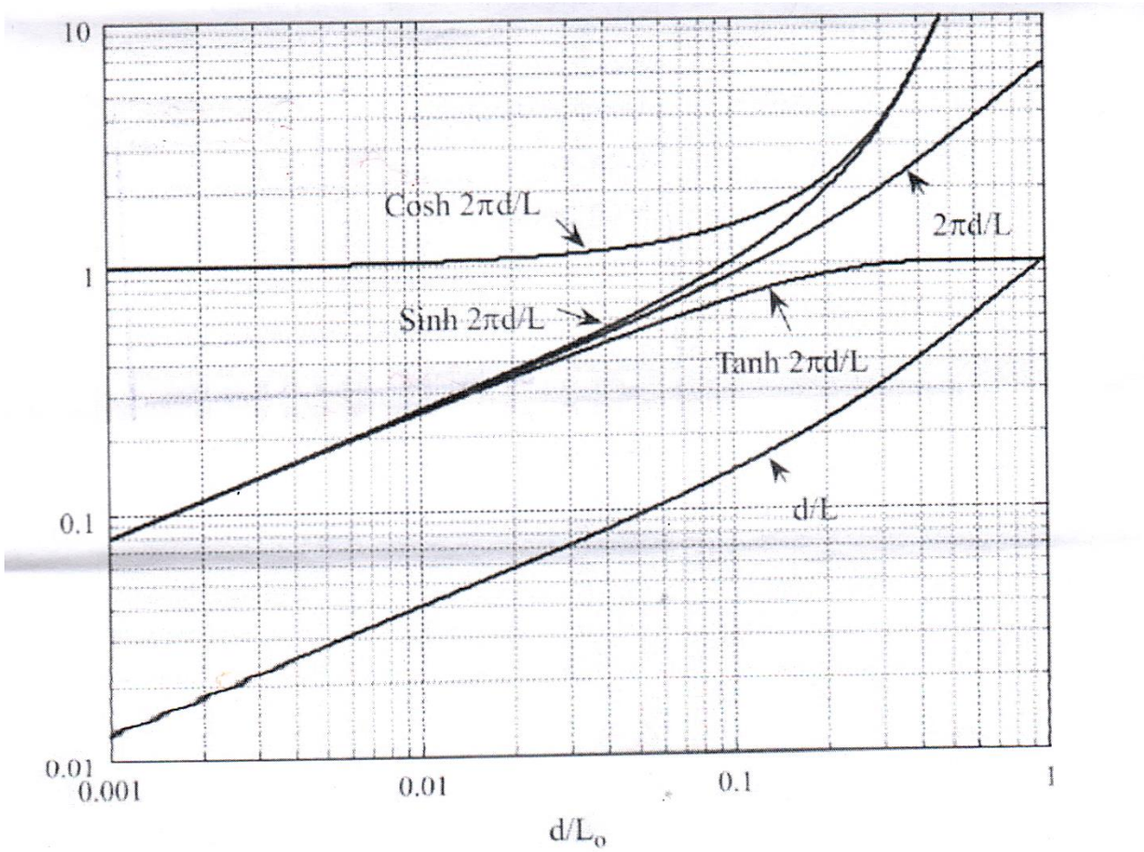


Figure 4: Relationship between d/L_o and functions of d/L (Figure for Question 1(c))

