L-4/T-2/WRE **Date : 16/01/2016**

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**.

1. (a) Compare Khosla's theory with Bligh's theory for seepage below a hydraulic structure. **(9)**

   (b) Write short notes on (i) piping (ii) direct uplift (iii) critical exit gradient. **(9)**

   (c) The concrete floor of a weir on permeable soil is 20 m long and has sheet piles at both ends. The upstream pile is 5 m deep and the downstream pile is 7 m deep. The weir creates a net head of 3.5 m. Neglecting the thickness of the floor, calculate the uplift pressures at the junctions of inner faces of the piles with the floor using Khosla's theory. Relevant equation is given below: **(17)**

$$\phi_E = \frac{1}{\pi}\cos^{-1}\left(\frac{\lambda-2}{\lambda}\right), \text{ where } \lambda = \frac{1+\sqrt{1+\alpha^2}}{2}, \ \alpha = \frac{b}{d}$$

2. (a) Differentiate between a weir and a barrage. Discuss how the thickness of the glacis and downstream floor of a barrage is determined. **(14)**

   (b) What do you mean by (i) pond level (ii) retrogression? **(4)**

   (c) Given the following data for a barrage across a river, determine (i) Total discharge that can pass through the barrage during high flood assuming a velocity of approach of 2 m/s (ii) level of jump formation in the undersluice portion during high flood considering a discharge concentration of 20% and retrogression of 0.5 m. **(17)**

   Undersluice: Crest level = 200.0 m, 5 bays of 16 m each

   Barrage portion: Crest level = 201.5 m, 25 bays of 12 m each,

   Crest width = 2 m

   HFL (before construction of barrage) = 206.0 m, Afflux = 1.0 m

3. (a) What are the different types of cross-drainage works? State the conditions under which each one is used. **(6)**

   (b) Explain how afflux and head loss through syphon barrel are determined. **(6)**

   (c) An aqueduct is to be designed for the following situation. Determine (i) drainage waterway (ii) canal waterway including bed levels at different sections (iii) transitions. **(23)**

Canal:	Drain:
Discharge = 20 cumec	High flood discharge = 250 cumec
Bed width = 20 m	HFL = 247.5 m
Depth of water = 1.5 m	High flood depth = 2.5 m
FSL = 251.5 m	General ground level = 251.0 m

Assume reasonable values for data if missing.

Contd P/2

WRE 435

4. (a) Give a comparison between a silt excluder and a sit ejector. Discuss briefly the principles involved in designing the different components of a silt excluder. **(14)**

   (b) Briefly explain how the size of opening of a culvert is determined. **(7)**

   (c) A head regulator is to be designed with the following data: **(14)**

   Full supply discharge of canal = 200 cumec

   FSL of canal = 203.0 m

   Crest level of undersluices = 200.5 m

   Pond level = 204.0 m

   U/s HFL = 207.0

   Determine (i) crest level of regulator (ii) waterway of the regulator (iii) gate opening during high flood.

SECTION – B

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

Assume the reasonable value of any data, if not given

5. (a) Describe the features of different types of dam according to (i) use of dam (ii) hydraulic design. **(7)**

   (b) Describe different types of flood control reservoirs, their functions and uses. **(14)**

   (c) Monthly inflow rates, pan evaporation, precipitation and demand during a low water period at the site of a proposed dam are given below. Prior water right makes it obligatory to release full natural flow of 22 ha-m per month whichever is minimum. The net pool area of the reservoir is 575 ha. Assuming pan evaporation coefficient 0.75, calculate the required storage capacity of the reservoir. **(14)**

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Inflow (ha-m)	2.5	1.6	0.6	0.5	8.6	25.4	320.0	610.0	32.6	8.7	3.2	3.0
Pan evaporation (cm)	2.1	2.6	6.8	22.5	32.2	26.4	30.5	32.0	18.8	8.2	6.5	2.6
Precipitation (cm)	2.5	1.8	1.2	0.0	6.5	8.2	22.6	26.8	12.0	5.2	3.6	3.1
Demand (ha-m)	26	18	17	12	8	8	8	8	15	20	25	30

6. (a) Discuss the geology and foundation conditions governing the selection of a particular type of dam. **(7)**

   (b) Derive the expression for principal and shear stresses near the toe and heel of a gravity dam considering reservoir full condition and a tail water at d/s side. **(14)**

   (c) Discuss about (i) compression failure of a gravity dam, (ii) fixation of reservoir capacity with the help of mass curve of inflow and outflow. **(7+7=14)**

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7. (a) Explain how the effects of (i) earthquake forces and (ii) wave pressure on a gravity dam are calculated. **(12)**

(b) Figure 1 shows the section of a non-overflow portion of a gravity dam built of concrete. Considering the earth quake effects on reservoir full case, check the stability of the dam against principal and shear stresses near toe and heel, against overturning and against sliding. Assume the unit weight of concrete as 23.5 KN/m^3. Assume the reasonable value of any other data if required. **(23)**

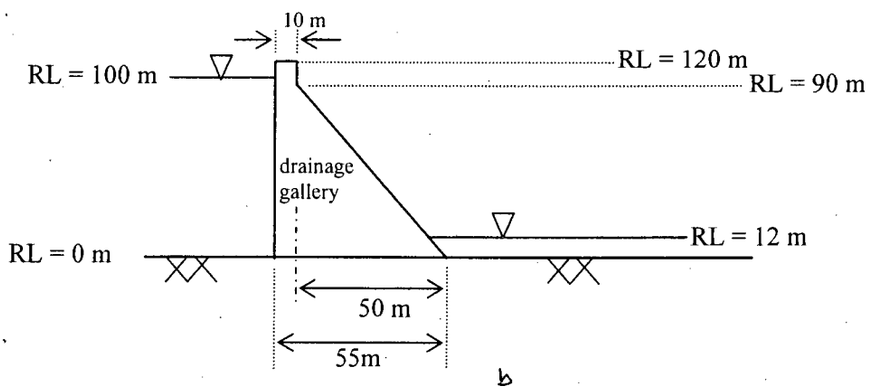

Figure 1 for Ques. 7 (a)

