

L-4/T-2/WRE

Date: 9/01/2021

**BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY**

L-4/T-2, B.Sc. Engineering Examinations January 2020

Sub: **WRE-421** (Professional Practices and Communication)

Full Marks: 180

Time: 2 Hours

**USE SEPARATE SCRIPTS FOR EACH SECTION**

The figures in the margin indicate full marks.

**SECTION – A**

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

- 1.(a) Why professional practice is studied in Engineering Studies? List the scopes of professional practices of a “Water Engineer”. (15)
- (b) Discuss briefly, how one can identify a project. Explain the importance of the feasibility analysis for a project formulation. (15)
2. (a) What are the sequential steps for project development? Discuss the various types of drawings required for a Engineering works. (15)
- (b) Write down a typical list of items against for dredging project. (15)
- 3.(a) What is specification? Discuss the role of specification in a bid document. (15)
- (b) Explain any two types of PPP for national development works. Which one do you prefer among the all types of PPP and why? (15)
- 4.(a) List the procurement methods under PPR-2008. Write down advantages and disadvantages of two different methods of your choice. (15)
- (b) Briefly illustrate the criteria of bid evaluation steps of World Bank procurement process. (15)

**SECTION – B**

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

- 5.(a) To whom should the Engineers are accountable according to the guidelines of professional practice? How? (7)
- (b) “A professional practice requires an effective program to ensure continuing competence of its professional staff”. What are programs that can be undertaken to ensure continuing competence of its professional staff? (10)
- (c) *Mr Asif, P.Eng., an engineering consultant with a M.Sc. and five years experience, is employed by a consulting firm. He has designed a ten-metre-high earthen dam for an industrial project. His recommendations are developed from a computer analysis, which, in turn, is based on soil properties derived from a limited field investigation. Mr. Mahbub, 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. Mr. Mahbub requests that Mr. Asif change the report accordingly. After considerable discussion, Mr. Asif agrees to recheck the analysis, but remains unconvinced that Mr Mahbub is correct.

What should Mr Asif do now?

(13)

6.(a) You are going to be an Engineer soon. Do you think it is worthwhile to be a registered Engineer? Why? What are the general requirements for this registration? (7)

(b) "Professionals should keep confidential all information that is acquired in the course of their professional duties and that concerns the business affairs of present or past clients/employers". How can this statement be interpreted under the guideline of professional ethics on integrity, honesty, fairness and objectivity? (10)

(c) "Mr Kabir, P.Eng., has contracted to purchase a large and expensive piece of equipment with a performance guarantee. The supplier's lack of expertise and its eagerness to make a sale, have contributed to an over-optimistic guarantee. Because of his firm's technical capability, Mr Kabir knows the equipment cannot perform to the performance specification but otherwise will be quite useable for his purposes. The contract stipulates that if the equipment does not perform as specified, the purchaser has the option of rejecting it and paying nothing. The threat of a complete rejection would seriously impact the supplier, so Mr Kabir's negotiating position would be extremely strong. When it becomes obvious the performance specification cannot be achieved, a settlement should be negotiated. "

Is it ethical for Mr Kabir to enter into the purchase arrangement with a view to enforcing the guarantee when he already knows or suspects that it cannot be met?

Can Mr Kabir ethically negotiate a significant settlement under these circumstances if the equipment is actually suitable to his application?- Explain briefly. (13)

7.(a) How should an Engineer act in reviewing the work of another Engineer so that the honour, dignity and reputation of the profession is not jeopardized? (10)

(b) "Professional engineers shall comply with applicable statutes, regulations and bylaws in their professional practices". How do you conform to this guideline? (10)

(c) For the purpose of your thesis you need to collect some data from Bangladesh Water Development Board (BWDB). Due to the Covid-19 situation, you are required to contact with the Superintending Engineer (SE) of BWDB through email. Write a proper email to the SE outlining your requirement. (10)

8.(a) Prepare a brief presentation of 6 slides outlining the proposal of your undergraduate thesis. (10)

(b) Discuss briefly advantages of different forms of contracts. (10)

(c) A local group of business and community leaders banded together and organized a Promotion Committee for the purpose of raising funds and conducting an educational program in support of a favorable vote for a major hydroelectric dam project. The project would entail extensive engineering services of substantial value to local engineering firms. The Promotion Committee approached local engineering firms and made similar contacts with bankers, realtors, insurance companies and other local business operators to solicit funds for the public education program in support of the dam project.

Is it ethical for engineering firms to contribute funds to the promotion fund in the expectation or possibility that those firms might later seek design works of the project? Explain under the guideline for conflict of interest. (10)

## BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY

L-4/T-2 B.Sc. Engineering Examinations January 2020

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

Full Marks: 180

Time: 2 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

**SECTION – A**There are **FOUR** questions in this section. Answer any **THREE**.*Assume reasonable value if not given.*

1. (a) "River water need to be utilized as major source of water supply in urban areas?"—Justify your answer. (10)
- (b) Calculate the total scour for a bridge using following data: (20)  
 Discharge  $Q=10000+10*(\text{last two digits of students Number}) \text{ m}^3/\text{s}$ ,  
 No. of pier =6 of each of 2.0 m wide,  
 Bed material size = 0.15 mm  
 R.L of river bed = -1.5 m  
 High water level = 4.5 m.
2. (a) Enumerate the causes of river bank failure with special referenced to Bangladesh. (15)
- b) Sketch a typical bank protection work. What are the protection measures you suggest for braided river like Jamuna and why? (15)
3. (a) Draw the plan view of a guide bank for given discharge  $20000+10*(\text{last two digits of students Number}) \text{ m}^3/\text{s}$ . (15)
- (b) What is falling apron? Calculate the volume of stone required for the falling apron if the river median bed material is 0.10 mm and average depth of flow is  $5+0.1*(\text{last two digits of students Number}) \text{ m}$ . (15)
4. (a) How sediment transport load of a river can be estimated from the field? Explain with sketches. (15)
- (b) Classify the waterway routes according to BIWTA and give examples of each type of route. (15)

**SECTION – B**There are **FOUR** questions in this section. Answer any **THREE**.**Marks for all questions are equal.**

5. (a) Describe the main causes of failure of an earthen dam/levee with neat sketches? Explain which types of failure are common in Bangladesh?

