

**SECTION – A**

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

Assume reasonable values if any data is missing.

1. (a) From the energy balance diagram (Figure 1) of the earth compute the following: (6 1/3)
    - (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 and Bowen ratio, Net radiation (in  $\text{W/m}^2$ ) and Evaporation in mm/day.

Given, 100 units =  $342 \text{ W/m}^2$  in the Figure 1.
  - (b) Describe the role of sea water salinity and humidity on climate change. Show the variation of humidity with altitude in a qualitative diagram for the areas located near the equator and the pole. (5)
  - (c) Write short notes on escape velocity and molecular velocity. Compute the escape velocity and molecular velocity of Hydrogen in the earth. Will this gas escape from the atmosphere of the earth? (6)
  - (d) Derive the expression of latent heat flux using the concept of eddy covariance method. Also state the necessary assumptions and application of this method in climate studies. (6)
2. (a) Determine the net radiation in a semi-arid area in June, 2015 with the following data: Latitude =  $54^\circ\text{N}$ , Total sunshine hour = 330, a mean monthly daily maximum and minimum air temperature are of  $25$  and  $12^\circ\text{C}$ , 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 = 0.22, fraction of  $R_a$  reaching on the earth on clear days = 0.70. (7 1/3)

Assume reasonable values if any data is missing.
  - (b) How can climate change affect the precipitation pattern of Bangladesh? Describe briefly how can these effects be quantified? (4)
  - (c) Write down the definition of aerosol and its natural and anthropogenic sources. Describe the direct and indirect effects of aerosol on climate? (6)
  - (d) Differentiate between (i) Climatology and Meteorology; (ii) Statistical downscaling and Dynamic downscaling; (iii) latent heat flux and sensible heat flux. (5)

**WRE 431**

3. (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 30% of the incoming solar radiation is absorbed by the atmosphere and the remaining 70% 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  $\epsilon_a$  and the surface absorptivity is  $\epsilon_s$ . (6 1/3)
- (b) If the top 100 m of ocean warms by 4°C during a 3 month summer period, what is the average rate of net energy flow into the ocean during this period in units of  $W/m^2$ ? If the atmosphere warms up by 10°C during the same period, what is the average rate of net energy flow into the atmosphere? (5)
- (c) Write short note on the following (6)
- (i) Representative concentration pathways,
  - (ii) Uncertainty in a climate model prediction,
  - (iii) Uses of General Circulation Model (GCM).
- (d) (i) What is climate feedback? Briefly describe how the increase of absorbed longwave radiation acts as both positive and negative forcing of climate change. (ii) Explain the effects of land use change on albedo and climate change. (6)
4. (a) Show the component of a global climate model in a schematic diagram. (6 1/3)
- (b) At present the emission temperature of the earth is 255 K, and its albedo is 30%. How would the emission temperature change if: (5)
- (i) the albedo were reduced to 10% (an all other conditions were held fixed);
  - (ii) the infrared absorptivity of the atmosphere were doubled, but albedo remained fixed.
- Assume a single layer atmosphere which is transparent to shortwave radiation.
- (c) What are the extraterrestrial and anthropogenic sources of climate change? (6)
- (d) Write a short note on earth's orbital parameters with neat sketches. Explain how these parameters influence climate. (6)

**SECTION – B**

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

5. (a) What is Koppen Climate Classification? State its different groups, types and subtypes. (5)
- (b) How polar stratospheric cloud is related to ozone depletion? (4)
- (c) Describe the way lightning strikes. Explain Orographic Lifting. (5)
- (d) Define (i) Climate Change, (ii) Contrails, (iii) Peru Current, (iv) Arctic and Antarctic Ozone Hole. (5)
- (e) Discuss the role of CO<sub>2</sub> as Greenhouse Gas. Compare the potential global warming between CO<sub>2</sub> and CFC. (4 1/3)

**WRE 431**

6. (a) What is photochemical smog? How it causes harmful effects? (5 1/3)
- (b) Explain buffer with respect to acid rain. Also state the causes and effects if acid rain. (8)
- (c) "El-Nino episodes are linked to droughts in Indonesia and Australia" – Explain with figure. (3)
- (d) Name different cloud types along with their respective groups. Describe 'Cirrus' cloud group. (7)
  
7. (a) Describe the 1970 and 1991 cyclones in Bangladesh. Compare the losses of those to recent Cyclone 'Mora' (where maximum wind speed and surge height were 117 kph and 5 feet respectively). (3)
- (b) Define ENSO. How it is related to a notable flood in Bangladesh? Discuss the effects of other causes of that flood event. (6 1/3)
- (c) Compare the effects of different UV radiations. (3)
- (d) How CFC is related to Ozone Depletion? (5)
- (e) Briefly describe the locations, controlling factors and distinguishing characteristics of (i) Subarctic with cold winters (Dwd), (ii) Humid continental hot summer (Dfa) and (iii) Highland Climate. (6)
  
8. (a) What is paleoclimatology? Describe the circulation by "the great ocean conveyor". (4 1/3)
- (b) Briefly explain the southwest monsoon. (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. (5)
- (f) Discuss the causes and potential impacts (with respect to Bangladesh) of sea level rise. (3)