8. (a) With neat sketches show the plan/section of chute spillway, side channel spillway, shaft spillway and siphon spillway. **(12)**

(b) Design a suitable section for the over flow portion of as concrete gravity dam (ogee spillway) having d/s face sloping 1.5H : 1V. The design discharge for the spillway is 6600 cumec. The height of the spillway above the river bed is 95 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 K_p = 0.02, K_a = 0.1, velocity head is negligible, u/s face of the dam is vertical. Sketch the design section of the spillway. **(23)**

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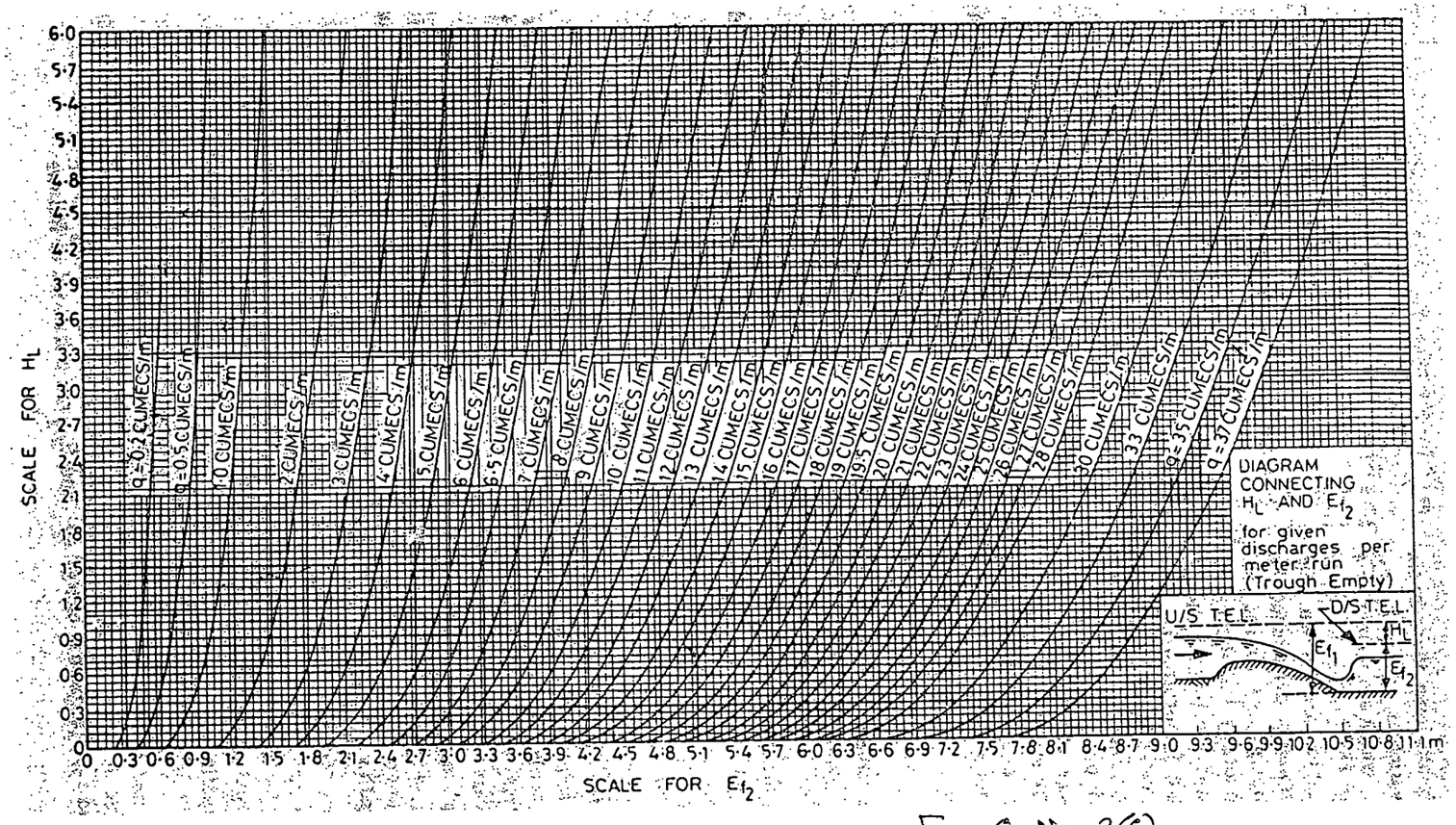

For Q. No. 2(e)

L-4/T-2/WRE **Date : 21/01/2016**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

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

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 hydraulics of nearshore water is very important in Bangladesh context? **(5)**

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

   (c) Draw a schematic diagram of a wave profile and identify all the features. **(7.5)**

   (d) Define: (i) wave height, (ii) wave length, (iii) group velocity, (iv) surf zone and (v) standing waves. **(12.5)**

2. (a) What are the basic assumptions to derive small amplitude surface wave theory? Why most of the times this theory is used in design? **(5+3)**

   (b) For local fluid velocities and accelerations, draw the schematic diagram showing the direction of particle movement in one wave length of propagation. **(6)**

