L-4/T-2/WRE **Date : 02/07/2015**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2012-2013

Sub : **WRE 423** (River Engineering and Flood Mitigation)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this Section. Answer any **THREE**.

Symbols denote their usual meanings

Assume reasonable values if any data is missing

1. (a) Classify alluvial rivers based on channel pattern and type, type of sediment load and relative stability. **(14)**

   (b) Explain 'Helicoidal flow' in a river bend with a neat sketch. Write down the differences between Anastomosing asnd Anabranching channels. **(10)**

   (c) What are the effects of cutoff? (i) A meandering river is flowing with a bankful area of 10000 m^2 and longitudinal slope of 1 m in 3 km. Calculate (i) meander length, (ii) meander ratio (iii) river width. **(5+6)**

2. (a) Design and sketch a guide bank including launching apron from the following data: **(14)**

   Maximum Discharge = 8000 cumec

   Highest Flood Level = 5.0 m PWD

   River bed level = –1.0 m PWD

   Average diameter of river bed material = 0.2 mm

   Launching slope = 1.5 H : 1V

   Also calculate the volume of launching apron.

   (b) Explain the shield's diagram and write down the applications sand limitations of Shield's diagram. **(10)**

   (c) Design a suitable bank protection work from the following data: **(11)**

   Discharge Q = 30000 cumec, Design High Flood Level = 100.00 m PWD; Low water level = 93.00 m PWD, Velocity V = 3.5 m/sec, Mean diameter of river bed material d = 0.30 mm, Angle of sloping bank = 3H : 1V, Angle of repose of protection material $\Phi = 35°$, launching (scour) slope = 2.5H : 1V.

3. (a) The following data are available for construction of a bridge with circular pier: Discharge = 15000m^3/s, Average width of river = 1500 m, approaching flow depth = 9.5 m, diameter of pier = 2 m, no. of pier = 8, radius of curvature = 3.5 km, mean diameter of bed material = 0.15 mm, length of abutment projected normal to flow = 20 m, coefficients of abutment shape = 1, coefficients for skew angle of abutment = 1. Calculate the (i) local scour around the pier, (ii) abutment scour and (iii) total scour. **(14)**

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Contd ... Q. No. 3

(b) Write short notes on (i) Bandalling, (ii) Artificial cutoff and (iii) General scour **(12)**

(c) Describe briefly the design considerations for selecting low water level for tidal and non-tidal area for a bank protection work. **(9)**

4. (a) A wide alluvial channel has a depth of 13 ft and a slope of 0.0002. The bed material consists of fine gravel for which $d_{65} = 0.01$ ft. Find (i) an equation for the velocity profile along the depth and (ii) the suspended load per unit channel width. Given: sediment concentration varies according to the following equation: **(14)**

$C = 1500 - 10\,z^2$; Where C is in parts per million by weight and z is in ft.

Also given, kinematic viscosity = 1.21×10^{-5} ft^2/s. Assume reasonable value for correction factor in logarithmic velocity distribution.

(b) Write down the effects of levee on river bed. Classify spurs based on functions served and show the flow fields around them in neat sketches. **(4+6)**

(c) A 20.0 m-long laboratory flume has a coarse sand bed and is discharging water at a depth of 0.50 m. The flume operator wants to ensure that the sediment on the bed is not mobile. Determine: (i) the appropriate slope of the flume and (ii) height by which the end of the flume must be lowered to ensure this condition? Given, critical shear stress, $\tau_{*c} = 0.05$, median size of bed material = 2 mm, and density of bed material = 2650 kg/m^3. **(11)**

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE**.

5. (a) Give an overview of past floods in Bangladesh and describe their impacts. **(12)**

(b) What are the main types of floods in Bangladesh? Briefly describe their characteristics. **(11)**

(c) What are the main reasons for failure of any flood mitigation policy? Write down the steps to minimize the losses due to flood. **(12)**

6. (a) Discuss the design consideration, merits and demerits of levees and floodwalls. **(12)**

(b) Discuss the salient features and limitations of flood forecasting and warning as practiced in Bangladesh. **(11)**

(c) What do you mean by flood fighting? Discuss the various problems encountered and remedial measures undertaken during flood fighting. **(12)**

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7. (a) What is flood risk analysis? Write down the techniques of flood risk analysis. **(12)**

(b) What do you understand by economic evaluation of flood mitigation projects? Discuss briefly. **(11)**

(c) Construction of a levee is under consideration for a reach of river vulnerable to flood damages. The estimated damages from various river stages and the cost of levee affording protection below the given stage are given below. The return periods of the flood stages 6.4, 7.0, 7.6, 8.2, 8.8, 9.4 and 10.0 are 10, 15, 22, 30 70, 150 and 300 years respectively. What river stage would you recommend for the design of the levee? **(12)**

Peak stage (m)	Total damage below indicated stage (Million $)	Project cost (Million $
6.1	0	0.4
6.7	3	0.6
7.3	10	0.8
7.9	20	1.0
8.5	32	1.3
9.1	45	1.6
9.7	60	1.8
10.3	80	2.0

8. (a) Describe different types of idealized bedform that can exist in alluvial channel with sketches. Also mention the flow regime of each bedform. **(12)**

(b) What are the objectives of environmental study and cyclone protection project under Flood Action Plan? **(11)**

(c) Describe the necessity of dredging operation in the context of Bangladesh. Write down the differences between capital dredging and maintenance dredging. **(12)**

L-4/T-2/WRE **Date : 09/07/2015**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2013-2014

Sub : **WRE 435** (Hydraulic Structures)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this Section. Answer any **THREE**.

Assume reasonable value of any missing data.

1. (a) Write down the names of various components of a diversion head works. State the design considerations of the under sluice portion of a barrage. **(3+4=7)**

   (b) Explain the principles of silt control devices used in a barrage. Draw with neat sketch and discuss the principles involved in designing the different components of a silt ejector. **(3+11=14)**

   (c) The following data are given for an off-taking canal of a barrage: Full supply discharge of the canal = 260 cumecs, Overall water way of the canal head regulator = 60 m, Lacey's silt factor for canal bed material = 1.1, Maximum full supply level of the canal = 105 m, Canal bed level = 100m, Pond level = 106 m, u/s H.F.L = 108 m, Crest level of undersluices = 99.5 m. Design and show with neat sketches the following components of the canal head regulator: (i) Depth of d/s cutoff wall, (ii) d/s loose protection works. Assume the reasonable value of any other data, if required. **(14)**

2. (a) Discuss the following factors governing the selection of a particular type of dam: **(7)**

   (i) Topography, (ii) Spillway size and location.