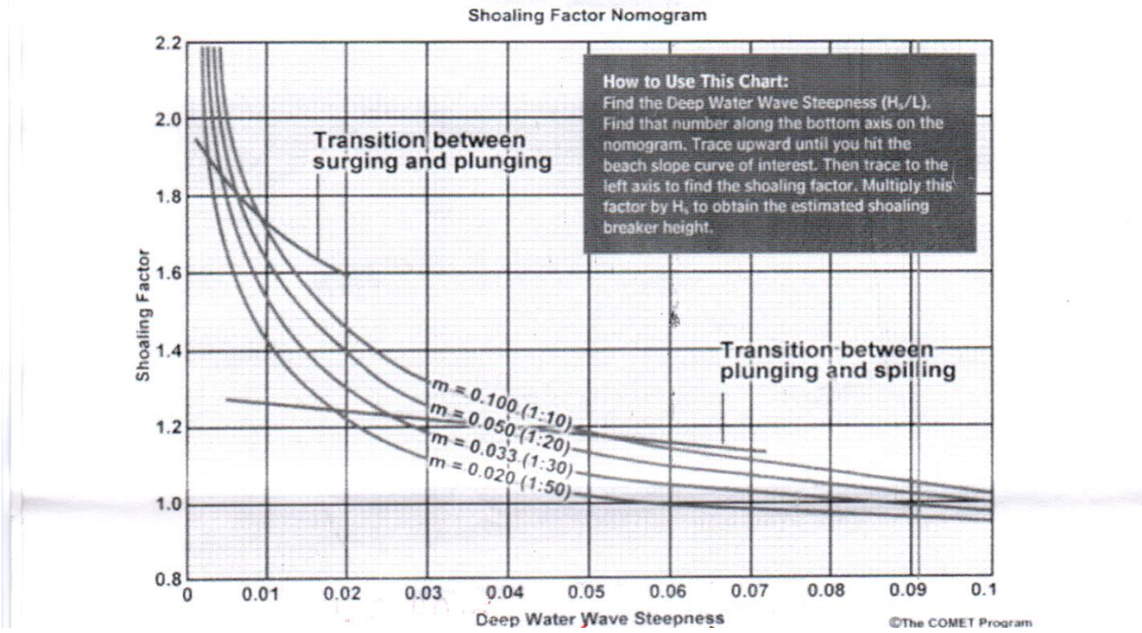


Figure 5: Shoaling Factor Nomogram (Figure for Question 4(b))

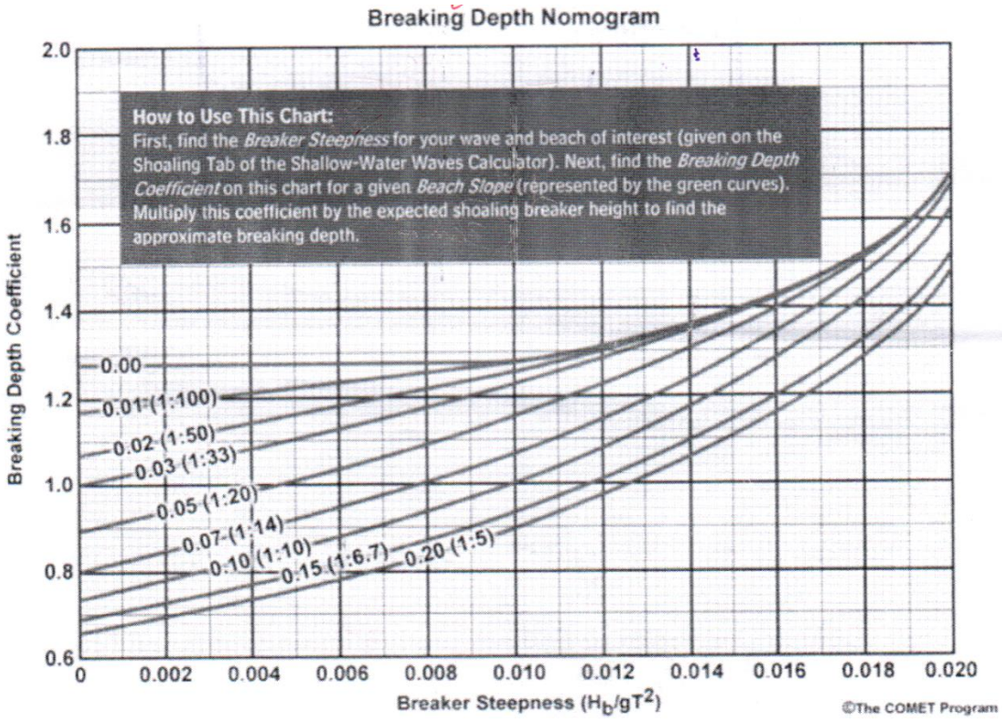


Figure 6: Breaking Depth Nomogram (Figure for Question 4(b))