   (c) A wave with a period of 5 seconds is propagated shoreward over a uniformly sloping shelf from a depth of 280 m to a depth of 2.8 m. Find the wave celerity and wave length at depths of (i) 280 m, and (ii) 2.8 m. **(6)**

   (d) What is water level variation in coastal design? Describe the variations for sea level rise. **(3+4)**

   (e) What are the different types of wave breakers? Show with figures. **(8)**

3. (a) List up the factors affecting tsunami 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 phenomenon

   (ii) Wave set up

   (iii) Wave breaking

   (d) Given a wave with a period T = 8 sec in water depth d = 15 m and wave height 1.75 m. Find the local horizontal and vertical velocities at a depth of 5 m below SWL when $\theta = 2\pi x/L - 2\pi t/T = \pi/6$. **(11)**

Contd P/2

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4. (a) Draw the pressure diagram for non-breaking wave forces in a vertical wall. **(6)**

   (b) Derive the equation for wave forces in an inclined wall (inclination with horizontal θ), when the waves approaches with an angle (α) with the shore line. **(5)**

   (c) What is an estuary? Define positive estuary, salt wedge estuary, meso tidal estuary and bar built estuary. **(8)**

   (d) What is the contribution of dynamic pressure in calculating total force on a structure? **(4)**

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

   (i) the vertical wall is built on a rubble base ($\chi = 0.9$)

   (ii) wave height at the structure if the structure were not there $H_i = 1.60$ m

   (iii) depth at structure d = 3.5 m

   (iv) the wave period considered in the design T = 7.0 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**.

Assume the reasonable value of any data not given.

5. (a) Define the tidal terms with graphical representation. **(7)**

   (b) Describe the characteristics of tide along Bangladesh coast. **(14)**

   (c) Explain the tide prediction method by the use of harmonic constituents. **(14)**

6. (a) Describe the procedure of estimating the storm surge height in an enclosed body of water. **(7)**

   (b) List various components of a harbor and write down one main function of each of those components. **(14)**

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

7. (a) Briefly explain the prediction and early warning system of tsunami. **(7)**

   (b) Describe the basic features and functions of following coastal structures: (i) storm surge barriers, (ii) training wall, (iii) reef breakwater and (iv) bulkhead. **(14)**

   (c) With neat sketches show (i) rubble-mound breakwater with concrete superstructure, (ii) piled breakwater, (iii) typical beach configurations with groins and (v) vertical front sea wall. **(14)**

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8. (a) Explain the (i) design conditions for shore protective measure, (ii) determination of wave force on a coastal structure for breaking waves. **(15)**

(b) The site and wave conditions along a coastal shore line are as below: **(20)**

RL of the Road level = + 20 ft 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 = 5.5 ft

Design wave period = 5 sec

Design a quarrystone revetment type shore protection structure including the filter and toe protection. Also show the design section with neat sketch. Use the attached tables and graph. Assume the reasonable value of any data if not given.