- (b) What are the general design criteria in designing earthen dams/levees? Explain why seepage analysis is important in designing earthen dams/levees?
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6. (a) What are the major reasons of drainage congestions of our major urban cities? Explain how this congestion can be reduced.
- (b) What are the challenges in developing an accurate flood forecasting model? Describe different components of a flood forecasting model.
7. (a) What is flood hazard? Describe different factors affecting flood hazard. Write down the names of different flood zones and describe their characteristics.
- (b) What do you mean by flood resilience? What are the major concepts to estimate flood resilience of a community?
8. (a) Describe what kind of flood protection measures or combination of measures are suitable for country like Bangladesh. Justify your answer.
- (b) Describe how climate changes may impact on flood behavior of our major rivers, such as for Jamuna river. What should be the remedial measures to reduce the adverse impacts of climate changes.

Sub: WRE-431 (Climatology)

Full Marks: 120

Time: 2 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

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

1. (a) Explain how the atmospheric inversion can eventually lead to air pollution. (4)
- (b) Explain how the ozone depletion can adversely affect the primary productivity in the oceans. (4)
- (c) What are the effects of earth's atmosphere on the three major types of solar radiations? (4)
- (d) Write down and briefly explain the catalytic chain reaction. (4)
- (e) Which of the UV radiations is the most critical regarding Ozone depletion and why? (4)
2. (a) How the excessive amount of CO<sub>2</sub> dissolved in the ocean is related to the oceanic biosystems? (4)
- (b) Differentiate between natural and anthropogenic greenhouse effects. (4)
- (c) Why we are not particularly worried about water vapor as a greenhouse gas? (4)
- (d) Briefly explain Nitrous Oxide as a greenhouse gas. (4)
- (e) What happens to visible light after it is being absorbed by the earth? (4)
3. (a) Differentiate between lower and upper atmosphere. (4)
- (b) Differentiate between Tropical Rain Forest and Tropical Monsoon climates. (4)
- (c) Mention three distinguishing characteristics of Icecap climate. (4)

- (d) Define: (i) Peru current, (ii) Oceanic upwelling. (4)
- (e) Explain why earth's major deserts occur in the horse latitudes. (4)
4. (a) Explain how boulder quarrying in Bhutan aggravated the flood situation in Bangladesh in 2004. (4)
- (b) Explain in brief the adverse outfall condition in the Bay of Bengal during 1998 flood. (4)
- (c) Mention the effects of acid rain on soil. (4)
- (d) Differentiate between Photochemical and Sulfurous Smogs. (4)
- (e) Why the deforestation in the hills and mountains of Bhutan, Nepal and India can affect the flood in Bangladesh? (4)

## SECTION – B

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

- 5.(a) What is climate feedback? Briefly describe the positive and negative feedback of atmospheric water vapor on climate change. (4)
- (b) The decline of Arctic sea ice has been reported in some recent studies. Explain its impact on albedo and hence climate. (3)
- (c) Explain the role of different atmospheric gasses on the variation of vertical thermal structure of the atmosphere. (3)
- (d) Determine the net radiation in Rangpur, Bangladesh in March from the following data: (10)
- Latitude  $= (25 + 0.1x)^\circ \text{N}$ , Total sunshine hours in March  $= (340 + x)$  hours, a mean monthly daily maximum and minimum air temperature are of  $(30 + x)^\circ \text{C}$  and  $22^\circ \text{C}$ , vapour pressure  $= (2.30 + 0.1x)$  kPa Albedo  $= 0.25$ , Stefan-Boltzmann constant  $= 4.903 \times 10^{-9} \text{ MJ K}^{-4} / \text{m}^2 / \text{day}$ , fraction of  $R_a$  reaching on the earth on overcast days  $= 0.2$ , fraction  $R_a$  reaching on the earth on clear days  $= 0.75$ . Assume reasonable values if any data is missing and assume  $x$  to be the last digit of your student ID in different variable calculation.

$$R_a = \frac{24 (60)}{\pi} G_{sc} d_r [\omega_s \sin(\varphi) \sin(\delta) + \cos(\varphi) \cos(\delta) \sin(\omega_s)]$$

- 6.(a) Calculate the pressure on the surface of a hilly area located at an altitude of  $(3+x)$  km. Given the atmospheric pressure at the mean sea level is 1000 mbar and temperature  $27^\circ\text{C}$ . Assume  $x$  to be the last digit of your student ID. (4)
- (b) How does cryosphere influence climate? (3)
- (c) A climate researcher wants to project the future thunderstorm frequency in Bangladesh. What should be the temporal and spatial resolution of the global/regional climate model data necessary for this analysis? Justify your answer. (3)
- (d) From the energy balance diagram (Figure 1) of the earth compute the following: (10)

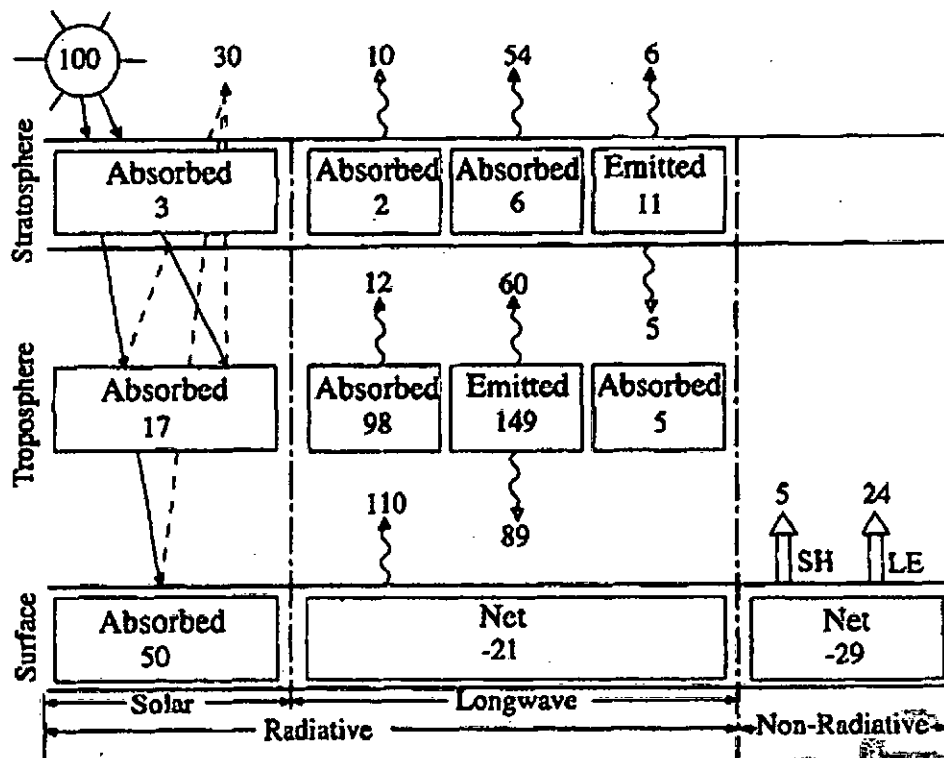


Fig. 1 Radiative and nonradiative energy flow diagram for Earth and its atmosphere. Units are percentages of the global-mean insolation ( $100 \text{ units} = 342 \text{ W/m}^2$ ).