Figure for Question no 5(b)

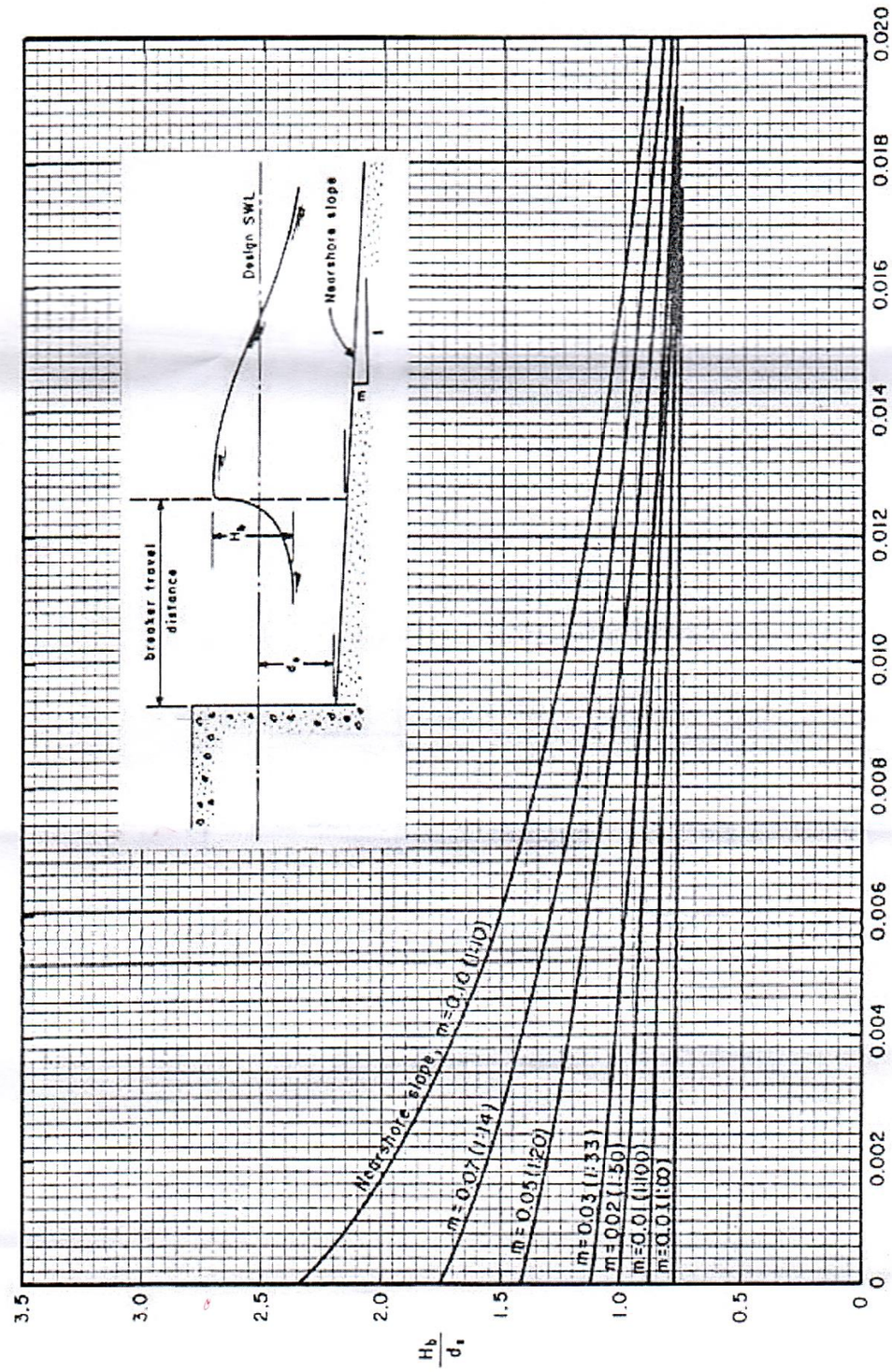


Figure 18 Dimensionless Design Breaker Height Versus Relative Depth at Structure [Weggel (1972)]