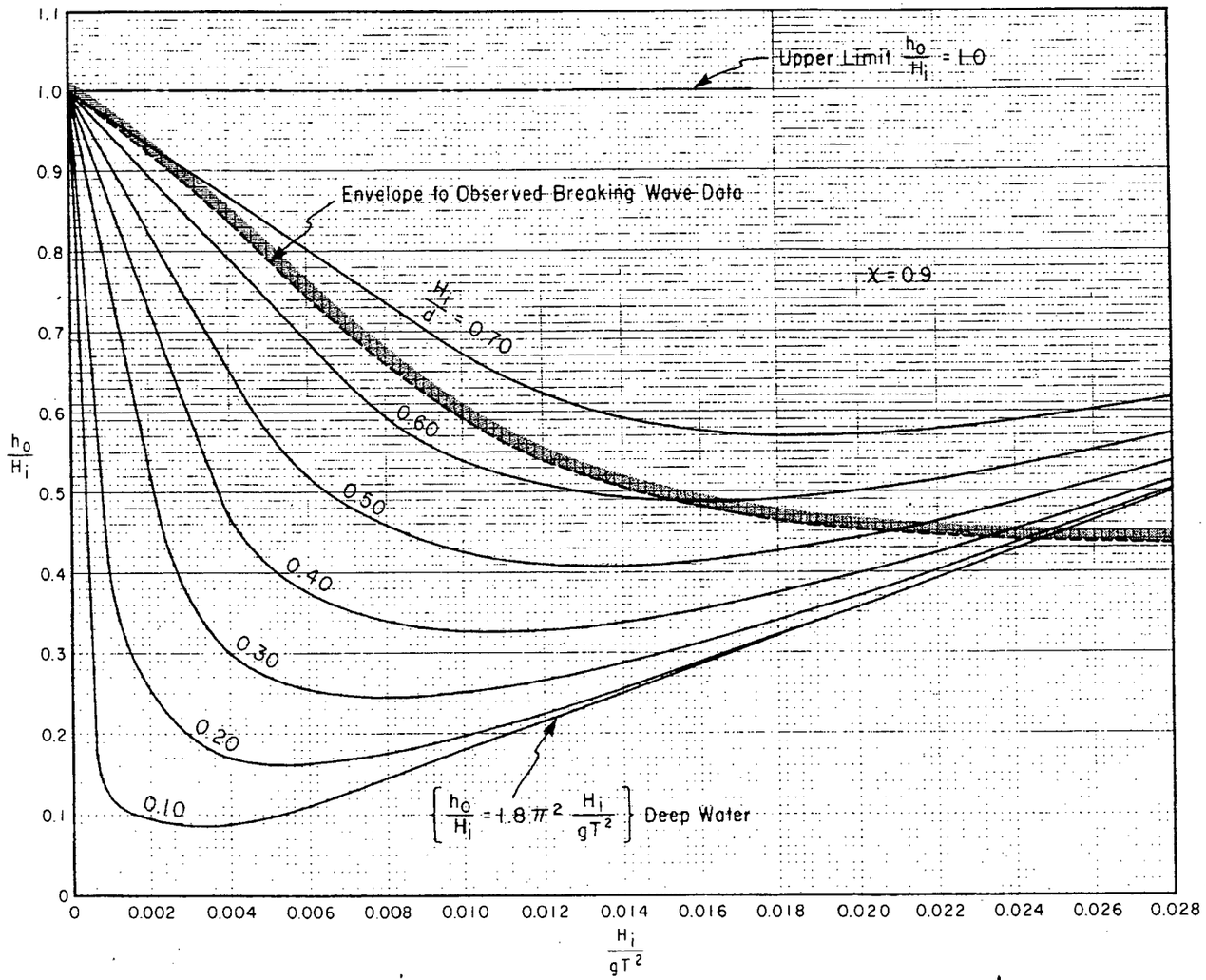

Figure 1 . Nonbreaking waves; $\chi = 0.9$.

for ¶ 4(e)

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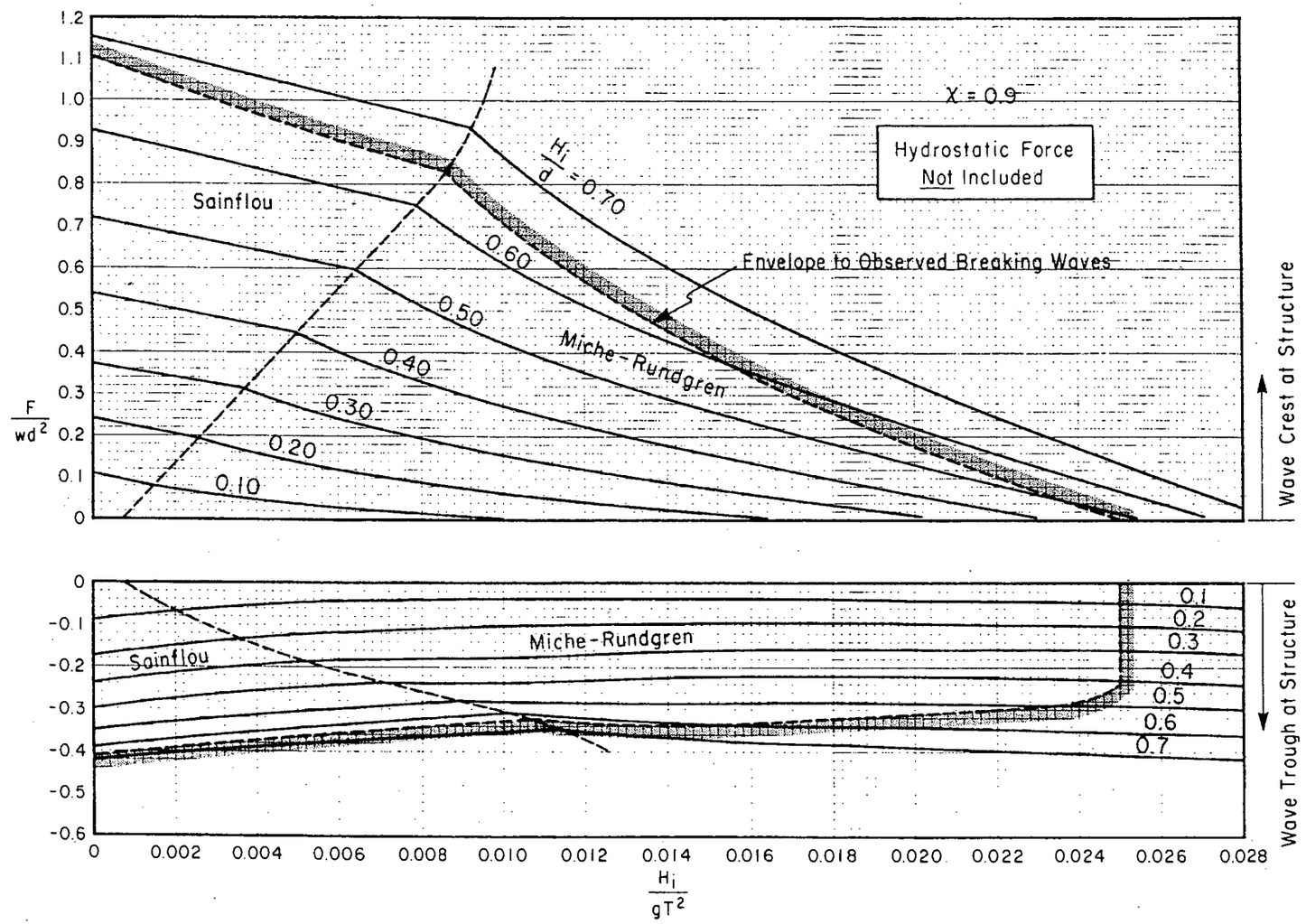

Figure 2 . Nonbreaking wave forces; $\chi = 0.9$. for § 4(e)