- i) Downward and upward shortwave radiation (in  $\text{W/m}^2$ ) at the surface
- ii) Downward and upward longwave radiation (in  $\text{W/m}^2$ ) at the surface
- iii) Albedo, Net radiation (in  $\text{W/m}^2$ ) and Evaporation in mm/day.

Given, 100 units =  $342 \text{ W/m}^2$  in the Figure 1.

- 7.(a) A climate scientist wants to study the effect of climate change on the extreme rainfall events of Meghna river basin. He has both Regional Climate Model and Global Climate Model data. Which dataset should he use for this study? Justify your answer by describing the advantages of your chosen dataset. (4)
- (b) For an island in the Bay of Bengal, find the maximum and minimum temperature and relative humidity on a certain day. Data available are: mean temperature =  $28^\circ\text{C}$ , extraterrestrial radiation =  $25 \text{ MJ m}^{-2} \text{ day}^{-1}$ , shortwave radiation =  $14 \text{ MJ m}^{-2} \text{ day}^{-1}$ . (3)
- (c) The Bay of Bengal lies to the south of Bangladesh. Write down four possible impact of climate change on the Bay of Bengal. (3)
- (d) Consider a simple greenhouse with two layers of atmosphere with temperature  $T_1$  in the upper layer and  $T_2$  in the bottom layer. Assume the upper and bottom layer of atmosphere absorbs  $(0.2+0.01x) \partial T_e^4$  and  $0.3 \partial T_e^4$ , respectively and the surface absorbs  $(0.5-0.01x) \partial T_e^4$  amount energy. Write down the energy balance equations at i) the surface, ii) atmospheric layers and iii) top of the atmosphere. Also compute  $T_1$ ,  $T_2$  and surface temperature in terms of emission temperature of the earth. Also assume, earth surface has an emissivity of one (blackbody) and atmosphere is completely opaque to infrared radiation (i.e,  $\epsilon=1$ ). Assume  $x$  to be the last digit of your student ID in different variable calculation. (10)
- 8.(a) Assume you have precipitation data from a GCM and Bangladesh meteorological department (BMD) for Rangpur district and for the period 1970-2010. Explain briefly how you will compute the local scale precipitation of Rangpur for 2011 to 2100 from that GCM data. (4)
- (b) How does thermohaline circulation impact climate? Explain (3)
- (c) Will climate change affect the river flow of Bangladesh? Justify your answer. (3)



- (d) Air with a temperature of 28°C moves across a catchment at a speed of  $(5+0.1x)$  m/s. The catchment is wet and the air is just at saturation. The insolation is  $(600+10x)$  W/m<sup>2</sup> and downward longwave radiation at the ground is 300 W/m<sup>2</sup>. The longwave emissivity of the surface is 0.98 and the albedo of the surface is 0.1. What will be surface temperature in equilibrium? Given, air density = 1.2 kg/m<sup>3</sup> and  $C_D=2 \times 10^{-3}$ ,  $C_p= 1004$  J/kg/K, latent heat flux = 3.5 × sensible heat flux, Stefan-Boltzmann constant =  $5.67 \times 10^{-8}$  W. K<sup>-4</sup>/m<sup>2</sup>. Assume  $x$  to be the last digit of your student ID while computing longwave radiation. (10)

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

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

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**BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY**

L-4/T-2 B.Sc. Engineering Examinations January 2020 (ONLINE)

Sub: **WRE-435** (Hydraulic structures)

Full Marks: 180

Time: 2 Hours

**USE SEPARATE SCRIPTS FOR EACH SECTION**

The figures in the margin indicate full marks.

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**SECTION – A**There are **FOUR** questions in this section. Answer **Question No. 1** and any **TWO** from the rest.

- 1) The **Sangu River** is a river in Myanmar and Bangladesh. Its source is in the North (30) Arakan Hills of Myanmar, located at  $21^{\circ}13'N$   $92^{\circ}37'E$ . The Arakan Hills form the boundary between Arakan and the Chittagong Hill Tracts. It follows a northerly circuitous course in the hill tracts and then enters Bangladesh near Remarki, Thanchi Upazila, Bandarban District, from the east (Figure-1). It flows north through Thanchi, Rowangchhari and Bandarban Sadar Upazilas of Bandarban District. It then flows west through Satkania and Banskhali Upazilas in Chittagong District and flows into the Bay of Bengal near Chittagong, at  $22^{\circ}6'N$   $91^{\circ}51'E$ , about 16 kilometers south of the mouth of the Karnaphuli River. The length of the river is 270 kilometers, of which 173 kilometers are located within Bangladesh.

As the river passes through the hilly areas, there may have some potential sites for construction of high dam for hydropower generation. Suppose, you are a water resources engineer working in a reputed Government Organization. You have been asked to conduct a feasibility study on planning and construction of a high dam and also planning the reservoir at its upstream on Sangu river. For this study, write down a **preliminary report** explaining the following issues:

*Types of data to be collected, study types/areas, methodology of the different studies, technical-social-environmental considerations, issues of dam type selection, issues of dam site selection, estimation of dependable catchment yield, estimation of reservoir capacity for a targeted reservoir water level for hydropower generation.*

- 2) Teesta Barrage has been constructed over the River Teesta at Lalmonirhat district. (30)

Teesta Barrage Irrigation Project (TBIP) is a blessing to the distressed people with supplying irrigation water through a network of canal system and a Barrage across the river Teesta mainly for supplementary irrigation during Monsoon. There are a large number of hydraulic structures in Teesta Barrage Irrigation Project. Write down the names of major types (at least five different types) of hydraulic structures exist in this project. State the functions of each structure. Explain the considerations for hydrologic and hydraulic design of each structure.