   (b) Briefly describe the different mode of failures and criteria for structural stability of gravity dams. **(10)**

   (c) (i) Show with neat sketches the storage zones of a reservoir.

   (ii) A contour survey of a reservoir site finds the area of 28 ha, 65 ha, 120 ha at the contour level of 120 m, 140 m, and 160 m respectively. The capacity of the reservoir upto 120 m elevation is found to be 35 ha-m. Determine the general equation of area-elevation curve and capacity-elevation curve. **(6+8=14)**

3. (a) Briefly describe the main features and working principles of (i) side channel spillway and (ii) siphon spillway. **(7)**

   (b) Describe the USBR Stilling Basin IV with necessary figure. Explain how the (i) Crest levels and (ii) Afflux are decided while designing a barrage. **(7+7=14)**

   (c) Figure 1 shows the section of a non-overflow portion of a gravity dam built of concrete. Neglecting the earth quake effects, calculate **(14)**

   (i) major principal stress at toe.

   (ii) shear stress on a horizontal plane near toe.

   Assume the unit weight of concrete as 23.5 KN/m^3.

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WRE 435

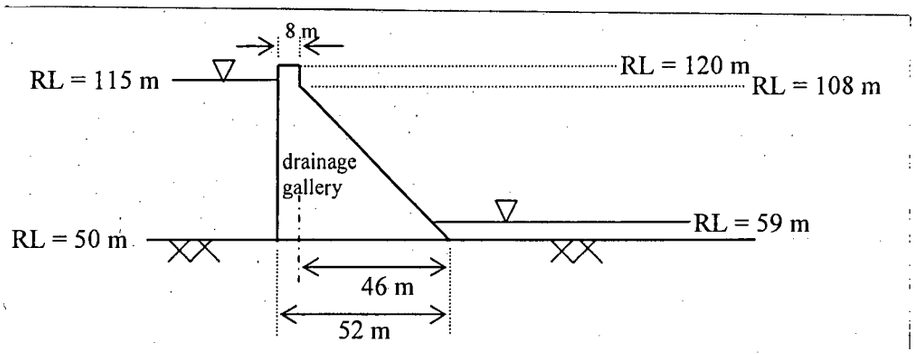

Figure 1 for Oues. 3 (c)

4. (a) Describe the different types of energy dissipators for the case when T. W. C lies Below the y_2 curve at all discharges. Draw necessary figure. **(15)**

   (b) Design a suitable section for the over flow portion of a concrete gravity dam having d/s face slopping 2.5 H:1V. The design discharge for the spillway is 2550 cumec. The height of the spillway above the river bed is 78 m. The spillway length consists of 8 spans having a clear width of 7 m each and thickness of each pier is 2 m. Assume reasonable value of any missing data. **(20)**

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE**.

5. (a) What is hydraulic structure? How these structures differ from any other civil engineering structures? **(10)**

   (b) Discuss the factors which should be considered in constructing hydropower plant. **(7)**

   (c) Briefly outline the salient features of Bligh's creep theory. What are the discrepancies of this theory? **(12)**

   (d) What is meant by critical exit gradient? Show that the critical exit gradient for most river sands is unity. **(6)**

6. (a) Discuss the main causes of failure of hydraulic structures constructed on permeable foundation. **(6)**

   (b) Explain Khosla's Theory of seepage below a hydraulic structure. **(12)**

   (c) Determine the percentage of uplift pressures at the key points for the intermediate pile line of the structure shown in Fig. 2 using Khosla's theory and apply necessary corrections. The correction factor for 1:3 slopes is 4.5. Also determine the exit gradient for pond level on upstream and no flow on downstream. **(17)**

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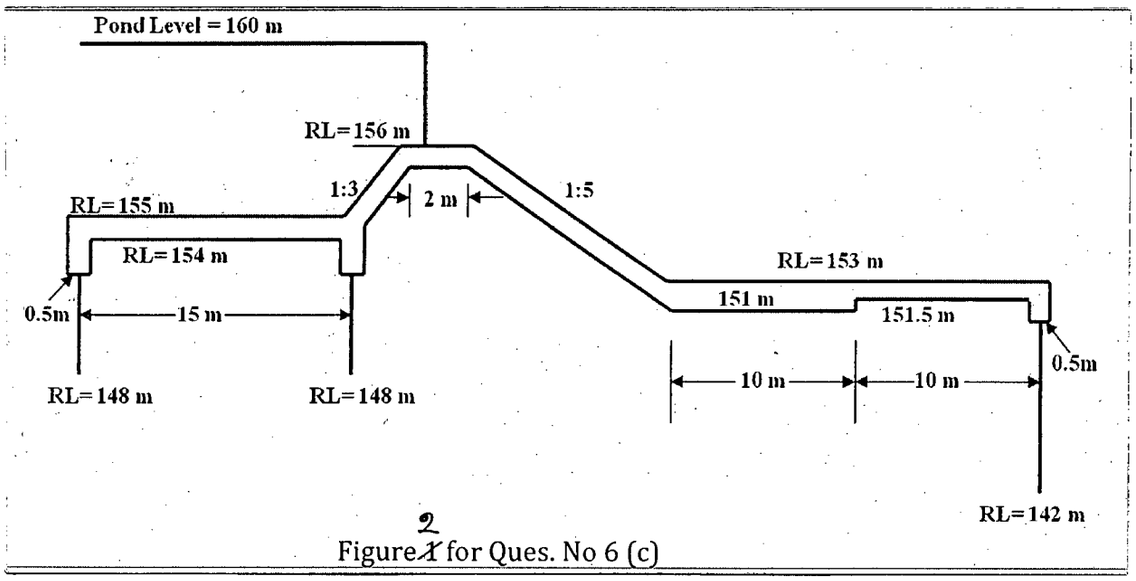

Figure 2 for Ques. No 6 (c)

7. (a) Discuss the factors which are considered in the selection of suitable type of cross-drainage works. **(8)**

(b) A syphon aqueduct is to be designed for the following situation: **(27)**

Canal:

Discharge = 20 cumec

Bed Width = 18 m

Depth of water = 1.3 m

Bed level = 250 m

Side slopes = 1: 1.5 (V:H)

Drainage:

High Flood Discharge = 200 cumec

High Flood Level = 250.7 m

Bed Level = 248.5 m

Determine (i) Drainage waterway (ii) Canal Waterway (iii) Head loss and bed levels at different sections (iv) Design of transitions (v) Design of Trough (vi) Head loss through Syphon Barrels (vii) Design of Roof of Barrels.