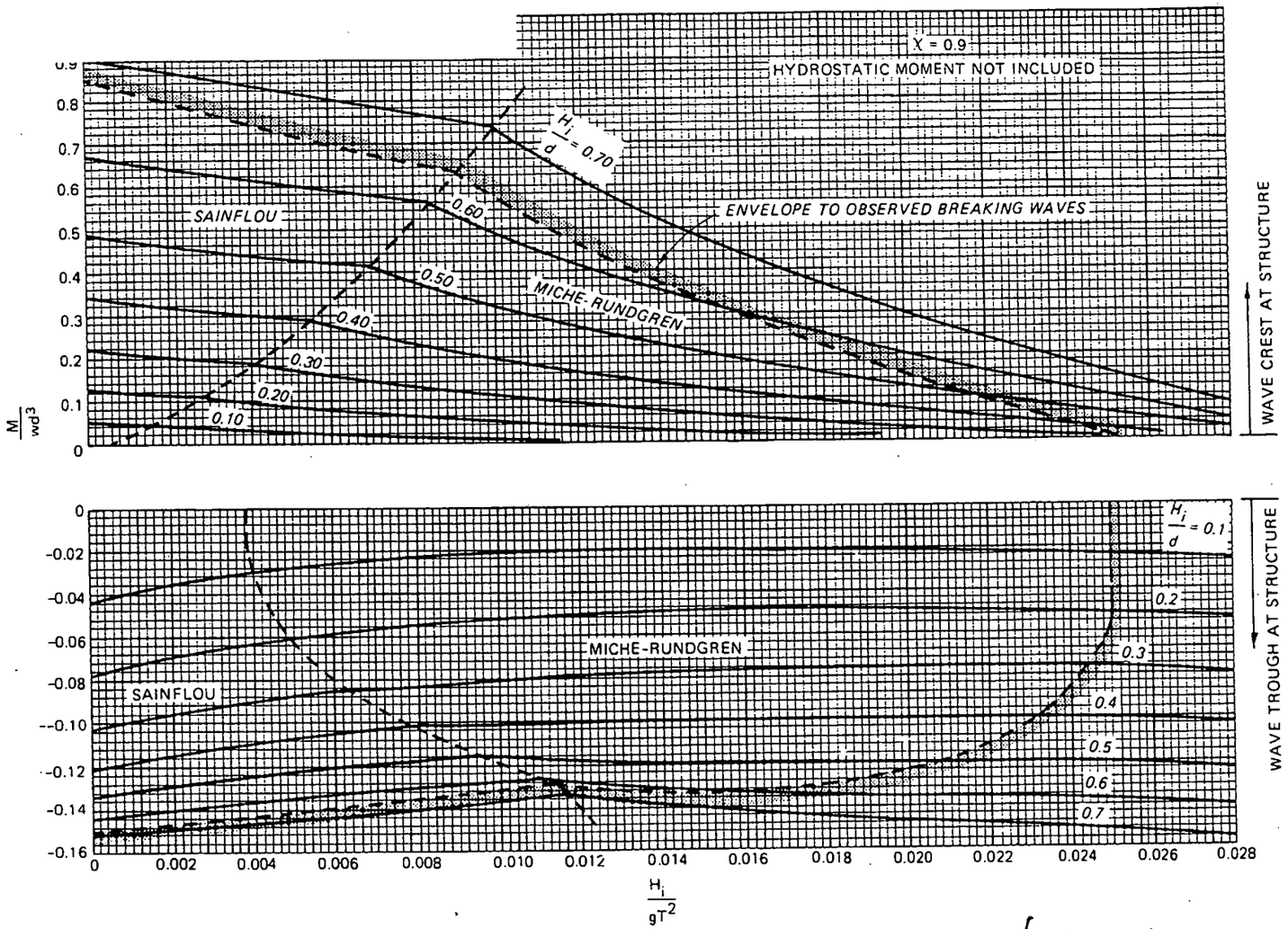

Figure 7-95. Nonbreaking wave moment; χ = 0.9 . for § 4(e)