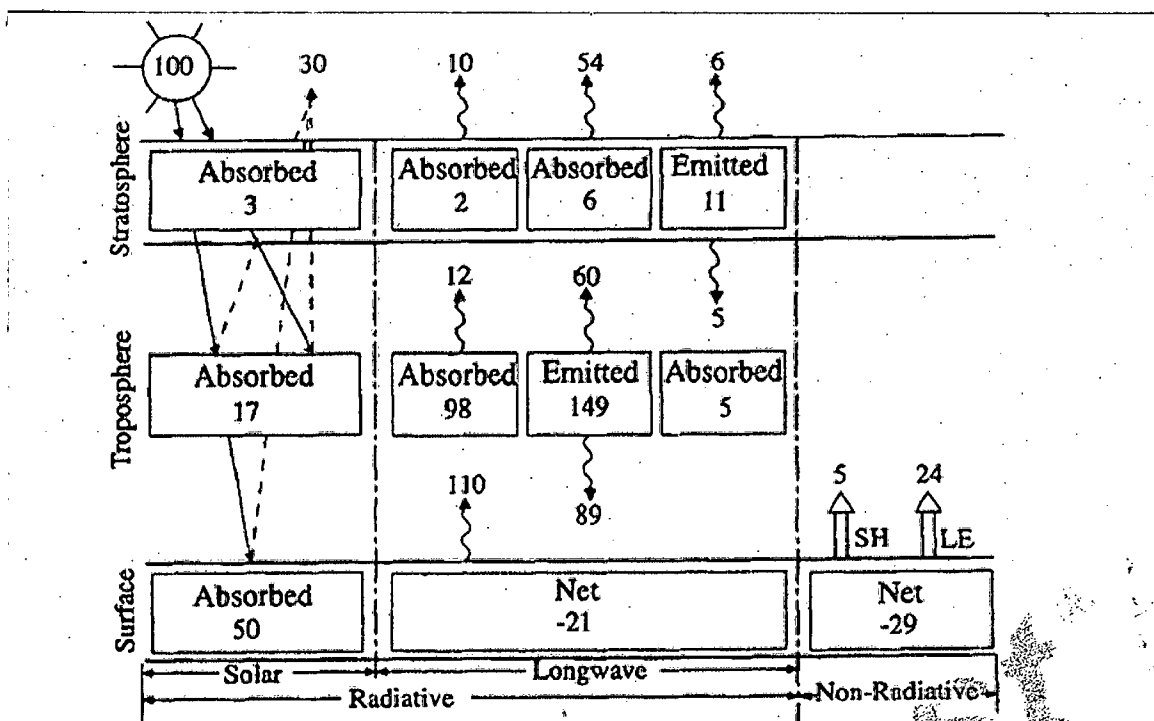


Fig. 1 Radiative and nonradiative energy flow diagram for Earth and its atmosphere. Units are percentages of the global-mean insolation (100 units =  $342 \text{ W m}^{-2}$ ).

**SECTION – A**

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

1. (a) Define hydraulic structures. What are the major characteristics of hydraulic structures? (7)

(b) 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. Calculate the required storage capacity of the reservoir. Assume pan evaporation coefficient 0.75 and 28% of the rainfall on the land area to be flooded by the reservoir has reached the stream in the past. (15)

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

(c) Show with neat sketches the various storage zones of a dam reservoir. Define each zone with respect to the diagram. (13)

2. (a) What is Capacity-Elevation and Area-Elevation curve for reservoir? Describe good and bad Capacity-Elevation curve for reservoir. (6)

(b) What are the factors of site selection need to be considered during construction of a reservoir for a dam? (6)

(c) Figure 1 shows the section of a non-overflow portion of a gravity dam built of concrete. Neglecting the earth quake effects, check the stability of the dam against principal and shear stresses near toe. Assume the unit weight of concrete as  $23.5 \text{ KN/m}^3$  and allowable stress in concrete is  $2500 \text{ KN/m}^2$ . Assume any reasonable value of any other data if required. (23)