8. (a) Discuss how to design the uplift pressure on the bottom floor of barrels of a syphon aqueduct. **(10)**

(b) What is afflux? Discuss how afflux is computed in designing a bridge when downstream water depth is more than 80% of the upstream water depth. **(8)**

(c) Distinguish between "normal scour depth and maximum scour depth" in a bridge design. **(8)**

(d) Do you think that reducing the waterway of bridge will reduce the cost of structure? Discuss the reason to support your answer. **(9)**

L-4/T-2/WRE **Date : 06/08/2015**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2012-2013

Sub : **WRE 431** (Climatology)

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this Section. Answer any **THREE**.

Assume reasonable values if any data is missing.

1. (a) What is the differences between climatology and meteorology? Describe the factors of climate variability. **(5 ⅓)**

   (b) How does humidity influence climate? Explain how cloud, land-use change and snow cover affect albedo and hence climate. **(6)**

   (c) Write short notes on (i) Climate forcing; (ii) Turbulent fluxes; (iii) Hydrostatic balance; **(6)**

   (d) Calculate the shortwave radiation for Andaman and Nicobar Island (11 .68°N) for the following two conditions: **(6)**

   (i) Month = April, daily maximum temperature = 34.8°C, daily minimum temperature = 25.6°C, extraterrestrial radiation = 38.1 $MJ/m^2/day$.

   (ii) Month = May, extraterrestrial radiation = 47 $MJ/m^2/day$. No other data is available.

2. (a) How does ocean temperature influence climate? **(5 ⅓)**

   (b) Determine the net radiation in South Africa in March with the following data: **(6)**

   Latitude = 30°S, Total sunshine hours in March = 350, a mean monthly daily maximum and minimum air temperature are of 30 and 21°C, vapour pressure = 2.5 kPa, Albedo = 0.3, Stefan-Boltzman constant = 4.903×10^{-9} MJ $K^{-4}/m^2/day$, fraction of R_a reaching on the earth on overcast days = 0.2, fraction of R_a reaching on the earth on clear days = 0.55. Assume reasonable values if any data is missing.

   (c) Draw the vertical thermal structure of the atmosphere showing the main zones of the atmosphere. What causes the temperature to rise or fall with height in each of these zones? **(6)**

   (d) Write down the definition of aerosol and its natural and anthropogenic sources. What are the direct and indirect effects of aerosol on climate? **(6)**

Contd P/2

WRE 431

3. (a) Show the modeling system of mesoscale climate model MM5 in a flow chart? Briefly describe the purpose, input and output of each of the main programs of MM5. **(5 ⅓)**

   (b) What is parameterization of climate models? Describe two typical climate model parameterizations. **(6)**

   (c) (i) Write short notes Regional Climate Model (RCM) and mentions the relative advantages and disadvantages of RCM and GCM. **(6)**

   (ii) Is solar energy playing any significant role recent in climate change? Justify your answer.

   (d) Find vapor pressure deficit for the following two locations. Data available are: **(6)**

   (i) Location 1 (vegetated and well-watered) : daily maximum temperature = 34.8°C, daily minimum temperature = 25.6°C, shortwave radiation = 38.1 $MJ/m^2/day$

   (ii) Location 2 (arid): daily maximum temperature = 38°C, daily minimum temperature = 27°C , shortwave radiation = 45 $MJ/m^2/day$

4. (a) Briefly describe how volcanic eruption acts as a natural forcing of climate change. **(5 ⅓)**

   (b) Describe the roles of methane and ozone as greenhouse gas. Also mention the anthropogenic sources of these two gases. **(6)**

   (c) Illustrate the Planetary Boundary Layer process with a diagram. **(6)**

   (d) How can climate change affect the rainfall and temperature pattern of Bangladesh? **(6)**

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE**.

5. (a) Discuss the role of CO_2 as Greenhouse Gas. Compare the potential global warming between CO_2 and CFC. **(4 ⅓)**

   (b) How polar stratospheric cloud is related to ozone depletion? Why the Antarctic ozone depletion is greatest during spring? **(4+2)**

   (c) Explain the way lightning strikes. **(3+5)**

   Define: (i) Climate Change, (ii) Contrails, (iii) Peru Current, (iv) Arctic and Antarctic Ozone Hole.

   (d) What is Koppen Climate Classification? State its different groups, types and subtypes. **(5)**

6. (a) "El-Nino episodes are linked to droughts in Indonesia and Australia" – Explain with figure. **(3)**

   (b) Explain buffer with respect to Acid Rain. Also state the causes and effects of Acid Rain. **(3+5)**

   (c) What is photochemical smog? How it causes harmful effects? **(5 ⅓)**

   (d) Name different cloud types along with their respective groups. Describe 'Stratus' cloud group. **(4+3)**

Contd P/3

WRE 431

7. (a) Briefly explain the 1991 cyclone of Bangladesh. **(2 ⅓)**

   (b) Define ENSO. How it is related to a notable flood in Bangladesh? Discuss the effects of other causes of that flood event. **(2+5)**

   (c) Compare the effects of different UV radiations. **(3)**

   (d) How CFC is related to Ozone Depletion? **(5)**

   (e) Briefly describe the location, controlling factors and distinguishing characteristics of (i) Tundra Climate, (ii) Icecap Climate and (iii) Highland Climate. **(6)**

8. (a) What is Atmospheric Inversion? How cloud cover is associated with it? **(4 ⅓)**

   (b) Briefly explain the southwest monsoon. Discuss the causes and potential impacts (with respect to Bangaladesh) of Sea level rise. **(3+3)**

   (c) Why natural flood is important? State some human induced causes of flood. **(5)**

   (d) "Hurricanes have been linked to La-Nina episodes" – which region is indicated here? Explain with proper figure. **(3)**

   (e) Define Doldrums. Differentiate between Tropical Monsoon Climate and Tropical Wet-Dry (high-sun dry) Savanna Climate. **(1+4)**

L-2/T-2/WRE **Date : 10/08/2015**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-2 B. Sc. Engineering Examinations 2013-2014

Sub : **WRE 421** (Professional Practices and Communications)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this Section. Answer Q. No. 1 is compulsory and any **TWO** from the rest.