- 3) Kaptai Dam is an earthen dam constructed on Karnaphuli river at Rangamati district. (30)

As the dam is earthen, there needs a separate spillway to be constructed made of concrete. Suppose, you are asked to design an overflow spillway for that dam. The spillway is  $M$  ft high. It will be discharging with a head of  $N$  ft. The spillway needs to carry a discharge of  $R$  cumecs. The slope of the u/s face of the spillway is  $2H:1V$ . The values of  $M$ ,  $N$  and  $R$  are given in **Table-1** against your student number. Use the attached figures 2, 3 and 4. Assume the reasonable value of any other data if not given.

- Design and sketch the crest level of the spillway.
- Calculate the magnitude of the dynamic force on the curve portion of the spillway at its end.

- 4) Figure 5 shows the section of a non-overflow portion of a gravity dam built of concrete. (30)

Considering the earth quake effects on reservoir full case and waves, **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  $23.5 \text{ KN/m}^3$ , wind velocity  $60 \text{ km/hr}$  and fetch length  $38 \text{ km}$ . Assume the reasonable value of any other data if not given. Use the values of  $a$ ,  $b$ ,  $c$  given in **Table-1** against your student number.

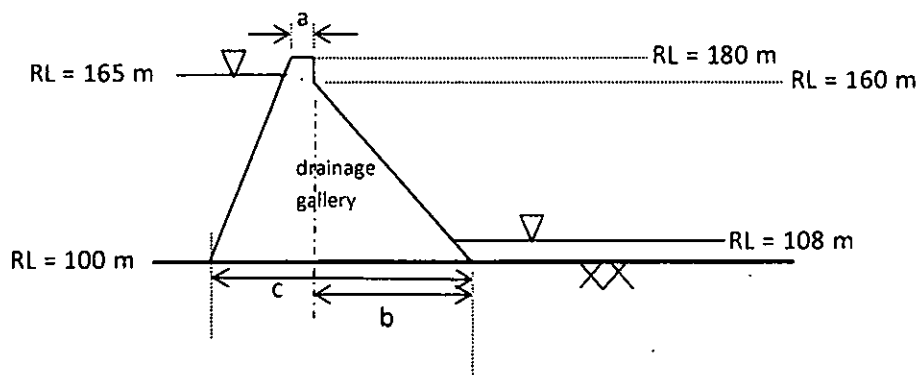


Figure 5 for Ques. No. 4

Table-1

Student No	M	N	R	a (m)	b (m)	c (m)
1116006	251	27	9870	9	70	124
1316029	247	12	6755	4	64	106
1416011	243	18	10650	6	60	120
1416021	239	24	7500	8	67	94
1516001	235	30	8925	10	58	116
1516002	231	36	11040	12	65	114
1516003	227	12	5985	13	69	112
1516004	223	18	10272	11	56	86
1516005	219	24	6846	7	62	108
1516006	215	30	11130	5	51	122
1516007	211	36	7665	9	69	104
1516008	207	39	9233	4	59	92
1516009	203	33	11559	6	66	100
1516010	199	21	5999	8	57	98
1516011	195	15	10714	10	63	96
1516012	191	27	6945	12	55	120
1516013	187	12	11658	13	54	92
1516014	183	18	7847	11	48	102
1516015	179	24	9571	7	52	88
1516016	175	30	12130	5	62	110
1516017	171	36	6013	9	50	84
1516018	167	12	11201	4	43	82
1516019	163	18	7055	6	53	66
1516020	159	24	12239	8	40	73
1516021	155	30	8046	10	38	76
1516022	151	36	9943	12	45	59
1516023	147	39	12758	13	41	72
1516024	143	33	6030	11	49	70
1516025	139	21	11736	7	42	88
1516026	135	15	7175	5	44	66
1516027	131	33	12878	4	47	64
1516028	127	24	8266	3	39	75
1516029	123	18	10352	5	47	74
1516030	119	15	13449	6	37	58