WRE435

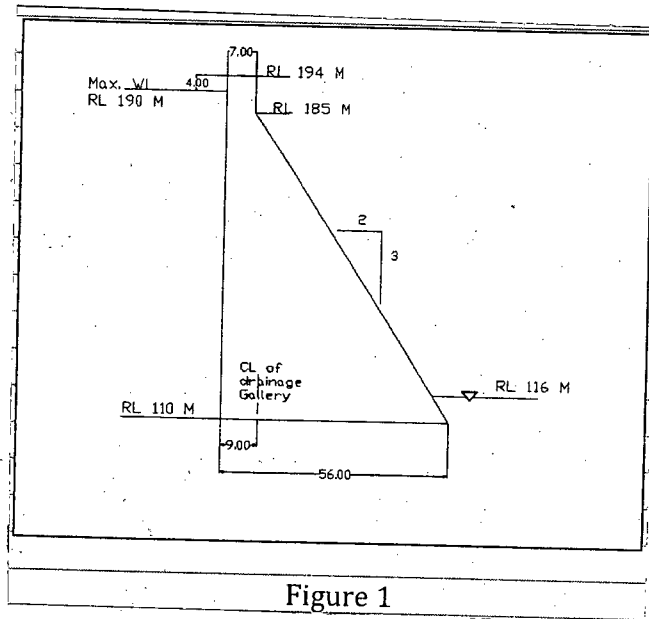


Figure 1

3. (a) Write short notes on (16)
- (i) Dependable yield
  - (ii) Overturning of dam from toe
  - (iii) Shear failure of dam
  - (iv) Radial gate of spillway
- (b) "A tension crack by itself does not fail the structure, but it leads to the failure of the structure by producing excessive compressive stress"- Justify this statement in context to concrete gravity dam design. (6)
- (c) Explain the effects of (i) uplift pressure and (ii) wave pressure on a gravity dam. (8)
- (d) List the names of energy dissipation devices used to dissipate excess energy of water based on  $Y_2$  curve and tail water level. (5)
4. (a) With neat sketches show the plan/section of chute spillway, side channel spillway, shaft spillway and siphon spillway. (12)
- (b) Design an ogee spillway for concrete gravity dam with following data. (23)
- Average river bed level = 250.0 m  
 R.L. of spillway crest = 350.0 m  
 Slope of d/s face of gravity dam = 0.75 H: 1 V  
 Design discharge = 6500 cumecs  
 Length of spillway = 5 spans with a clear width of 7 m each  
 Thickness of each pier = 2.0 m  
 Consider  $K_p = 0.01$  and  $K_a = 0.1$

**SECTION-B**

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

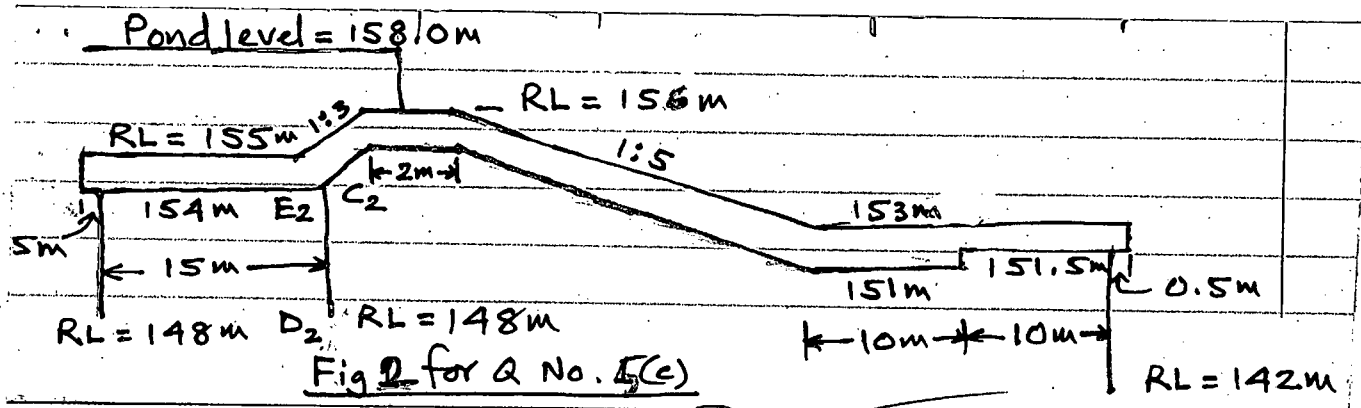
5. (a) Compare Khosla's theory with Bligh's creep theory for seepage below a hydraulic structure. (8)

**WRE435**

**Contd... Q. No. 5**

(b) What is meant by critical exit gradient? Show that the critical exit gradient for most of river sands is unity. (7)

(c) Determine the percentage uplift pressure at  $E_2$  and  $C_2$  for the structure shown in Fig.2 using Khosla's theory and apply necessary corrections. The correction factor for 1:3 slopes is 4.5. (20)



6. (a) Explain the terms (i) afflux, (ii) retrogression. (4)

(b) Why are protection works required for weirs? Describe their design procedure. (8)

(c) A barrage is to be constructed on an alluvial river having a flood discharge of 8500 m<sup>3</sup>/s. The relevant data are as follows: (23)

- Average river bed level = 202.0 m
- HFL (before construction of barrage) = 207.3 m
- Permissible afflux = 1.0 m
- Lacy's silt factor = 1.0

Determine (i) the crest levels of under sluices and barrage bays, (ii) the water way to pass the flood discharge, (iii) downstream floor level for under-sluices portion considering a retrogression of 0.5m and 20% discharge concentration.