Assume reasonable values if needed.

1. (a) Define Engineering. Why is Engineering characterized as a profession? **(6×7=42)**

   (b) Write down the activities of specialists that constitute an Engineering team.

   (c) Write the guidelines on "Presentation of Qualifications" under engineering ethics.

   (d) Why are Professions not "elitist" and "monopoly"?

   (e) Why is public trust important in professional practice?

   (f) What are "Rule of Contra Proferentem" and "Parol Evidence Rule"?

   (g) List the guidelines for effective writing for Engineers.

2. (a) Discuss the key factors in effective management of professional practice. **(17½)**

   (b) Discuss briefly the components in an effective 'Professional Practice Management Plan'. **(7)**

   (c) "Bill Ding, P.Eng., a WRE consultant with an M.Sc. and five years experience, is employed by a consulting firm. He has designed a ten-metre-high earth dam for an industrial project in the USA. His recommendations are developed from a computer analysis, which, in turn, is based on soil properties derived from a limited field investigation. Eddy Fice, P.Eng., a principal in the consulting firm, reviews the report before submission to the client. His experience suggests that steeper side slopes can be used, reducing the earth fill volume by about fifteen percent.

   Eddy requests that Bill change the report accordingly. After considerable discussion, Bill agrees to recheck the analysis, but remains unconvinced that Eddy is correct."

   What should Bill do now? Explain briefly. **(7)**

3. (a) "Professional engineers shall conduct themselves with integrity, honesty, fairness and objectivity in their professional activities" – Discuss this statement. **(17½)**

   (b) "Lee Gality held professional accreditation both in law and in engineering. He engaged in the practice of law, but also advertised his professional engineering designation on his letterhead. He was convicted in Criminal Court of converting client trust funds from his law practice to his own use or benefit. He received a prison

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WRE 421

Contd ... Q. No. 3(b)

sentence. The media reported that Lee intended to engage in the practice of engineering upon his release from prison." **(7)**

The Engineering Association initiated discipline proceedings against Lee. After a properly convened hearing, the Association cancelled his membership. Why? Explain briefly.

(c) List briefly the Code of Ethics prescribed by the Institute of Engineers, Bangladesh (IEB). **(7)**

4. (a) What is a contract? State the elements of a contract. **(10 ½)**

(b) Discuss different ways for settlement of contractual problems. **(7)**

(c) Why conversation and speaking skills are essential for engineers. List the guidelines for effective speaking. **(7)**

(d) Write short notes on **(7)**

- Force Majeure
- Cost-plus-contract

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE**.

5. (a) What do you mean by feasibility study with respect to a project? Write down the typical contents of a feasibility report for a water resources development project. **(2+10=12)**

(b) Briefly describe the steps and methodology of Environmental Impact Assessment. **(18)**

(c) Explain why Social Impact Assessment is very important for a water sector project. **(5)**

6. (a) Suppose the feasibility estimate of a project is Tk. 5.0 million with an expected operating life of 10 years. Annual operation and maintenance costs are forecasted Tk. 400,000 per year. Using a 12% discount rate, what net annual income must be received to recover the capital investment of the project? **(7)**

(b) Explain why the open tendering method is the most preferred method of procurement. Write down the situations that warrant the use of two-stage tendering method of procurement. **(7+5=12)**

(c) Write short note on the following items: **(4×4=16)**

(i) Eligible Tenderer (ii) Qualification Criteria (iii) Performance Security

(iv) Sub-contracting.

Contd P/3

WRE 421

7. (a) What do you mean by Tender Evaluation? Briefly describe the procedure for technical and financial evaluation of tender applicable for Quality and Cost Based Selection method. **(2+10=12)**

   (b) Define the following terms: **(12)**

   (i) Public Procurement

   (ii) Framework Contract

   (iii) Procurement plan

   (iv) Conflict of Interest.

   (c) Write down the purposes of Technical Specification. What data/information should be provided in Technical Specification? Write down a typical specification for a river bank protection work in Bangladesh. **(2+4+5=11)**

8. (a) What are the considerations for selecting the method of procurement for goods? **(7)**

   (b) What are the provisions in PPR 2008 relating to splitting of an object of procurement into more than one package? **(10)**

   (c) Briefly describe the term 'Tender Security'. Also explain the conditions for forfeiture of Tender Security. **(3+4=7)**

   (d) What are the conditions and information that the Procuring Entity should set out clearly in the Tender Documents? **(11)**

L-4/T-2/WRE **Date : 06/08/2015**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2013-2014

Sub : **WRE 205** (Numerical Methods)

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this Section. Answer any **THREE**.

1. (a) Use Gauss Elimination method to solve the following equation **(10)**

$$8x_1 + x_2 + 2x_3 + 7x_4 = 18$$
$$-10x_1 - 3x_2 + 8x_3 + 5x_4 = 142$$
$$-6x_1 - 9x_2 - 8x_4 = -80$$
$$-6x_1 + 2x_2 - 4x_3 + 5x_4 = 35$$

(b) Use Euler's method and Heun's method to solve the following equation for y(1) using h = 0.25

$$y' = x + y + xy, \quad \text{where } y(0) = 1$$ **(6+7 ⅓)**

2. (a) Solve the following system of linear equation using Gauss-Seidal method. (Do minimum four iterations) **(10)**

$$-2x_1 + 7x_2 + 6x_3 - 4x_4 = -32$$
$$2x_1 + 4x_2 + 5x_3 + 4x_4 = -45$$
$$5x_1 + 7x_2 - x_3 - x_4 = 6$$
$$x_1 - 10x_2 + 8x_3 - 9x_4 = 75$$

(b) Find the root of the following equation using Newton-Raphson method. (correct upto three decimal places)

$$x - 1.5\sin(x) - 2.5 = 0$$ **(10)**

(c) Use Taylor's series expansion to derive the numerical form of central difference formula. **(3 ⅓)**

3. (a) Find a root (up to four decimal points) for the following equation using secant method

$$x^5 - 3x^2 - 100 = 0$$ **(10)**

(b) Use fourth order Runge-Kutta method to estimate y(0.5) of the following equation with h = 0.25. **(10)**

(c) Differentiate between rate of accuracy and precision. **(3 ⅓)**

4. (a) Solve the following system of linear equations using LU decomposition method **(10)**

$$4x + 9y + 9z = 3$$
$$4x + 4y - 8z = 0$$
$$-4x - 10y - 10z = -6$$

Contd P/2

(b) Find the root (up to four decimal points) for the following equation using method of False Position. $x^3 - 2x^2 - 3x + 10 = 0$ **(10)**

(c) Briefly discuss truncation and round-off errors in numerical computation. **(3 ⅓)**

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE**.

