2)

BANGLADESH UNIVERSITY OF PROFESSIONALS
Military Institute of Science and Technology
B.Sc. in Environmental, Water Resources, and Coastal Engineering
Student Group : 108 < Earned Credit Hour, Spring Final Examination: June 2019

Subject: EWC 471, 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-7 in Section B** are compulsory
c. Answer **any other TWO** questions from each section.
d. Figures in the margin indicate **full marks**.
e. Assume reasonable data if necessary.
f. **Symbols** used have their usual meanings.

SECTION-A

Question – 1

a. What is coastal engineering? Why it is different from other ocean related studies? **05**

b. What are the basic assumptions to derive 'Small Amplitude Surface Wave Theory"? **05**

c. Define 'Seiche' and 'Tsunami' with respect to water level variation. **05**

d. Draw Mixiken wave pressure diagram. Write down the total moment about the toe (the equation only). **05**

e. Why diffraction occurs in shallow water waves?

f. Differentiate between tide dominated estuary and wave dominated estuary. **05**

Question – 2

a. Draw a neat sketch of typical beach profile and identify all the salient features. **06**

b. Define secondary coasts. List up the different types of marine deposited coasts under secondary coasts. **06**

c. A wave propagated with a wave period of T = 5 sec. in a water depth d = 16 m and a wave height, H = 2.5 m. Find the local horizontal and vertical velocities at a depth 4 m below the SWL when $\theta = \left[\frac{2\pi}{L}x - \frac{2\pi}{T}t\right] = \frac{\pi}{4}$ **08**

d. Differentiate between deep water waves and shallow water waves. **05**

e. Draw a neat sketch of local fluid velocities in the direction of wave propagation. **05**

Question – 3

a. Write down the equation for horizontal force per unit length of a vertical cylindrical pile and identify all the terms including the dimensionless terms. **05**

b. What are the basic information needed for oceanology with their applications. **05**

c. Find the non-breaking wave forces and moments against a completely reflecting vertical wall ($\lambda = 1.0$) resulting from the wave condition given below: **10**

i) Wave height at the structure if the structure were not there $H_i = 2.0$ m.
ii) Depth of the structure d = 4.0 m
iii) The wave period considered in this design is T = 6 sec.

Figure 1, Figure 2 and Figure 3 are attached for relevant uses.

d. Write short note on – **10**

i) Wave breaking
ii) Tombolo
iii) Sinusoidal wave profile
iv) Sub surface pressure

Question – 4

a. Illustrate the classification of wave forces problems by type of wave action and by structure type. **05**

b. What is group velocity? What is the significance of energy conservation in wave theory? **07**

c. Define: wave height, wave number, relative depth and wave steepness. **10**

d. A wave with a wave period T = 7 seconds is propagating shoreward over a uniformly sloping shelf from a depth of 220.0 m to a depth of 2.2 m. Find the wave celerity and wave length at depths (i) 220.0 m and (ii) 2.20 m. **08**

SECTION-B

Question – 5

a. How do you distinguish a lake from a sea? When is a sea called an ocean? Justify your answer with appropriate examples. **06**

b. Explain (i) Newton's theory of tide generation, (ii) Tidal level and changes in sounding datum. **7+7 =14**

c. Illustrate various element of a harbor with a neat sketch of harbor layout plan. **10**

Question – 6

a. State the physical and functional characteristics of the following coastal structures: **07**

i) Detached breakwater
ii) Sea wall

b. Illustrate with neat sketches (i) Typical beach configuration with groins, (ii) Vertical front sea wall. **08**

c. Write down the tidal characteristics of Bangladesh. How can coastal erosion be managed or reduced? **7+8 =15**

Question – 7

a. State the mechanism and also show with neat sketches the following failures in coastal structures: **10**

(i) Slip surface failure of rubble foundation

(ii) Hydraulic instability and breakage of armor unit of breakwater

b. The site and wave conditions along a coastal shoreline are given in the following figure: **20**