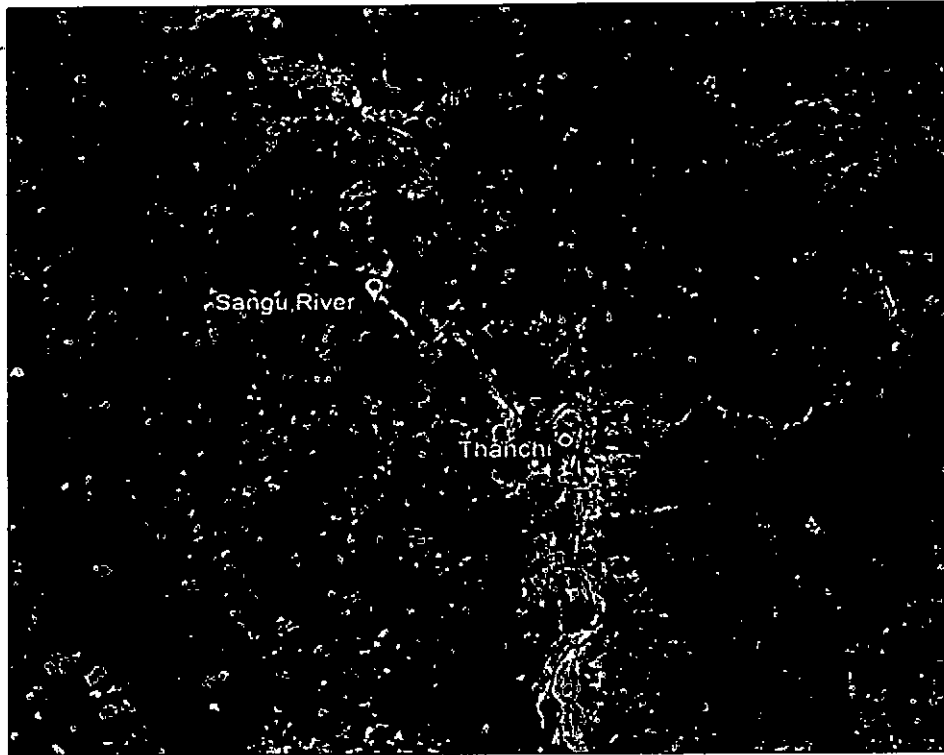


Figure 1: Sangu River passing through Bandarban district

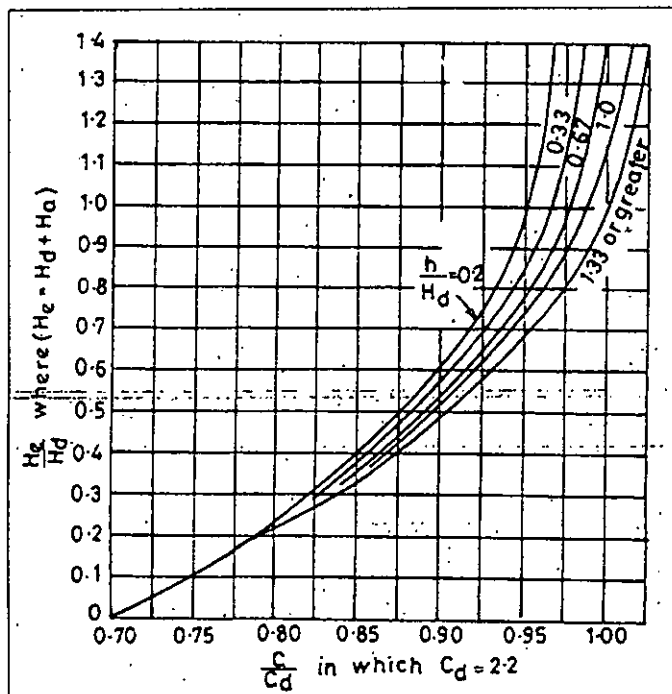


Figure-2

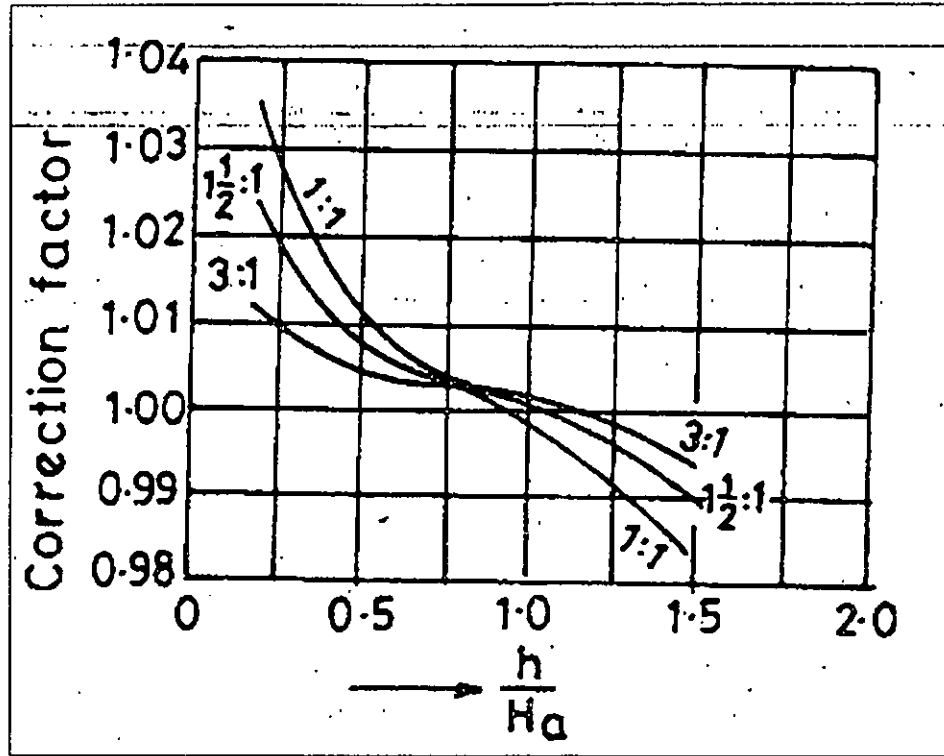


Figure-3

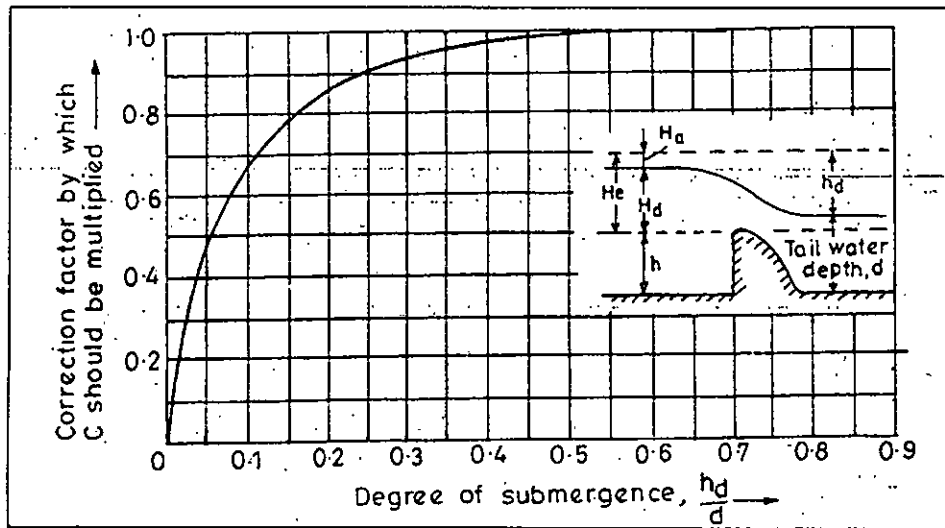


Figure-4

## SECTION -B

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

- 5 (a) Why is it necessary to provide the 'fish ladder' and how does it help in achieving the required objectives? (10)
- (b) What are the main causes of failures of weirs on permeable foundations, and what remedies would you suggest to prevent them? (15)
- (c) How does Bligh's theory differ from Lane's weighted creep theory? (5)
- 6 (a) What is the purpose served by the 'scouring sluices' at weirs? (7)
- (b) Briefly outline Khosla's theory in the design of weir or barrage on permeable foundation. Enumerate the necessary corrections applied in the application of the theory. (15)
- (c) What is the design consideration for floor thickness against uplift pressure? (8)
- 7 (a) What are the various types of Aqueduct and Syphon Aqueduct? Explain with figures. (10)
- (b) Write down the factors to be considered during the design of a barrage. (15)
- (c) Explain the basic causes of retrogression in the channel? (5)
- 8 (a) Draw and explain the difference between the uplift pressure diagram in the jump trough with and without flow condition. (12)
- (b) What factors govern during the fluming of the canal in the cross drainage works? (10)
- (c) Write the functions of inverted filters and launching apron at u/s and d/s of weirs. (8)
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## BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY

L-4/T-2 B.Sc. Engineering Examinations January 2020 (ONLINE)

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

Full Marks: 180

Time: 2 Hours

**USE SEPARATE SCRIPTS FOR EACH SECTION**

The figures in the margin indicate full marks. The symbols and notations have their usual meanings. Assume reasonable value of any data, if required.