7. (a) Give a comparison between a silt excluder and a silt ejector. Briefly describe the design considerations for a silt excluder. (10)

(b) Write short notes on (i) uplift pressures in jump trough of a weir, (ii) design of weir floor thickness. (10)

(c) A head regulator is to be designed with the following data: (15)

- Full supply discharge of canal = 180 m<sup>3</sup>/s
- FSL of canal = 203.0 m
- Crest level of under sluices = 200.5 m
- Pond level = 204.0 m
- u/s HFL = 207.0 m

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

**WRE435**

8. What are the different types of cross-drainage works? State the conditions under which each one is used. (7)

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

(c) A syphon aqueduct is to be designed for the following situation: (22)

Canal:

- Full supply discharge =  $30 \text{ m}^3/\text{s}$
- Full supply level =  $201.8 \text{ m}$
- Bed level =  $200.0 \text{ m}$
- Bed width =  $25 \text{ m}$
- Side slope =  $1:1.5 \text{ (V:H)}$

Drainage:

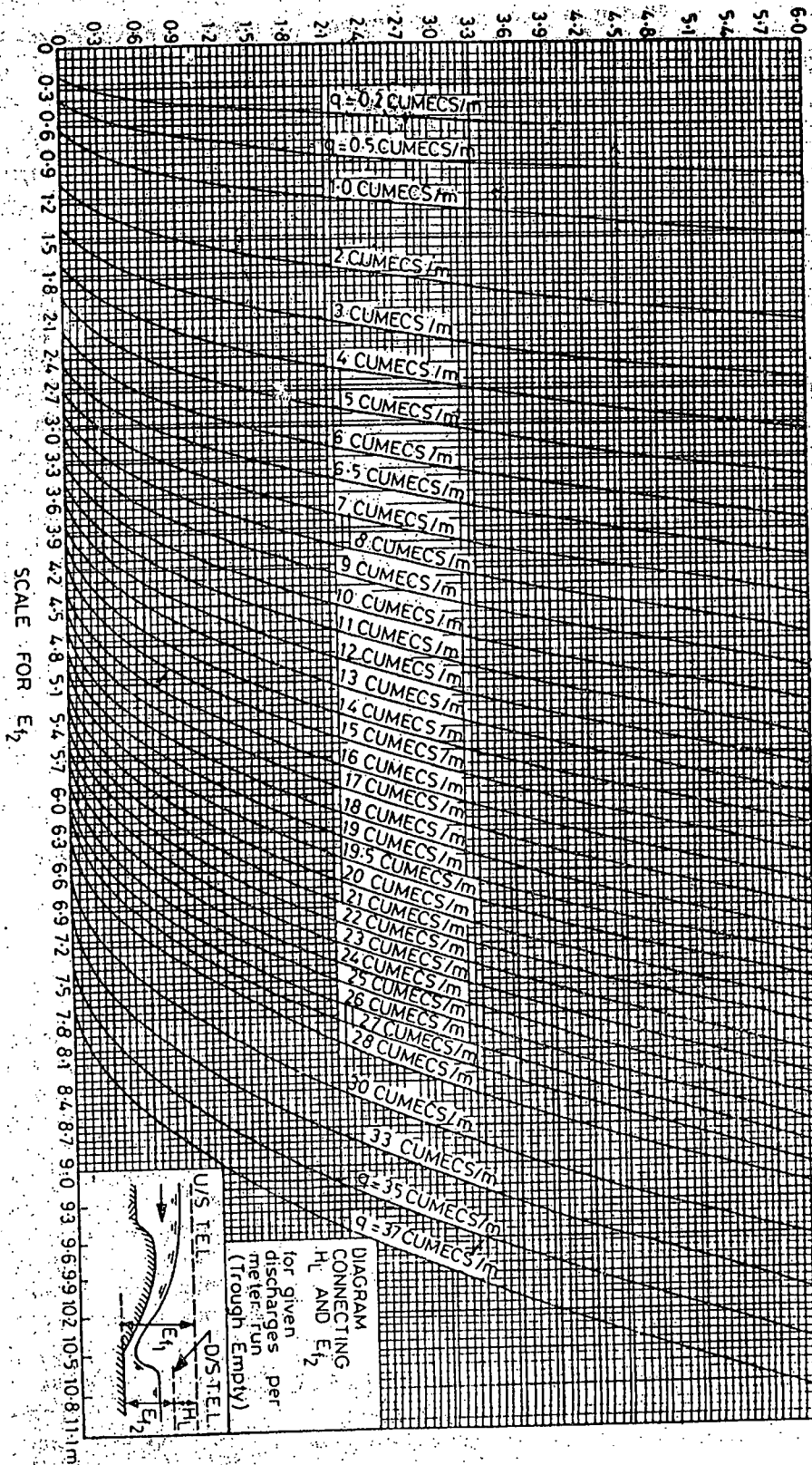
- High flood discharge =  $450 \text{ m}^3/\text{s}$
- High flood level =  $200.5 \text{ m}$
- Bed level =  $198.0 \text{ m}$

Design: (i) Drainage waterway, (ii) canal water way including bed levels at different sections, (iii) transition.

Assume reasonable values for other data if needed.

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SCALE FOR  $H_L$



For Q.No. 6(c)

WRE 435

5 =



**SECTION – A**

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

Assume reasonable values if data is not given.