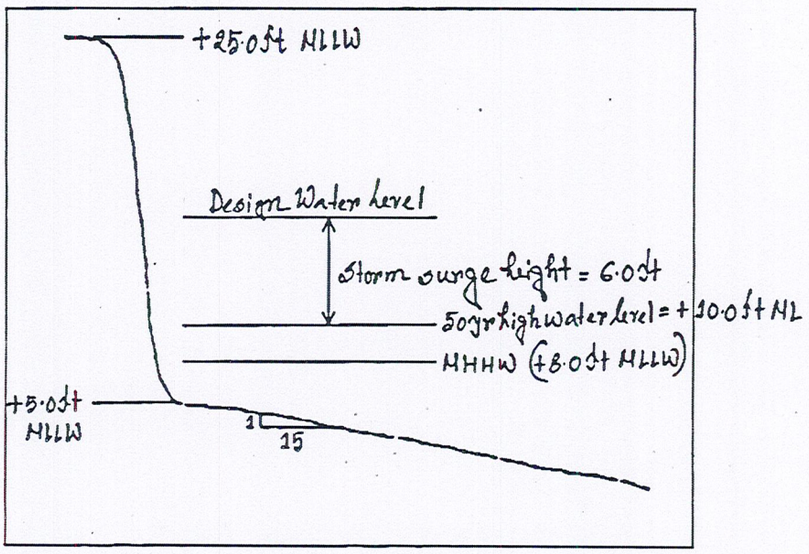


Figure for Question No. 7 (b)

If the design wave height = 6 ft and design wave period = 5 sec, design a revetment type shore protection structure including the filter and toe protection with a suitable armor unit. Also, show the design section with neat sketch. (Use the attached tables and graph. Assume any reasonable value of data, if not given).

Question – 8

a. How do coastal sediment process occur? Explain briefly with neat sketches. **07**

b. Compare the geometry of different types of Delta. **08**

c. What do you understand by "Hotspots"? Compile the Hotspot issues and challenges according to Bangladesh delta plan (BDP) 2100. **15**