**SECTION – A**

There are **FOUR** questions in this section. **Answer Question No. 3 and any TWO** from the rest.

1. Bangladesh has a long coast line. A significant portion of the country's land area has been demarked as coastal zone. Coastal zone of Bangladesh contains huge resources of different types. On the other hand, it faces many hydrodynamic, climatic and manmade challenges. (30)

Write down an essay on "Coastal zone of Bangladesh, its resources, challenges and Management". Your answer should include the physical description of coastal zone of Bangladesh; its delineation; brief description of different types of resources; description of hydrodynamic, climatic and manmade challenges and their impacts; how those challenges are currently managed.

2. Bangladesh Power Development Board (BPDB) has planned to construct a coal based power plant on the shore of Bay of Bengal at Anwara Upazila of Chittagong district. In this plant, large size ocean going vessels (ships) of minimum draft 9 m carrying the raw materials of power generation should be berthed. You are a Water Resources Engineer working as an Assistant Engineer in BPDB. You are asked to plan and design the terminal and jetties for the targeted ships. You will need to construct a harbour area at the near shore area. (30)

For this study, explain the issues of site selection, considerations for tide and wave conditions, storm surge challenges that you will have to take care for planning and preparing layout of this harbour. Also, assuming a suitable sea bathymetry and typical hydrodynamic conditions of the sea at the proposed area, sketch a qualitative layout of the harbour area for this project showing all necessary components.

3. The site conditions along a coastal shore line have been surveyed. The dimensions of the cross-section of the shoreline and necessary data at a particular location are given below: (30)

Average slope of the shoreline cross-section = 1V : 5.5H

Slope of the near shore at sea bottom = 1V: 50H

R.L. of the Crest level of the shoreline = 35 ft

R.L. of mean low water level = 10 ft

R.L. of mean high water level = 15 ft

R.L. of high water level for 100-yr return period = 18 ft

Design storm surge height = 12 ft

The shoreline slope ends at mean low water level.



The design wave height and period are given as  $H$  ft and  $T$  sec, respectively, where the values of  $H$  and  $T$  are given in Table-1 against your student number. Design a c.c. block revetment (all components) as shore protection structure and also sketch the designed section. Use the Figure 1 and Tables 2-2, 2-3, 2-4, 2-5, as attached. Assume the reasonable value of any data if not given.

4. A hurricane approached at a speed of 22 nautical miles per hour along the coast of Florida at a maximum wind speed of  $V$  nautical miles per hour. The velocity distribution of the cyclonic wind was triangular and it has a fetch length of  $F$  nautical miles. The values of  $V$  and  $F$  are given in Table-1 against your student number. The hurricane approached the continental shelf whose width is 820 km, edge depth 550 ft and inshore depth 45 ft. Compute (30)

(i) Maximum surge height

(ii) Length of coast is affected by such high water.

Use Figures 2, 3, 4 and 5 as attached.

Table-1

Student No	H (ft)	T (sec)	V (nautical miles per hour)	F (nautical miles)
1116006	5.2	3.2	60	720
1316029	7.0	4.0	115	910
1416011	6.6	5.1	82	680
1416021	5.5	4.1	78	870
1516001	6.4	4.6	110	750
1516002	7.5	5.5	79	710
1516003	6.5	5.2	95	855
1516004	8.8	3.0	104	725
1516005	5.6	3.8	86	905
1516006	7.2	4.6	77	690
1516007	6.1	4.9	114	860
1516008	8.7	3.1	117	770
1516009	5.3	4.6	69	715
1516010	6.0	5.5	96	730
1516011	7.9	5.2	74	840
1516012	6.6	3.0	65	695
1516013	5.8	3.8	120	735
1516014	7.9	4.6	87	860
1516015	7.4	4.9	83	895
1516016	6.9	3.1	115	795
1516017	5.7	4.6	84	745
1516018	6.8	5.5	100	875
1516019	8.5	5.2	109	785
1516020	8.9	3.0	91	725
1516021	5.9	3.8	82	905
1516022	6.7	4.6	118	690
1516023	7.6	4.9	109	860
1516024	8.5	3.1	74	770

1516025	8.2	3.5	101	715
1516026	5.1	3.8	71	730
1516027	7.5	4.6	113	840
1516028	8.0	4.9	99	725
1516029	5.4	3.1	88	865
1516030	7.8	3.5	107	900