1. (a) What are the uses of river? “Rive water has to be utilized as major source of water supply for urban areas”? Justify your answer. (5)
- (b) Derive the expression for the variation of shear stress along the depth of flow. (10)
- (c) Sketch and name the various types of scour. Calculate the total scour (constriction and local) for a bridge for following data: (20)
  - Discharge  $Q = 10000 \text{ m}^3/\text{s}$ ,
  - No. of pier = 6 of each of 2.0 m wide,
  - Bed martial size = 0.15 mm
  - R.L. of river bed = – 1.5
  - High Water Level = 4.5 m.
2. (a) Enumerate the cause of river bank failure with special referenced to Bangladesh. (10)
- (b) Discuss the objectives and importance of river training works. What are the typical river training structures used in alluvial streams? (10)
- (c) Draw a typical river bank protection revetment works and level its various components. If the flow velocity is 4.6 m/s and discharge is  $76000 \text{ m}^3/\text{s}$  calculate the nominal size of cover layer due to current action. Assume reasonable data if not given. (15)
3. (a) Sketch a conceptual model describe the morphological evolution of channel types indicating the condition of dominant variables. (15)
- (b) The following hydraulic data pertains to a bridge site at Bhairabbazar of Meghna River. (15)
  - 100 year flood discharge =  $18000 \text{ m}^3/\text{s}$ .
  - 100 year HFL = 7.89 m PWD
  - River bed level = –12.50 m PWD
  - Average dia of bed material = 0.052 mm.

Design and sketch a Guide bank required to train the river at bridge site.
- (c) What are the various sediment loads in river stream? How sediment flow rate can be estimated in a river? (5)

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- 4. (a) Write the causes of the deterioration of water ways. How these routes can be improved? (10)
- (b) Classify the waterway routes according to BIWTA and give examples of each route. (10)
- (c) How the dredging depth can be design for the improvement of a navigation channel? Answer with sketches. (15)

**SECTION – B**

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

- 5. (a) What are the different types of flood in Bangladesh? Describe the main causes of flood in Bangladesh. (11)
  - (b) What are the general deign consideration of designing an earthen dam/levee? Explain why pore water pressure is important in designing earthen dams/levees? (12)
  - (c) Under your consideration, which flood control measure or combination of measures would be the most suitable in case of Bangladesh? Justify your answer. (12)
  
  - 6. (a) What do you mean by flood resilience? How flood resilience of a community can be increased? (11)
  - (b) Elaborate different types of flood diversion and flood proofing methods to reduce flood damages. (12)
  - (c) Discuss how channel improvement and watershed management can reduce flood damages? (12)
  
  - 7. (a) Distinguish between “Risk” and “Vulnerability”. What are the significances of flood risk mapping in terms of flood mitigation measures? (11)
  - (b) What is flood hazard? Describe different factors affecting flood hazard. How a flood hazard map can be prepared? (12)
  - (c) What are the direct and indirect damages of flood? Discuss different ways to measure flood damages? (12)
  
  - 8. (a) What are the different ways to develop a flood inundation map. Write down the advantages and limitations of each individual method. (11)
  - (b) Distinguish between flood water and storm water. What are the main causes and impacts of urban flood? (12)
  - (c) What are the challenges in developing an accurate flood forecasting model? Describe the different components of a flood forecasting model? (12)
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BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2015-2016

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

Full Marks: 210

Time : 3 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) Define Profession. Write down the characteristics of professional conduct. (6)  
 (b) Write the importance of human resources management in professional practice. (6)  
 (c) What is peer review? Write down the characteristics of peer reviews. (6)  
 (d) Discuss the considerations of professionals under the guideline for professional practice. (17)
2. (a) Why is the 'Statement of purpose' important in effective management of professional practice? (6)  
 (b) Discuss briefly the components for the management of technical quality of professionals. (6)  
 (c) List the importance of effective communication for Engineers. (6)  
 (d) "*Professional engineers shall undertake only work that they are competent to perform by virtue of their training and experience*" – Discuss this statement. (17)
3. (a) Why is it important for Engineer to be involved in Professional and technical societies? (6)  
 (b) What are the different functions of Engineering? (6)  
 (c) Write down the typical format of an undergraduate thesis. (6)  
 (d) Discuss how Professional Engineers can uphold and enhance the honour, dignity, and reputation of their profession. (17)
4. (a) What is a contract? Discuss briefly different elements that constitute a contract. (12)  
 (b) Discuss different types of contract used for engineering works. (12)  
 (c) "Reysona Software Ltd. sets up a computer system in its home office and purchases appropriate software packages for its business operation. Frank Ness, P.Eng., hold 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 Reysona'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.

## WRE 421

### Contd... Q. No. 4(c)

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 Reysona sues Frank for damages." (11)

Has Frank Ness acted ethically towards Reysona 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?

### SECTION-B

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

5. (a) Define procurement. Briefly explain various procurement categories with examples. (10)  
(b) Make a comparative analysis among different procurement methods. (20)  
(c) What are the components of tender document? (5)
  
  6. (a) Define specification and write down its importance related to contract. Mention salient features of a well-written specification. (15)  
(b) Mention the general requirements of specification. List the item that may cover the typical specification for excavation and earth work. (10)  
(c) Write a short note on Bill of Quantities. (10)
  
  7. (a) Briefly describe the subjects responsible for contractual problems. (15)  
(b) What are the methods to select consultants and contractors? Mention the salient features of negotiated tending. (10)  
(c) Explain the necessity of feasibility study. Briefly describe different types of it. (10)
  