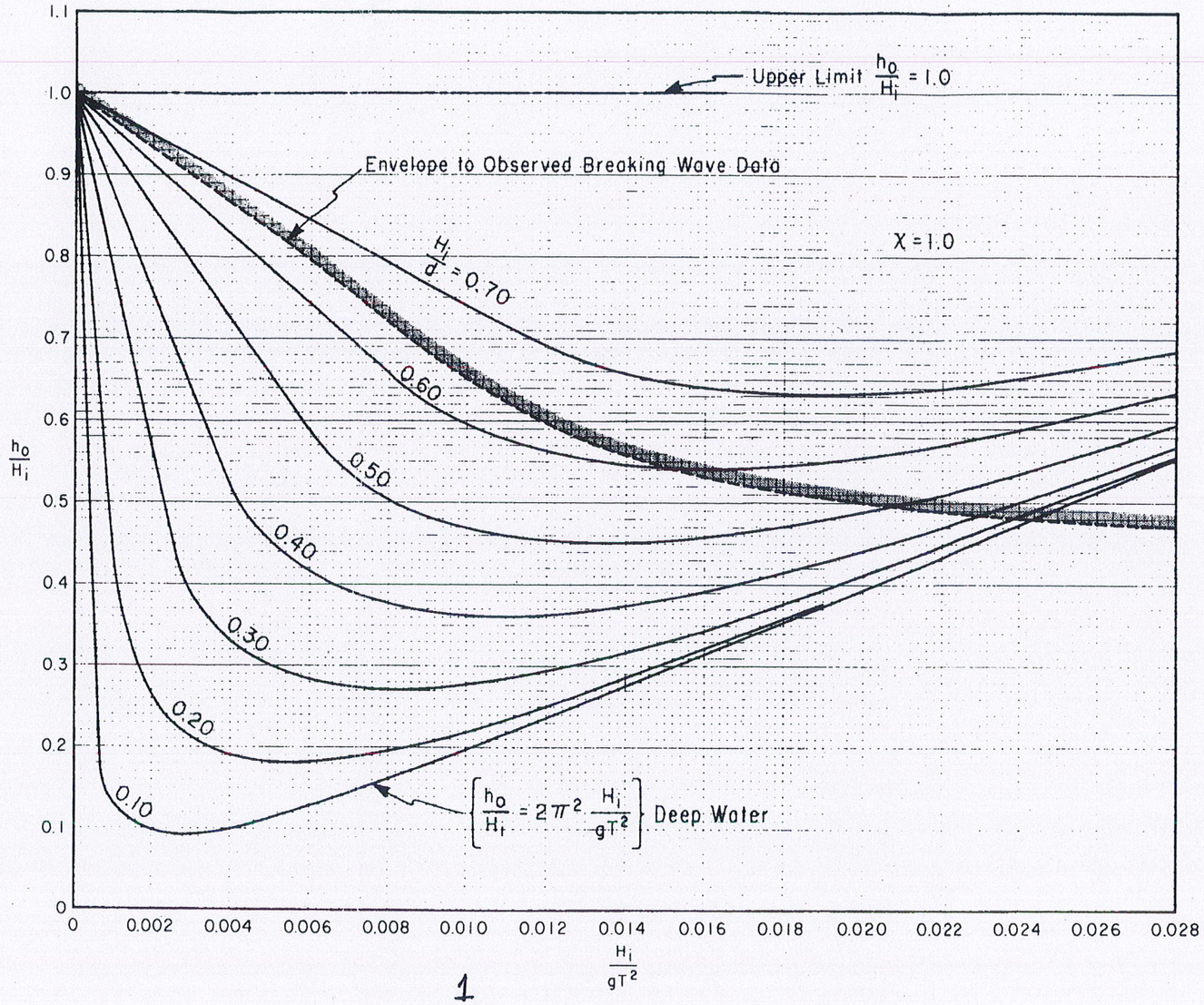


Figure ~~7-90.~~ 1 Nonbreaking waves; $\chi = 1.0$.