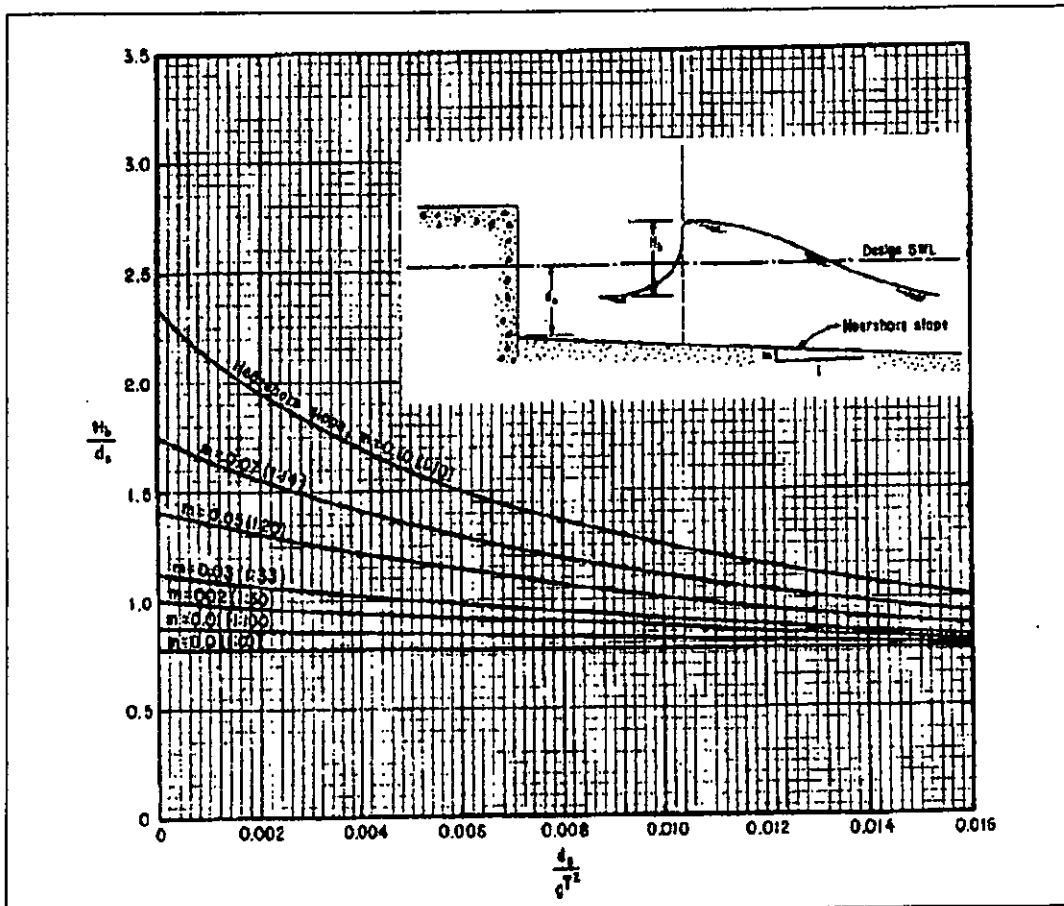


Figure:1 Design breaker height

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

Armor Type	Slope (cot $\theta$ )	Relative Size $H/K_c^{1/2}$ <sup>a,b</sup>	Correction Factor $r$
Quarystone	1.5	3 to 4	0.60
Quarystone	2.5	3 to 4	0.63
Quarystone	3.5	3 to 4	0.60
Quarystone	5	3	0.60
Quarystone	5	4	0.68
Quarystone	5	5	0.72
Concrete Blocks <sup>c</sup>	Any	6 <sup>c</sup>	0.93
Stepped slope with vertical risers	1.5	$1 \leq H_c/K_c^d$	0.75
Stepped slope with vertical risers	2.0	$1 \leq H_c/K_c^d$	0.75
Stepped slope with vertical risers	3.0	$1 \leq H_c/K_c^d$	0.70
Stepped slope with rounded edges	3.0	$1 \leq H_c/K_c^d$	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

<sup>a</sup>  $K_c$  is the characteristic height of the armor unit perpendicular to the slope. For quarystones, it is the nominal diameter; for armor units, the height above the slope.

<sup>b</sup> Use  $H_c'$  for  $d/H_c' > 3$ ; and the local wave height,  $H_c$ , for  $d/H_c' \leq 3$ .

<sup>c</sup> Perforated surfaces of Gobi Blocks, Monosteaps, and concrete masonry units placed hollows up.

<sup>d</sup>  $K_c$  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 $\theta$ )	$K_o$
Quarystone				
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 <sup>2</sup>	1.5 to 3.0	7.0 to 20.0
Graded rriprap <sup>3</sup>	2 <sup>4</sup>	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 <sup>5</sup>	15.0 <sup>6</sup>

<sup>1</sup>  $n$  equals the number of equivalent spherical diameters corresponding to the median stone weight that would fit within the layer thickness.

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

<sup>3</sup> Graded rriprap is not recommended where wave heights exceed 5 ft.

<sup>4</sup> By definition, graded rriprap thickness is two times the diameter of the minimum  $W_{50}$  size.

<sup>5</sup> Stability of dolosse on slope steeper than 1 on 2 should be verified by model tests.

<sup>6</sup> No damage design (3 to 5 percent of units move). If no rocking of armor (less than 2 percent) is desired, reduce  $K_o$  by approximately 50 percent.

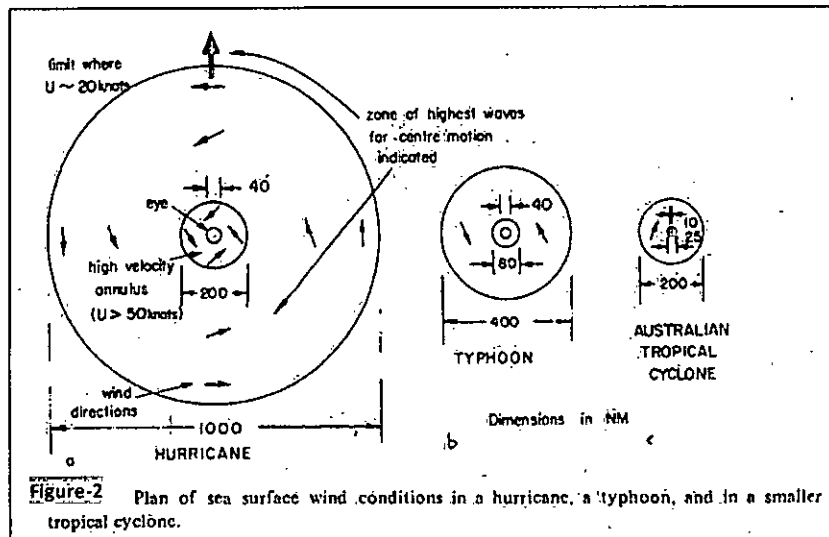
**Table 2-4**  
**Layer Coefficients and Porosity for Various Armor Units**