  8. (a) Define claim. What are the types of claim? How a contractor should proceed to make a claim. (15)  
(b) Write down the names of the documents needed to form the basis of the claim and evidence in support of it. (10)  
(c) Describe possible ways to settle down the contractual problems. (10)
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**SECTION – A**

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

1. (a) Why it is necessary to develop the coastal areas of a country? List up the different Coastal system. (6)
- (b) Illustrate the why, where and how aspects of the scientific base and scientific knowledge of "Coastal Engineering". (7)
- (c) "The Nation's stake in the uses of the sea is synonymous with the promise and the threat of tomorrow" - explain. (6)
- (d) Primary coasts are shaped primarily by non-marine processes - List up the major types of primary coasts. (10)
- (e) Draw a typical coastal beach profile and identify all the zones. (6)
2. (a) Define: (i) Wave height, (ii) Relative depth, (iii) Regular waves, and (iv) Shallow water wave. (10)
- (b) What are the assumptions to derive "Small amplitude surface wave" theory? Among the assumptions some are essential and some can be relaxed - explain. (7)
- (c) A wave with a period of 5 seconds is propagated shoreward over a uniformly sloping shelf from a depth of 480.0 m to a depth of 4.5 m. Find the wave celerity and wave length at depth of (a) 480.0 m, and (b) 4.5 m. (6)
- (d) Name the equation  $C = \sqrt{\left(\frac{gL}{2\pi}\right) \tanh \frac{2\pi d}{L}}$ , what is the significance of this equation in water wave theory? (6)
- (e) Show the changes in value of (kd) and tanh(kd) when a wave travels from deep water through transitional water to the shallow water.
3. (a) Draw the local fluid velocities and acceleration diagram for one water wave in the direction of the propagation of the wave. (6)
- (b) Define sub-surface pressure. Both the static and dynamic component of pressure has contribution in the total pressure, show with the equation and figure. (4)

**WRE 437**

**Contd ... Q. No. 3**

- (c) List up the factors effecting 'sea level rise' and 'tsunamis'. (8)
- (d) Write short notes on the following terms: (i) Wave refraction, (ii) Wave set up, and (iii) Wave breaking (9)
- (e) Given a wave with a period  $T = 6$  sec in water depth  $d = 20$  m and wave height 1.25 m. Fine the local horizontal and vertical velocities at a depth of 5 m below SWL when  $\theta = 2\pi x/L - 2\pi t/T = \pi/6$ . (8)
4. (a) Draw the Miniken wave pressure diagram for breaking wave forces in a vertical wall. (5)
- (b) Derive the equation for wave forces in an inclined wall (inclination with horizontal  $\theta$ ), when the waves approaches with an angle ( $\alpha$ ) with the shore line. (5)
- (c) What are the significance of an estuary? Define estuary based on tidal range and water circulation processes. (10)
- (d) Write down the classification of wave forces based on the type of wave action and by the type of the structure. (5)
- (e) Find the non breaking wave force and moments against a completely reflecting vertical wall ( $\chi = 1.0$ ) resulting from the wave condition given below: (10)
- (i) Wave height at the structure if the structure were not there  $H_i = 2.05$  m.
- (ii) depth at structure  $d = 4.10$  m
- (iii) the wave period considered in the design is  $T = 6.0$  sec
- Figure 1, Figure 2 and Figure 3 are attached for relevant uses.