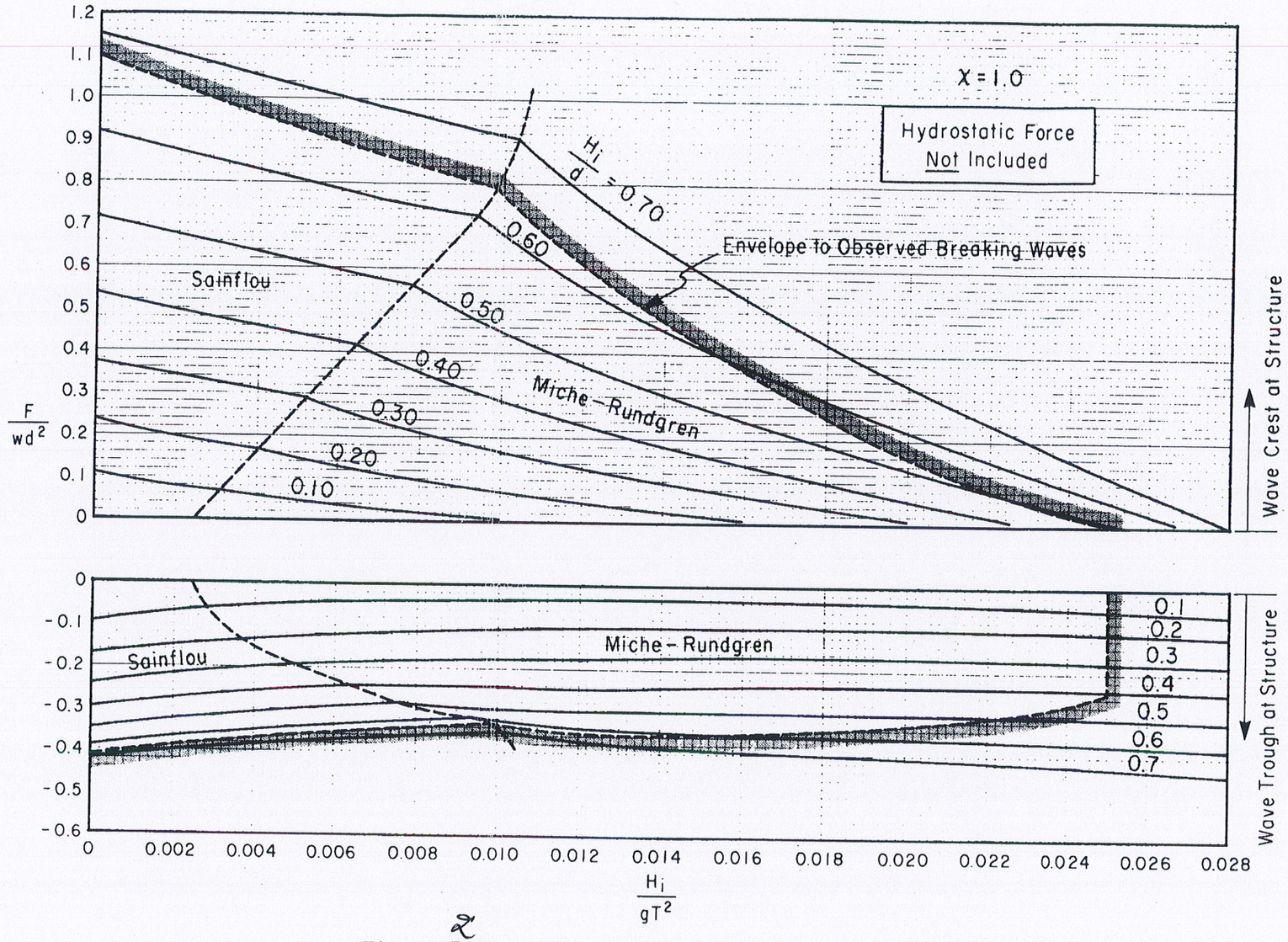


Figure ~~7-91~~ 2. Nonbreaking wave forces; $\chi = 1.0$.