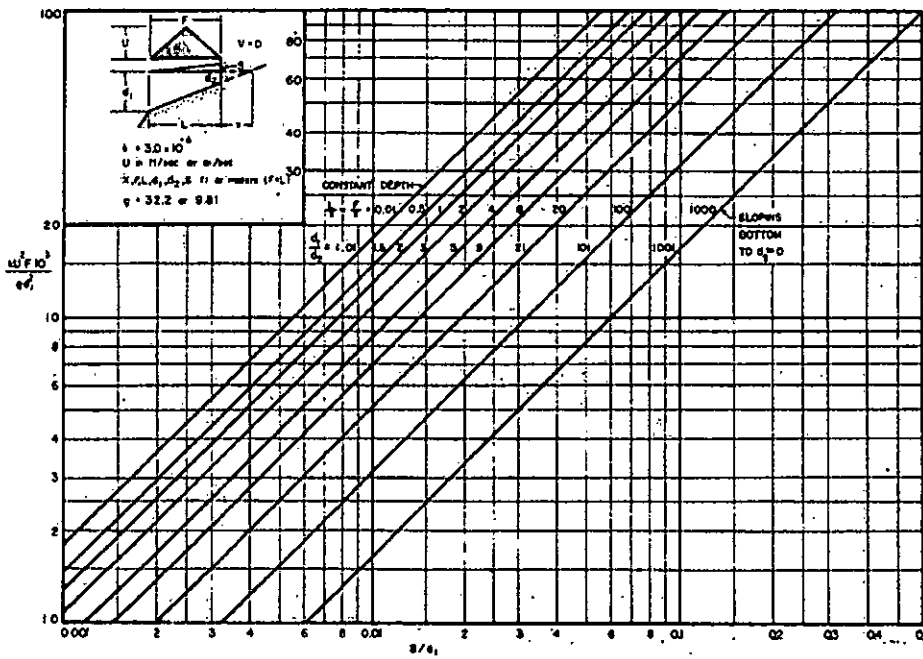
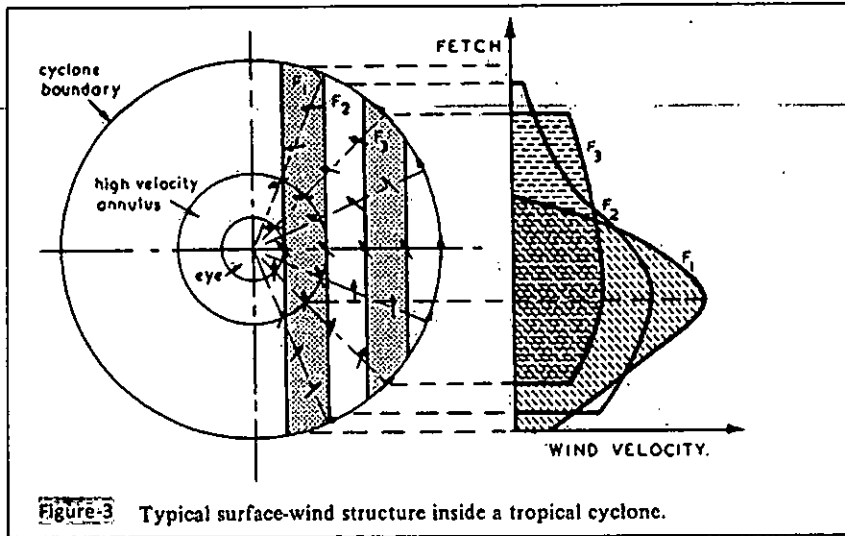
Armor Unit	$n$	Placement	$K_a$	$P$ (%)
Quarystone (smooth)	2	Random	1.00	38
Quarystone (rough)	2	Random	1.00	37
Quarystone (rough)	$\geq 3$	Random	1.00	40
Graded r/rap	2*	Random	N/A	37
Tetrapod	2	Random	1.04	50
Triber	2	Random	1.02	54
Triber	1	Uniform	1.13	47
Dolos	2	Random	0.94	56

\* By definition, r/rap 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	$0 \leq \%_D < 5$	$5 \leq \%_D < 10$	$10 \leq \%_D < 15$	$15 \leq \%_D < 20$	$20 \leq \%_D \leq 30$
Quarystone (smooth)	1.00	1.08	1.14	1.20	1.29
Quarystone (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





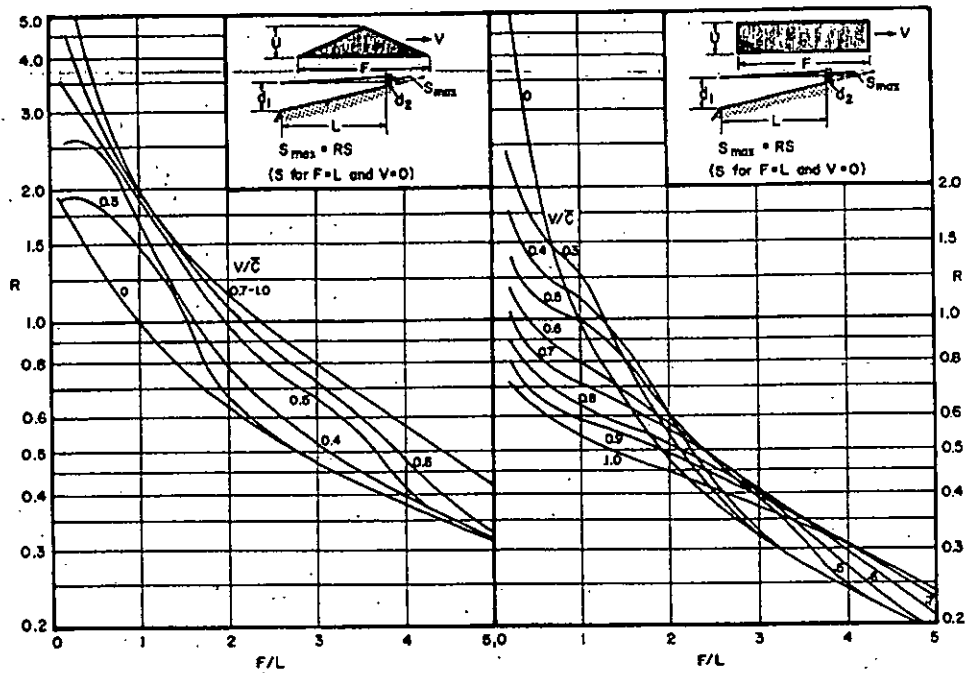


Figure-5 . Optimum surge resulting from various fetch lengths and velocities of advance.

## SECTION - B

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

5. (a) Why coastal engineering is an important subject in Bangladesh context? (5)
- (b) Define: wave height, angular frequency, wave steepness, and relative depth of wave. (10)
- (c) A wave with a period of 5 seconds is propagated shoreward over a celerity 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. (15)
6. (a) What are the basic assumptions to derive small amplitude surface wave theory? Why most of the times this theory is used in design? (15)

- (b) Discuss the phenomena of wave refraction and wave shoaling, when a wave passes from deep water to shallow water. Also explain how wave refraction and wave shoaling are considered in the design of coastal structures. (15)
- 
7. (a) Briefly explain the causes of water level variation due to tide. Define the following tidal datum and show with neat sketch: MHHS, MHW, MTL, MLW, and MLLW. (15)
- (b) Given a moving wave with a wave period of 8 sec in a water depth of 15 m has wave height of 1.50 m. Find the local horizontal and vertical velocities at a depth of  $(6 + \sin\beta)$  m below SWL when  $\theta = 2\pi x/L - 2\pi t/T = \pi/6$ . Consider  $\beta$  (degree) is the last two digits of your student number. (15)
8. (a) Show the local fluid velocities and acceleration diagram for a wave cycle in the direction of the wave propagation. (10)
- (b) Explain different types of wave breaking with neat sketches. (10)
- (c) How can you determine if a wave is in the class of (i) deep water or (ii) shallow water or (iii) transitional water? Explain. (10)

===== END =====