5. (a) What are the assumptions for interpolation? **(3)**

(b) Consider the following data table: **(13 ⅓)**

X	– 1	0	1	2
f(x)	– 1	1	3	17

Perform polynomial interpolation (divided difference) to find value of f(1.5). Suppose an additional data point (3, – 26) is added to the data table. What is the interpolated value of f(1.5). When this additional data point is considered?

(c) Use trapezoidal rule to calculate the value of the integral and compare with exact value.

$$\int_4^{5.2} \log_e x\,dx$$ **(7)**

6. (a) In a certain machine a slider moves along a fixed straight rod. Its distance x cm along the rod is given below for various values of the time t seconds. **(12 ⅓)**

t	0	0.1	0.2	0.3	0.4	0.5	0.6
x	30.13	31.26	32.87	33.64	33.95	33.81	33.24

Find velocity and acceleration of the slider at t = 0.3.

(b) Fit a Cubic $y = a + bx + cx^2 + dx^3$ to the following data: **(11)**

x	–4	–2	–1	0	1	3	4	6
y	–35.1	15.1	15.9	8.9	0.1	0.1	21.1	135

7. (a) Consider the following data table: **(13 ⅓)**

x	0.2	0.25	0.5	1
Y	–15	–11	–3	1

It is required to fit a curve through these data points. The equation of the curve has the following form $x + by + cxy = 0$. Convert this equation to linear form and perform linear curve fitting to find the values of the constant 'b' and 'c'.

(b) Find the first derivatives of the function $f(x) = x^3 - 9x - 14$ at $x = 3.0$. Using x values 3, 3.2, 3.4, 3.6, 3.8 and 4.0. **(10)**

8. (a) The following data define the sea level concentration of dissolved oxygen for fresh water as a function of temperature. **(12)**

T,°C→	0	8	16	24
O, mg/L→	14.621	11.843	9.870	8.418
T,°C→	32	40		
O, mg/L→	7.305	6.413		

Estimate O(27) using lagrange interpolation.

(b) A gas field production can be modeled as $f(x) = 2e^{(-1.5x)}$ **(11 ⅓)**

evaluate the integral form 0 to 0.6 using

(i) Simpsion's ⅓ rule (ii) Simpson's ⅜ rule (iii) Weddle's rule

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L-4/T-2/CE **Date : 02/08/2015**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2012-2013

Sub : **WRE 437** (Coastal Engineering)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this Section. Answer any **THREE**.

1. (a) Why coastal engineering is an important subject in Bangladesh context? **(5)**

   (b) List up coastal classification scheme for coastal feature and formation introduced by Shepard in 1937. **(10)**

   (c) Draw a typical coastal beach profile and identify all the zones. **(8)**

   (d) Define: wave height, angular frequency, wave steepness, and relative depth of wave. **(12)**

2. (a) Write down the assumptions to derive linear wave theory. **(6)**

   (b) Draw a neat sketch for orbital flow in shallow water and in deep water. **(6)**

   (c) A wave with a period of 6 seconds is propagated shoreward over a uniformly sloping shelf from a depth of 300 m to a depth of 3 m. Find the wave celerity and wave length at depths of (a) 300 m, and (b) 3 m. **(12)**

   (d) Why water level variations in coastal engineering design is important? **(5)**

   (e) Define: Seiches and tsunami. **(6)**

3. (a) List up the factors effecting tide and storm surges. **(6)**

   (b) Discuss the phenomenon of wave refraction, when a wave passes from Deep water to shallow water. What is energy conservation in wave theory? **(6+3)**

   (c) Write short notes on the following terms: **(9)**

   (i) Shoaling coefficient

   (ii) wave breaking criteria

   (iii) tombolo

   (d) Given a wave with a period T = 8 sec in water depth d = 20 m and wave height 2.5 m. Find the local horizontal and vertical velocities at a depth of 4 m below SWL when $\theta = 2\pi x/L - 2\pi t/T = \pi/3$. **(11)**

4. (a) Draw the Miniken wave pressure diagram for breaking wave forces in a vertical wall. **(5)**

   (b) What is the difference between wave set up and wave run up? **(6)**

   (c) What is an estuary? Define hyposynchronous estuary, partially mixed estuary, macro tidal estuary. **(8)**

   (d) What are the trends of sea level rise in future? **(4)**

Contd P/2

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Contd ... Q. No. 4

(e) Find the non breaking wave force and moments against a vertical wall resulting form the wave condition given below: **(12)**

(i) the vertical wall is smooth faced

(ii) wave height at the structure if the structure were not there H_i = 1.80 m.

(iii) depth at structure d = 4.0 m.

(iv) the wave period considered in the design is T = 8.0 sec. Figure 1, Figure 2 and Figure 3 is attached for relevant uses.

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE**.