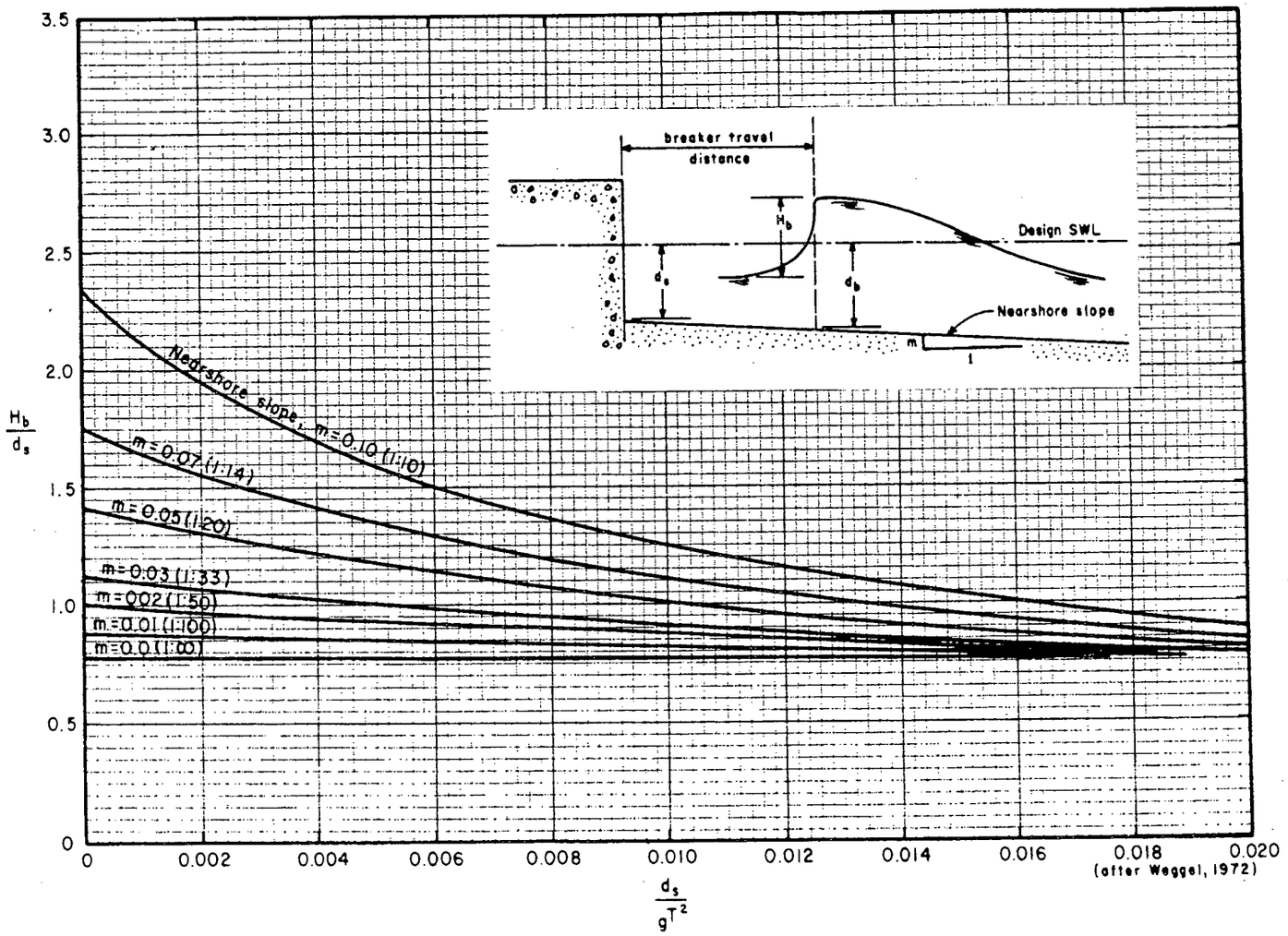

Figure 7-4. Dimensionless design breaker height versus relative depth at structure.

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}.

L-4/T-2/WRE **Date : 26/01/2016**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/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 any **THREE**.

1. (a) List the scope of professional practices for a Water Engineer. **(5)**

   (b) Discuss how one can identify a project. Explain the importance of the feasibility analysis for a project formulation. **(15)**

   (c) What are the various types of engineering drawings required for implementation of a project – discuss each type. **(15)**

2. (a) Discuss the various types of contract. Write down the contract risks and responsibilities? **(15)**

   (b) What are the methods of procurement? Write down the steps of limited tendering method. **(10)**

   (c) List the items of clauses to be considered for general conditions of contract. **(10)**

3. (a) What are the requirements of a pre-qualification (PQ) document? **(5)**

   (b) How you will compile a specification? Write the steps to be following to arrange a specification. What are the items to be included in a typical specification of earth works? **(15)**

   (c) Write down the typical preamble required for the preparation of a Bill of Quantity (BOQ). Give example of a typical BOQ for dredging works. **(15)**

4. (a) Why Standard Tender Document (STD)is necessary? Write the contents of section-7 and Section-8 of STD of your desired project. **(15)**

   (b) List the steps of bid evaluation process. Illustrate the procedure and criteria for bid evaluation. **(10)**

   (c) Discuss sequentially the methods of dispute/conflict of resolution. **(10)**

SECTION – B

There are **FOUR** questions in this section. Answer **Q. No. 5** and any **TWO** from the rest.

Q. No. 5 is compulsory.

5. (a) Write down the characteristics of a professional. **(6×7=42)**

   (b) Why is professional registration required?

   (c) How can professionalism be encouraged?

   (d) Write down the characteristics of peer reviews.

   (e) What steps a professional engineer should follow if his recommendations are overruled by his senior engineer?

   (f) List the guidelines for effective speaking for Engineers.

Contd P/2

WRE 421

6. (a) Discuss the considerations of professionals under the guideline for professional practice. **(17 ½)**

   (b) Why is the 'Statement of purpose' important in effective management of professional practice? **(7)**

   (c) Discuss briefly the components for the management of technical quality of professionals. **(7)**

7. (a) "*Professional engineers and geoscientists shall uphold and enhance the honour, dignity, and reputation of their professions, and thus the ability of the professions to serve the public interest*". – Discuss this statement. **(17 ½)**

   (b) What are the role and responsibilities of a professional in a society? **(7)**

   (c) Write down the typical format of a technical report. **(7)**

8. (a) Discuss briefly contractual problems that may arise from interpretation of contract clauses. **(7)**

   (b) List the guidelines for conducting a meeting. **(7)**

   (c) What are guidelines for 'expressing opinion in public' under the ethical rules of conduct? **(7)**

   (d) "Reynosa Software Ltd. sets up a computer system in its home office and purchases appropriate software packages for its business operation. Frank Ness, P. Eng, holds a senior position with the company. His expertise is called on for making revisions and modifications to the software so that the packages become tailor-made for the Reynosa's use. Frank takes a disk copy of the completed program home and is later discharged from the job because of a downturn in business that forces the software company to reduce its staff. **(10 ½)**

   At this time, Frank forms his own company and uses the software, after he has extensively updated it to suit his own business purposes. Although the nature of Frank's work is not in competition with his former employer, his use of the software becomes known and Reynosa sues Frank for damages".

   Has Frank Ness acted ethically towards Reynosa Software Ltd., and is he legally liable for damages by using a modified copy of software that he assisted in creating? What should you do under such a circumstance?

L-4/T-2/WRE **Date : 30/01/2016**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

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

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**.