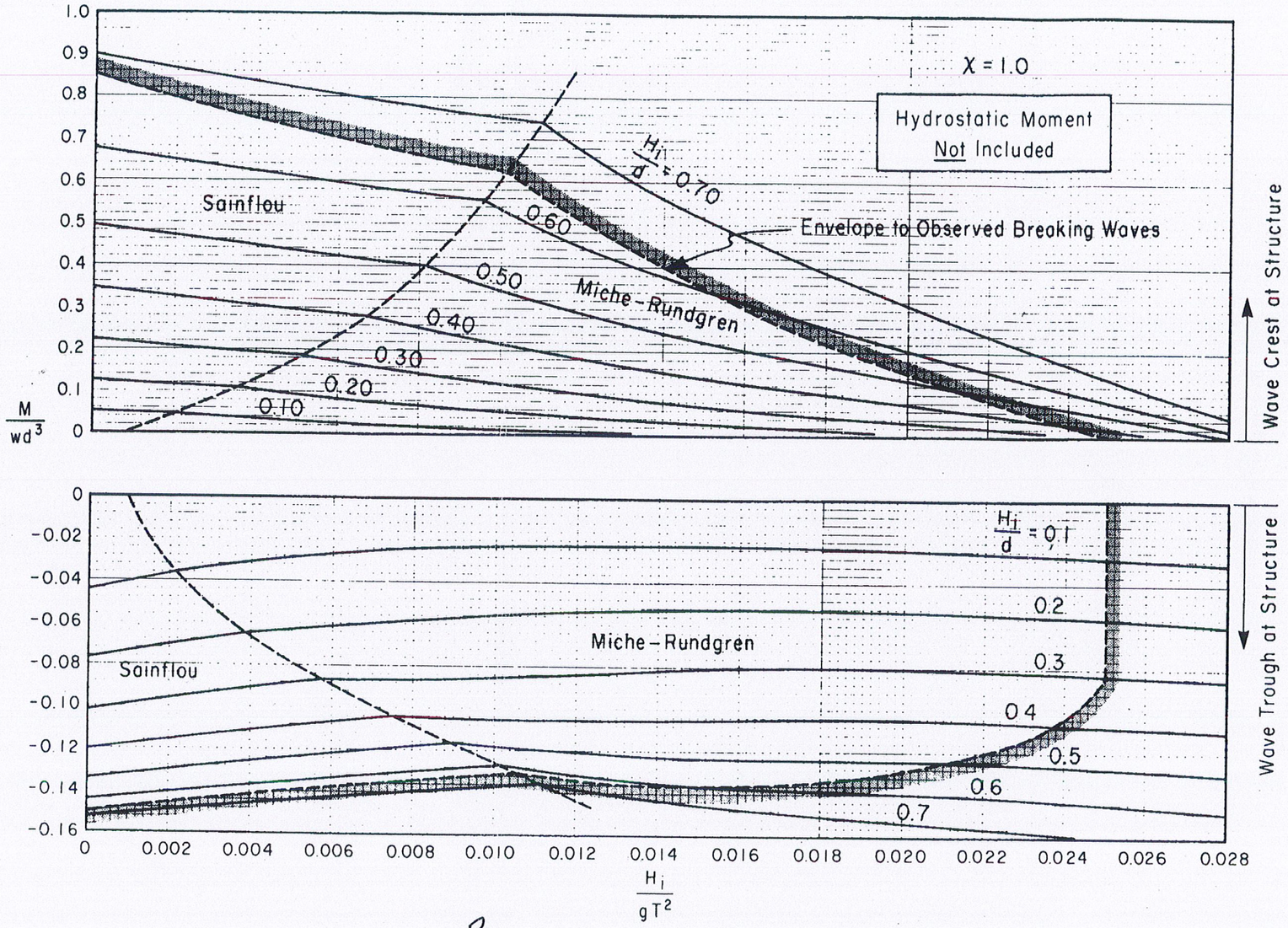


Figure ~~7-92.~~ 3 Nonbreaking wave moment; $\chi = 1.0$.

Figure for Question No. 7(b)

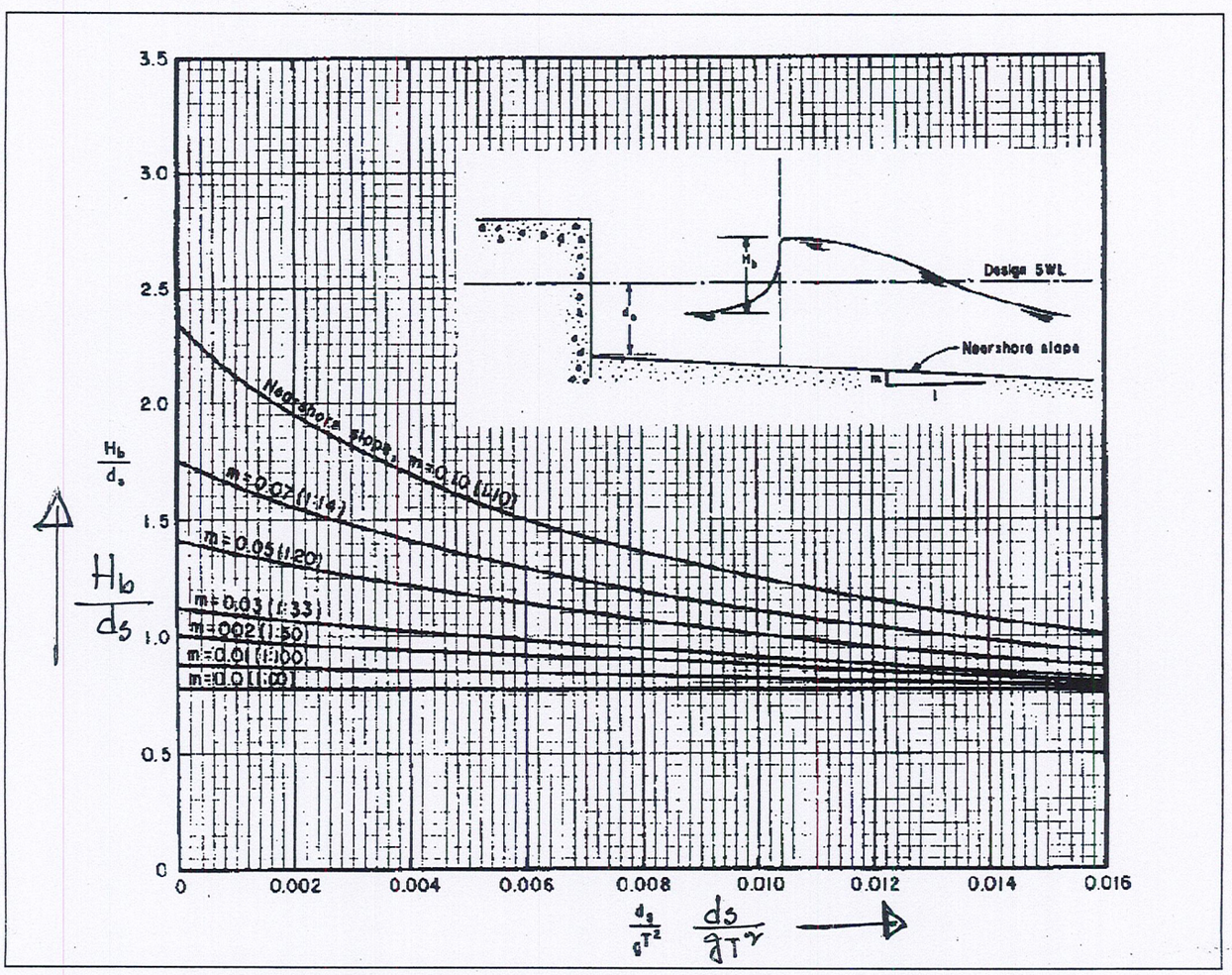


Table for Question No. 7(b)