5. (a) Define Lowest astronomical tide, Mean sea level, Neap tide, Semi-diurnal tide and Tidal stream. **(7)**

(b) Briefly explain different measuring systems of tide level. Describe the characteristics of tide along Bangladesh coast. **(6+8)**

(c) Give Newtonian explanation of tidal phenomenon. Why is this called statical theory? What is dynamic theory of tide? **(14)**

6. (a) State the guiding factors during selection of a site for constructing a harbor. **(7)**

(b) Explain how the wind stress that causes storm surges in a coast is calculated. Describe the procedure of estimating the storm surge height in a water body of trapezoidal shapes in plan and uniform slopping bottom. **(4+10)**

(c) With neat sketches, draw the Madras Harbor with outer dock and show its various components. **(14)**

7. (a) Explain the considerations while designing groins as a coastal structure. **(7)**

(b) Write down the names of different types of coastal structures and state one principal function of each of the structures. **(14)**

(c) With neat sketches show (i) typical cross-section and layout of sea dike at Danish North Sea Coast, (ii) typical cross-section of sloping front seawall/revetment with fixed surfaces of asphalt and in situ cast concrete, (iii) typical beach configurations with detached nearshore breakwater and (iv) vertical composite caisson breakwater. **(14)**

8. (a) Based on stability considerations, explain the criteria of selecting (i) design water level, (ii) wave height and (iii) height of protection works used in the design of coastal structures? **(15)**

(b) The site conditions along a coastal shore line are shown in Fig. 4 below. The design wave height and period are given as 6.0 ft and 4.5 sec respectively. Design a revetment type shore protection structure using the armor units of riprap, quarrystone and concrete blocks. (use the tables and graphs attached). Assume the reasonable value of any data if not given. **(20)**

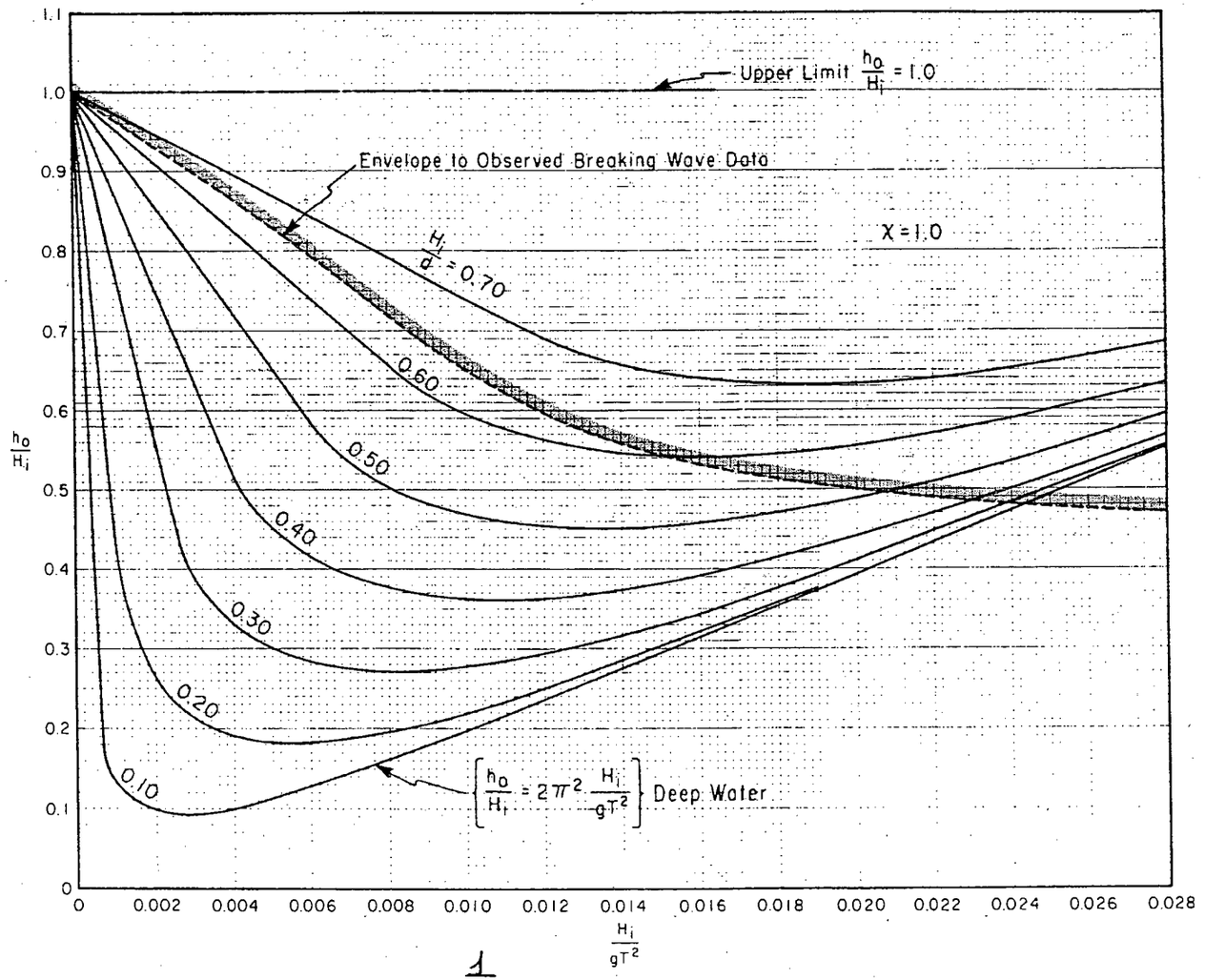


Figure 1. Nonbreaking waves; $\chi = 1.0$.