1. (a) Explain how the cloud cover is associated with atmospheric inversion. **(3)**

   (b) Differentiate between Arctic and Antarctic ozone holes. **(3)**

   (c) What are the effects of earth's atmosphere on three types of UV radiations? **(3)**

   (d) Define ozone hole. Explain if it is an actual hole in the ozone shield. **(3)**

   (e) Explain how the ozone depletion affects global warming. **(3)**

   (f) Explain why ozone depletion does not occur during polar winter even if there is high concentration of chlorine present. **(3)**

   (g) Write down the features of Molina and Roland hypothesis. **(3)**

   (h) What is the advantages of HFC over CFC regarding ozone depletion? **(2 1/3)**

2. (a) Briefly explain the Southwest Monsoon of Bangladesh **(3)**

   (b) How the excessive amount of CO_2 dissolved in the ocean is related to the oceanic bio-systems? **(3)**

   (c) What would have happened to the earth without the natural greenhouse effect? **(3)**

   (d) Discuss the effects of global warming on North America's prime forming climate. **(3)**

   (e) Discuss the potential global warming between CFC and CO_2. **(3)**

   (f) What happens to visible light after it is being absorbed by the earth? **(3)**

   (g) Name the primary and secondary causes for the rise in sea level due to global warming. **(3)**

   (h) Discuss the effects of global warming on tropical diseases. **(2 1/3)**

3. (a) Explain how boulder quarrying in Bhutan aggravated the flood situation in Bangladesh in 2004? **(3)**

   (b) Mention three reasons as to why normal flood is essential to Bangladesh. **(3)**

   (c) '1987 flood of Bangladesh was triggered by human interference' – explain. **(3)**

   (d) Explain how El Nino was related to 1998 flood in Bangladesh. **(3)**

   (e) Mention two effects of acid rain on lake ecosystem. **(3)**

   (f) Draw temperature profile of earth's atmosphere. **(3)**

   (g) Differentiate between Photochemical and Sulfurous smogs. **(3)**

   (h) Define: (i) Antarctic Polar Vortex, (ii) Doldrums. **(2 1/3)**

Contd P/2

WRE 431

4. (a) Differentiate between middle and upper atmospheres. **(3)**

(b) Differentiate between Tundra and Icecap climate. **(3)**

(c) Mention three distinguishing characteristics of tropical monsoon climate. **(3)**

(d) Name three locations each for arid climates (i.e., BWh and BWk). **(3)**

(e) Write down a location, a controlling factor and a distinguishing characteristic for highland climates. **(3)**

(f) Explain why temperature increases with altitude in Stratosphere and Thermosphere. **(3)**

(g) Explain why earth's major deserts occur in the horse latitudes. **(3)**

(h) Show in figure the belts of low pressure, Ferrel cell and Westerlies for 'Northern hemisphere. **(2 1/3)**

SECTION – B

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

Assume reasonable values if any data is missing.

5. (a) The longwave emission (LW) from the surface can be linearized about some reference temperature T_0 as **(5 1/3)**

$$LW = \sigma T_0^4 + 4\sigma T_0^3 (T_s - T_0)$$

And the sensible heat flux (SH) of the surface can be written as

$$SH = c_p \rho C_D U (T_s - T_0)$$

If the surface temperature rises by 1°C, determine how much will the longwave and sensible heatflux increase/decrease? Assume $T_0 = 300$ K, T_a is fixed, $\rho = 1.2$ kgm^{-3}, $c_p = 1004$ Jkg^{-1}k^{-1}, $C_D = 2 \times 10^{-3}$, and $U = 5$ m/s. Variables denote their usual meaning.

(b) Explain how sea water salinity and cryosphere influence climate? **(6)**

For an atmosphere with a constant lapse rate derive an expression for the variation of height with pressure, z(p), in terms of the surface pressure P_0, surface temperature T_0, and lapse rate Γ. If $T_0 = 288$ K, $P_0 = 1013.5$ hPa, and $\Gamma = 6.5$°C/km, find the thickness of the atmosphere between 1000 hPa and 500 hPa.

(c) Write short notes on (i) Escape velocity; (ii) Radiative flux and Turbulent fluxes; (iii) Regional climate model. **(6)**

(d) Derive the expression of vertical CO_2 flux using the concept of eddy covariance method. Also state the necessary assumptions and application of this method in climate studies. **(6)**

Contd P/3

WRE 431

6. (a) How can climate change affect the coastal areas of Bangladesh? **(5 1/3)**

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

(c) Determine the net radiation in Edmonton (semi-arid) in June, 2010 with the following data: **(7)**

Latitude = 54° N, a mean monthly daily maximum and minimum air temperature are of 21 and 12°C, Relative humidity = 55%, Albedo = 0.3, Stefan-Boltzmann constant = 4.903×10^{-9} MJ K^{-4}/m^2/day, fraction of R_a reaching on the earth on overcast days = 0.22, fraction of R_a reaching on the earth on clear days = 0.70. Assume reasonable values if any data is missing.

(d) Differentiate between (i) Climatology and Meteorology; (iii) Statistical downscaling and Dynamic downscaling. **(5 1/3)**

7. (a) In an energy balance model, the atmosphere is represented by a single layer of gas to account the greenhouse effect. The model assumes that 20% of the incoming solar radiation is absorbed by the atmosphere and the remaining 80% is absorbed by the ground. Write down the energy balance equations at (i) the surface, (ii) atmosphere and (iii) top of the atmosphere. Assume, the atmospheric absorptivity is ϵ_a and the surface absorptivity is ϵ_s. **(5 1/3)**

(b) What is climate model? Write short note on the following **(6)**

(i) Forcing, initial and boundary condition of climate model,

(ii) Model parameterization.