Table 2-2
Rough Slope Runup Correction Factors (Carstea et al. 1975b)

Armor Type	Slope (cot θ)	Relative Size H / K_r[a,b]	Correction Factor r
Quarrystone	1.5	3 to 4	0.60
Quarrystone	2.5	3 to 4	0.63
Quarrystone	3.5	3 to 4	0.60
Quarrystone	5	3	0.60
Quarrystone	5	4	0.68
Quarrystone	5	5	0.72
Concrete Blocks[c]	Any	6[b]	0.93
Stepped slope with vertical risers	1.5	$1 \le H_o'/K_r$[d]	0.75
Stepped slope with vertical risers	2.0	$1 \le H_o'/K_r$[d]	0.75
Stepped slope with vertical risers	3.0	$1 \le H_o'/K_r$[d]	0.70
Stepped slope with rounded edges	3.0	$1 \le H_o'/K_r$[d]	0.86
Concrete Armor Units			
Tetrapods random two layers	1.3 to 3.0	-	0.45
Tetrapods uniform two layers	1.3 to 3.0	-	0.51
Tribars random two layers	1.3 to 3.0	-	0.45
Tribars uniform one layer	1.3 to 3.0	-	0.50

[a] K_r is the characteristic height of the armor unit perpendicular to the slope. For quarrystone, it is the nominal diameter; for armor units, the height above the slope.
[b] Use H_o' for $d_s/H_o' > 3$; and the local wave height, H_s for $d_s/H_o' \le 3$.
[c] Perforated surfaces of Gobi Blocks, Monoslaps, and concrete masonry units placed hollows up.
[d] K_r is the riser height.

Table for Question No. 7(b)

Table 2-3
Suggested Values for Use In Determining Armor Weight (Breaking Wave Conditions)

Armor Unit	n[1]	Placement	Slope (cot θ)	K_D
Quarrystone				
Smooth rounded	2	Random	1.5 to 3.0	1.2
Smooth rounded	>3	Random	1.5 to 3.0	1.6
Rough angular	1	Random	1.5 to 3.0	Do Not Use
Rough angular	2	Random	1.5 to 3.0	2.0
Rough angular	>3	Random	1.5 to 3.0	2.2
Rough angular	2	Special[2]	1.5 to 3.0	7.0 to 20.0
Graded riprap[3]	2[4]	Random	2.0 to 6.0	2.2
Concrete Armor Units				
Tetrapod	2	Random	1.5 to 3.0	7.0
Tripod	2	Random	1.5 to 3.0	9.0
Tripod	1	Uniform	1.5 to 3.0	12.0
Dolos	2	Random	2.0 to 3.0[5]	15.0[6]

[1] n equals the number of equivalent spherical diameters corresponding to the median stone weight that would fit within the layer thickness.

[2] Special placement with long axes of stone placed perpendicular to the slope face. Model tests are described in Markle and Davidson (1979).

[3] Graded riprap is not recommended where wave heights exceed 5 ft.

[4] By definition, graded riprap thickness is two times the diameter of the minimum W_{50} size.

[5] Stability of dolosse on slope steeper than 1 on 2 should be verified by model tests.

[6] No damage design (3 to 5 percent of units move). If no rocking of armor (less than 2 percent) is desired, reduce K_D by approximately 50 percent.

Table for Question No. 7(b)

Table 2-4
Layer Coefficients and Porosity for Various Armor Units

Armor Unit	n	Placement	K_Δ	P (%)
Quarrystone (smooth)	2	Random	1.00	38
Quarrystone (rough)	2	Random	1.00	37
Quarrystone (rough)	≥3	Random	1.00	40
Graded riprap	2[a]	Random	N/A	37
Tetrapod	2	Random	1.04	50
Tribar	2	Random	1.02	54
Tribar	1	Uniform	1.13	47
Dolos	2	Random	0.94	56

[a] By definition, riprap thickness equals two cubic lengths of W_{50} or 1.25 W_{100}.