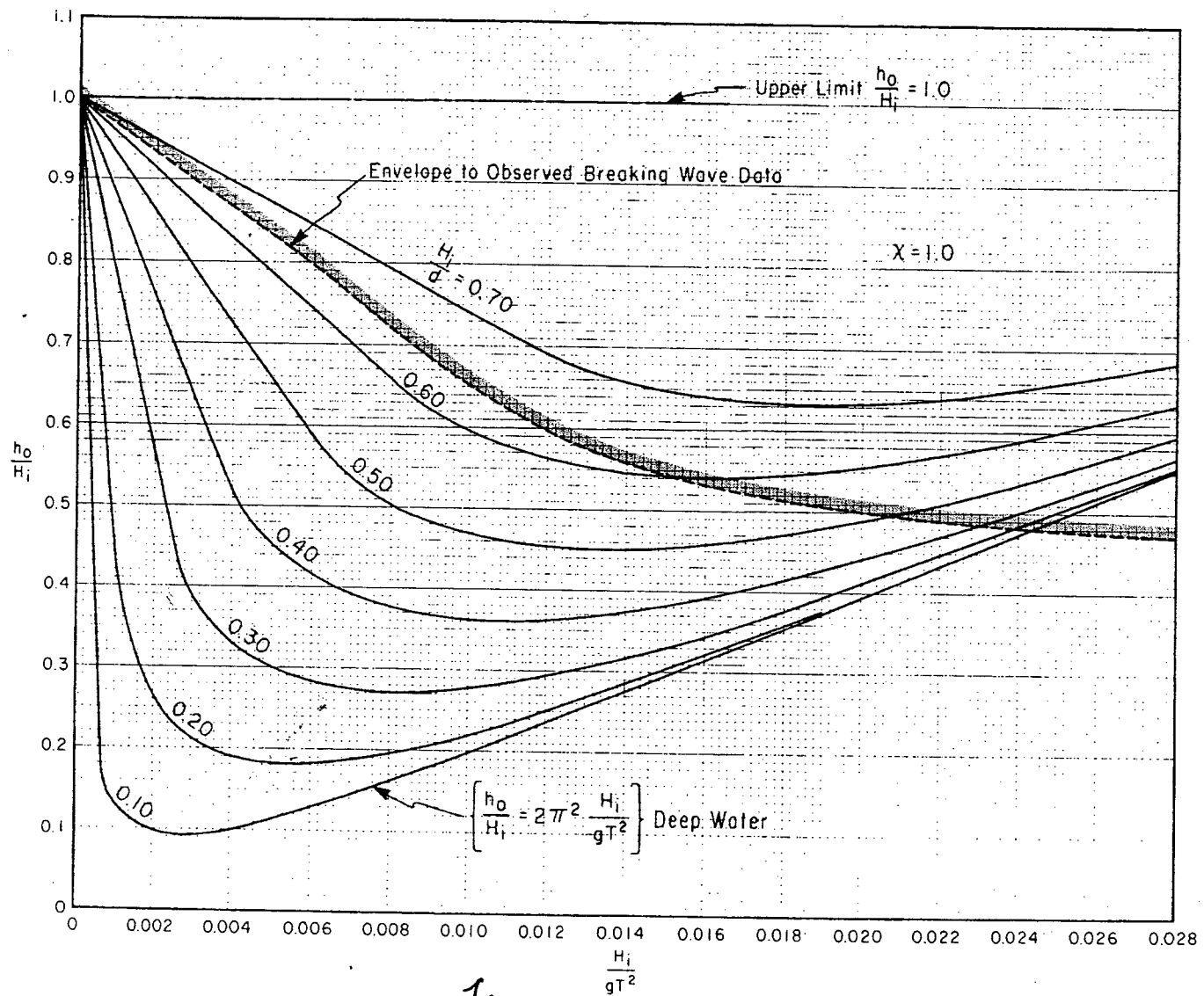
**SECTION – B**

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

5. (a) Define the flowing terms: Indian standard Low Water, Height of the tide, Tidal constituents, mean tide level, Harbour of refuge. (7)
- (b) Explain (i) Tide prediction by harmonic constants, (ii) Tide measurement methods. (7+7)
- (c) Define various elements of a harbor and show them with near sketches in a layout plan. (14)
6. (a) Briefly explain few major tsunamis generated by earthquake. (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 continental shelf for static wind field. (4+10)
- (c) Explain (i) Mitigation the risk and hazards of a tsunami , (ii) Pacific Tsunami Warning System. (7+7)

**WRE 437**

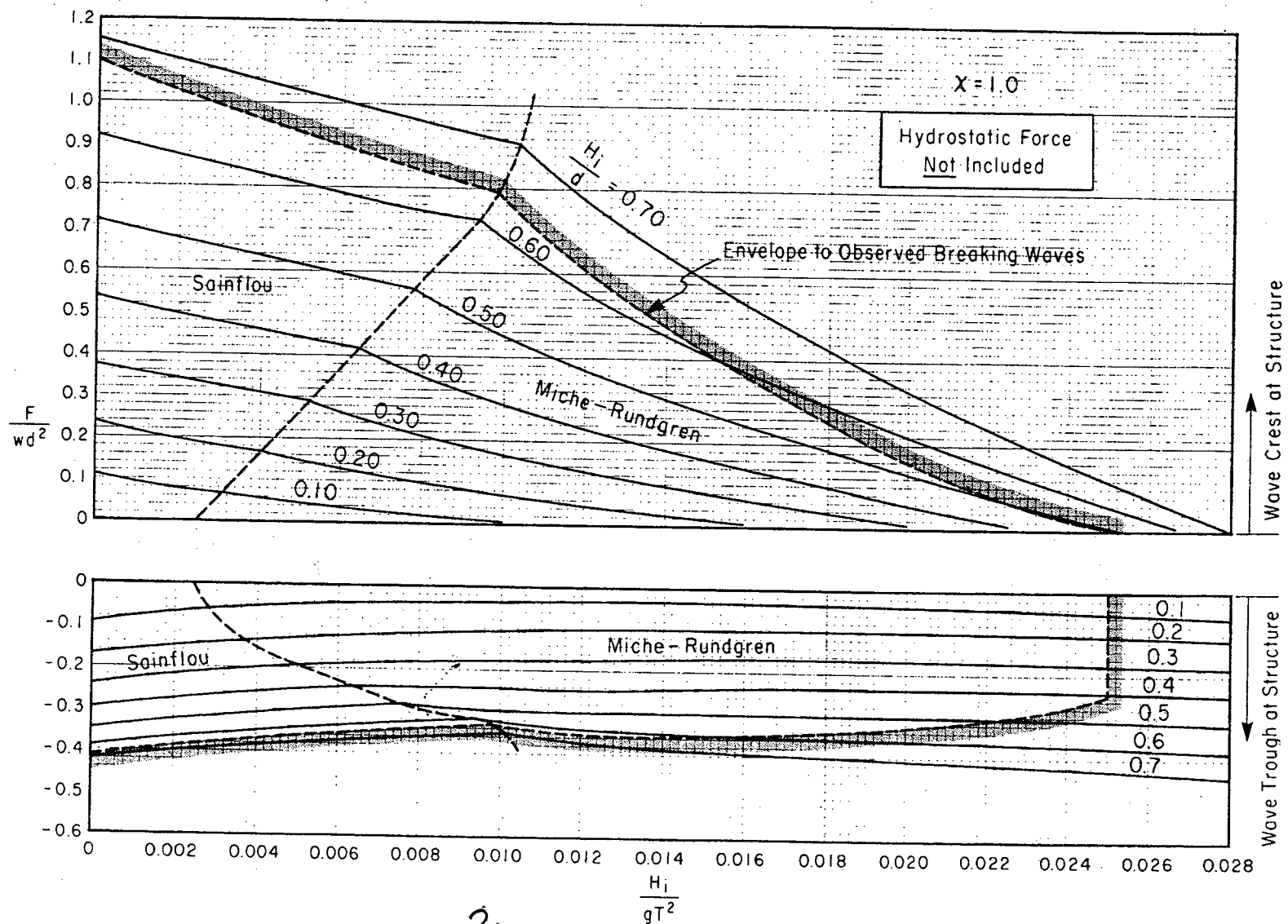
7. (a) Explain the coastal structures (i) submerged sill, (ii) storm surge barrier in context to their physical and functional characteristics.
- (b) With neat sketches show the section of (i) sloping front revetment/sea wall with fixed surfaces of asphalt and in situ cast concrete, (ii) sloping front revetment design from Danish North Sea Coast, (iii) Grass armored sea dike in Danish North Sea Coast. **(14)**
- (c) Name different types of Massive, Bulky, Slender and Multi-hole concrete armor units used in coastal structures. Describe Rubble Mound breakwater with necessary sketches. **(6+8)**
8. (a) Write down the tidal characteristics of Bangladesh. Explain the design of revetment toe protection. **(7+8)**
- (b) In context to design of various coastal structures, explain the following parameters (i) Armor unit stability, (ii) Wave Runup, (iii) Wave height, (iv) Filter, (v) Forces of breaking wave. **(20)**
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1.  
Figure 1. Nonbreaking waves;  $\chi = 1.0$ .