(c) What are the components of Global Circulation Model? What are the sources of uncertainty in a climate model prediction? **(6)**

(d) What is climate feedback? Briefly describe how volcanic eruption acts as both positive and negative forcing of climate change. **(6)**

8. (a) What are the extraterrestrial and anthropogenic sources of climate change. How can climate change affect the coastal areas of Bangladesh? **(5 1/3)**

(b) Consider a leaky greenhouse with one layer of atmosphere whose absorptivity is ϵ. Derive the expression for surface temperature and air temperature in terms of the emission temperature of the earth. **(6)**

(c) Write a brief description on different types of climate models based on model complexity. Among these models which one will be suitable to predict the rainfall of Sylhet in 2050? Justify your answer. **(6)**

(d) The radius of a star is 7.3×10^9 m and its surface temperature is 5200 k. The distance of the star from the earth is 4.3×10^{17} m. Determine the flux of the starlight reaching the earth. **(6)**

L-4/T-2/WRE **Date : 04/02/2016**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

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

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**.

Assume reasonable data if not given. Sketch wherever necessary.

1. (a) Define the following terms used in River Engineering **(8)**

   (i) Bed sediment discharge

   (ii) Critical shear stress

   (iii) Dominant discharge

   (iv) Revetment and riprap

   (b) Explain the mechanism of helicoidal flow that occurs in a bend. A meandering river channel of radius of curvature 3 km has a bankful flow area of 1000 m^2 and longitudinal slope is 1 m in 3 km. Calculate (i) the channel forming discharge and (ii) Transverse gradient. **(12)**

   (c) Briefly discuss the characteristics of confluence and bifurcation of a river system. Give examples of each river of Bangladesh. **(8)**

   (d) Express the idealized longitudinal profile of a river as an exponential decay function in (x, z) plane. Given that S_0 is the initial slope and α is a slope reduction coefficient. **(7)**

2. (a) Sketch Shield's diagram and mention its salient features. Also write its usage in practice. **(5)**

   (b) Calculate the depth of flow at which the bed particle of size 0.15 mm just starts to move for a wide channel with longitudinal gradient 0.3 m per 3 km. Assume reasonable value if not given. **(10)**

   (c) Sketch and name the various types of scour that occur in a river. Also calculate the total scour for a bridge for the following data: **(15)**

   Discharge Q = 10000 m^3/s,

   No. of pier = 6 of each of 2.0 m wide

   Bed material size = 0.15 mm

   R.L of river bed = –1.0 m PWD

   High Water Level = 5.0 m PWD

   (d) Make a generalized comparison among the available formulae for estimating the local scour around bridge pier and suggest a thumb rule scour prediction. **(5)**

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3. (a) Name the various types of river training and bank protection techniques. Answer with sketches. **(10)**

(b) For the river Ganges, following data are given. **(15)**

Design discharge = 45,000 m^3/s

Highest Flood level = 10.5 m PWD

Average Water level = 6.5 m PWD

Low water level = 2.5 m PWD

Bed material size = 0.15 mm

Design a guide bank for a barrage construction. Sketch your design.

(c) List the various types of groyne used in river stabilization. **(5)**

(d) Name the types of sediment load. What are the various types of alluvial bed forms? Answer with sketches. **(5)**

4. (a) Discuss briefly the causes of deterioration of water ways in Bangladesh. How the river improvement can be done? **(10)**

(b) According to BIWTA, classify IWT routes and suggest the required navigational clearances. **(5)**

(c) How dredging depth and width can be designed for the improvement of a navigation channel? Estimate the design dredging depth of a navigation channel for a 1000 tonnage Cargo ship. **(10)**

(d) Write notes on "Dredge spoil disposal for beneficial use". **(10)**

SECTION – B

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

5. (a) What are the different types of flood in Bangladesh? Describe the main causes of flood in Bangladesh. **(11)**

(b) Discuss the main causes of failure of an earthen levee with sketches. **(11)**

(c) Elaborate the design procedures of an earthen levee. **(13)**

6. (a) What are the advantages and limitations of using reservoir as a flood mitigation measure? **(11)**

(b) Elaborate different types of flood proofing methods to reduce flood damages. **(12)**

(c) Discuss how channel improvement and watershed management can reduce flood damages? **(12)**

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7. (a) What is flood hazard? Describe different factors affecting flood hazard. **(6)**

   (b) What are the significances of flood risk mapping in terms of flood mitigation measures? **(6)**

   (c) What are the direct and indirect damages of flood? What do you understand by economic evaluation of flood mitigation projects? Discuss briefly. **(12)**

   (d) Construction of a levee is under consideration for a river reach vulnerable to flood damages. The estimated damages from various river stages and cost of levee protection below the given stages are given below. The return periods of the flood at mid-height of the interval are 10, 15, 25, 30, 75, 150 and 300 years, respectively. Select the most satisfactory river stage for the design of the levee. **(11)**

Peak Stage (m)	Total damage below indicated stage (Million $)	Project cost (Million $)
6.1	0	0.4
6.5	5	0.6
7.2	9	0.8
8.0	19	1.0
8.6	30	1.3
9.2	45	1.6
9.8	60	1.8
10.5	80	2.0

8. (a) Describe various Flood Action Plans that have been implemented in Bangladesh. **(12)**

   (b) What are the main causes and impacts of urban flood? **(6)**

   (c) Distinguish between *flood water* and *storm water*. **(6)**

   (d) Write down the names of different flood zones and describe their characteristics. **(11)**