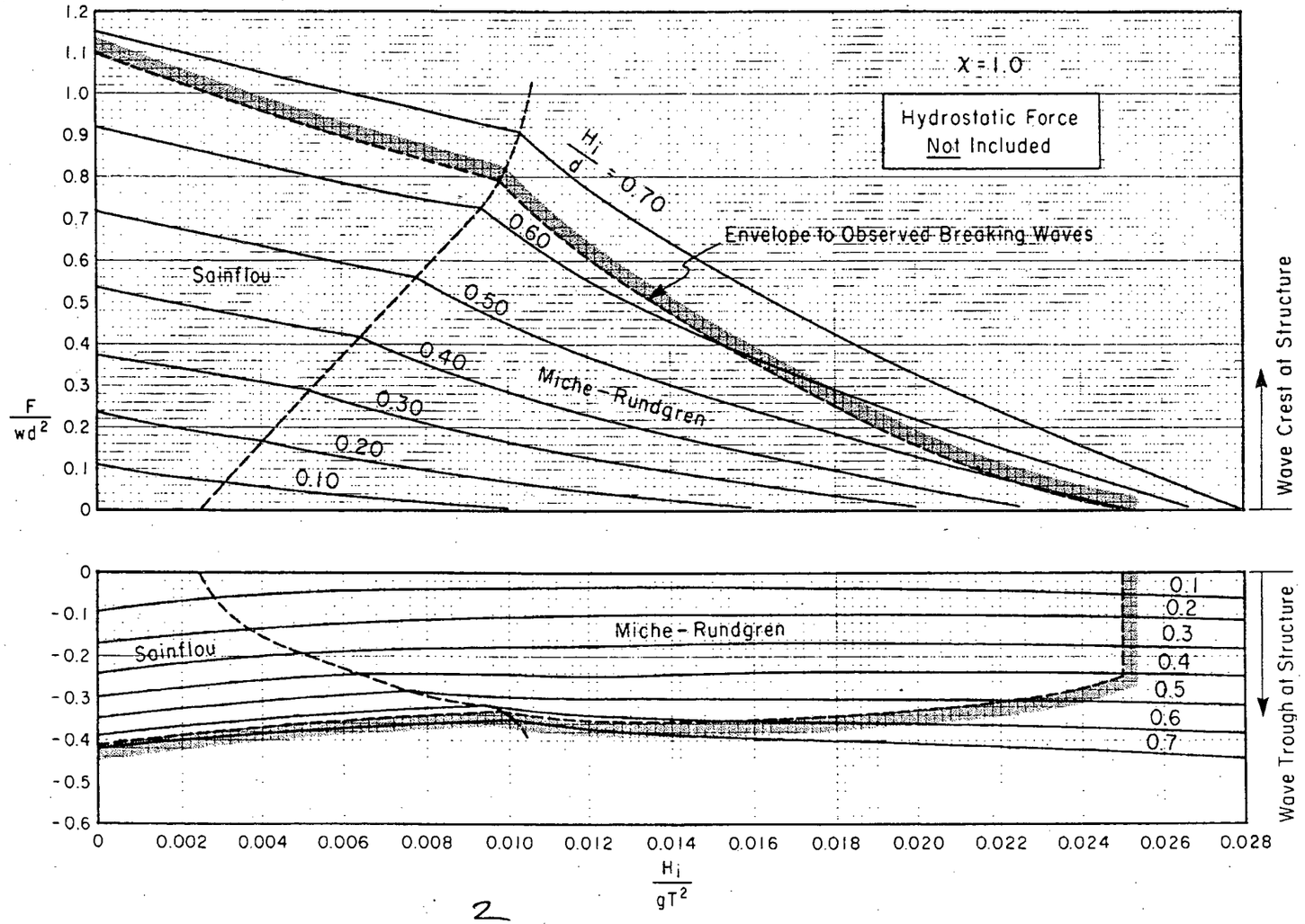


Figure 2 Nonbreaking wave forces; $\chi = 1.0$.

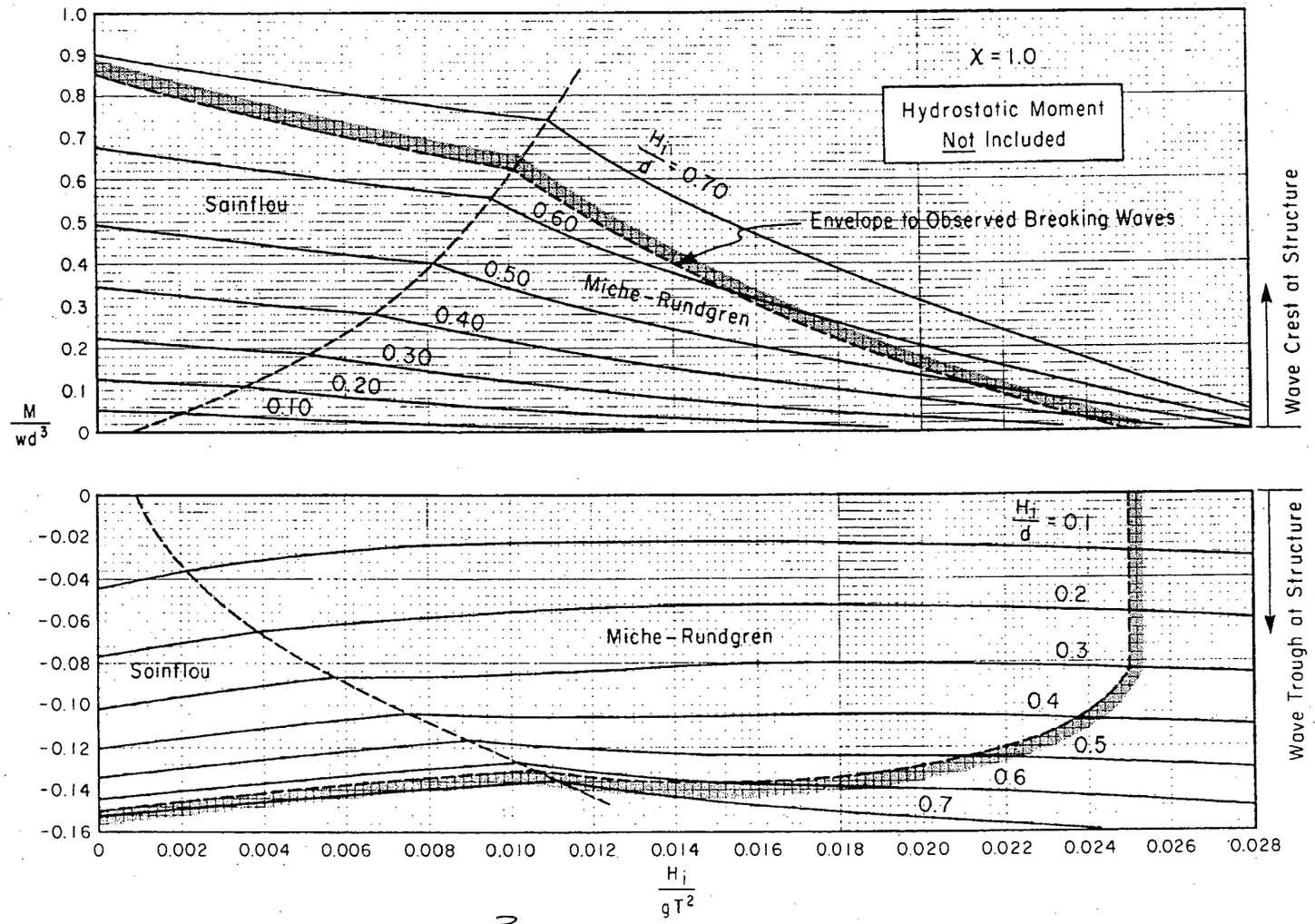


Figure 3. Nonbreaking wave moment; $\chi = 1.0$.

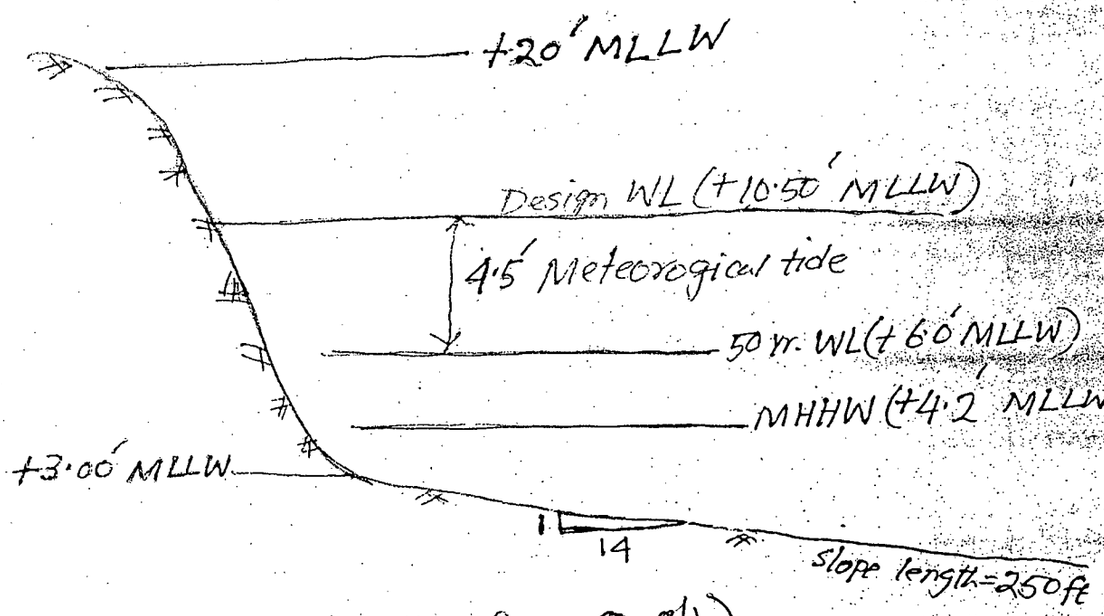
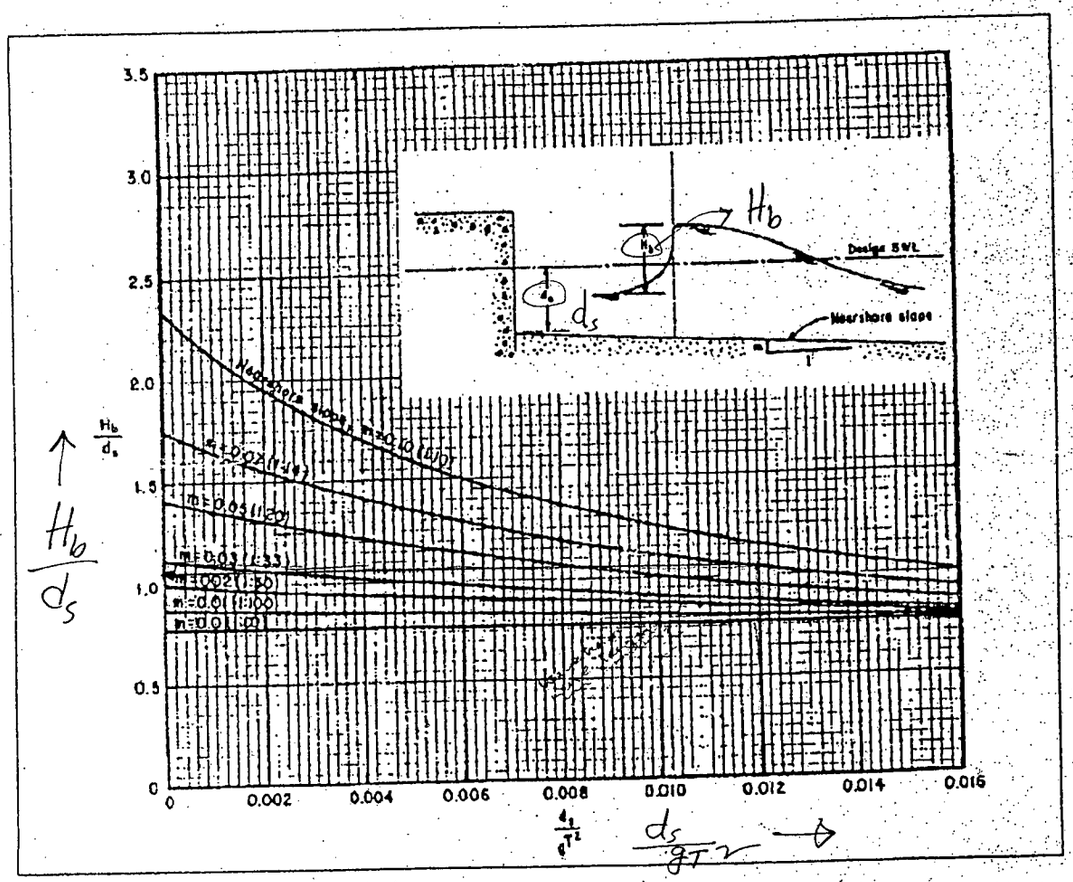


Fig. 4(a) for Q. 8(b)



~~Figure 2-2. Design breaker height~~ Fig: 4(b) for Q. 8 (b).

= 7 =

Table 1 for Q 8(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 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 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}.

Table 2-5
$H/H_{D=0}$ for Cover Layer Damage Levels for Various Armor Types ($H/H_{D=0}$ for Damage Level in Percent)

Unit	$0 \le \%_D < 5$	$5 \le \%_D < 10$	$10 \le \%_D < 15$	$15 \le \%_D < 20$	$20 \le \%_D \le 30$
Quarrystone (smooth)	1.00	1.08	1.14	1.20	1.29
Quarrystone (angular)	1.00	1.08	1.19	1.27	1.37
Tetrapods	1.00	1.09	1.17	1.24	1.32
Tribars	1.00	1.11	1.25	1.36	1.50
Dolos	1.00	1.10	1.14	1.17	1.20