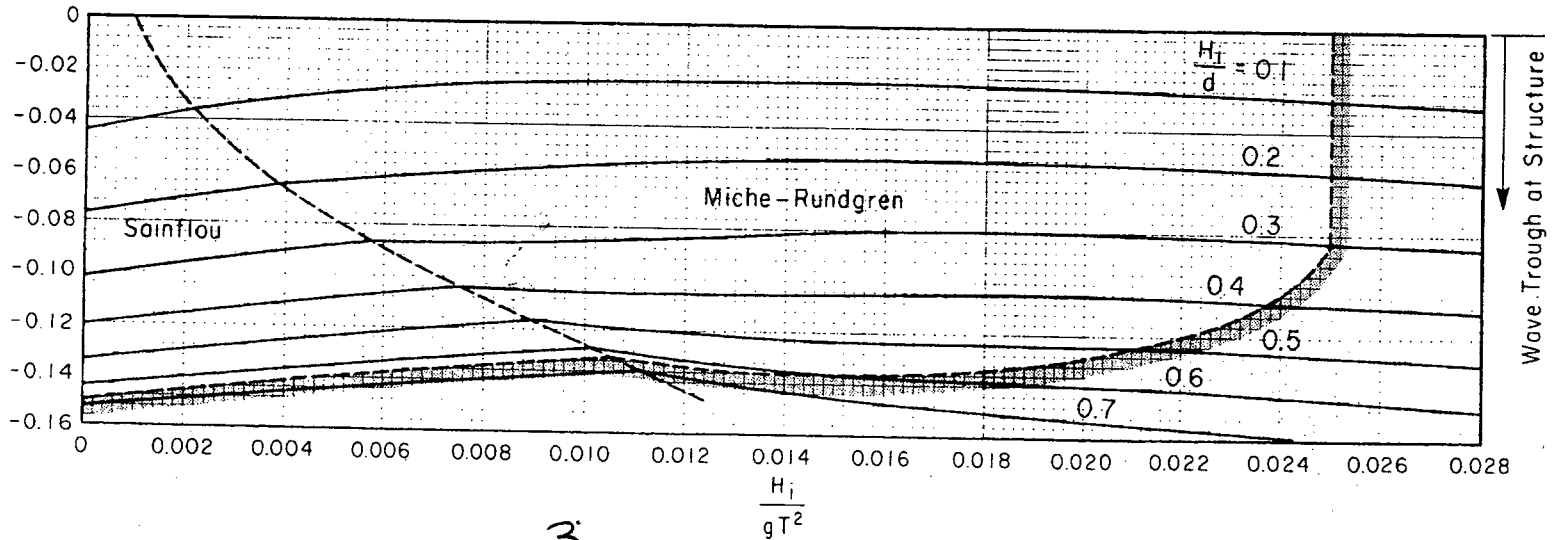
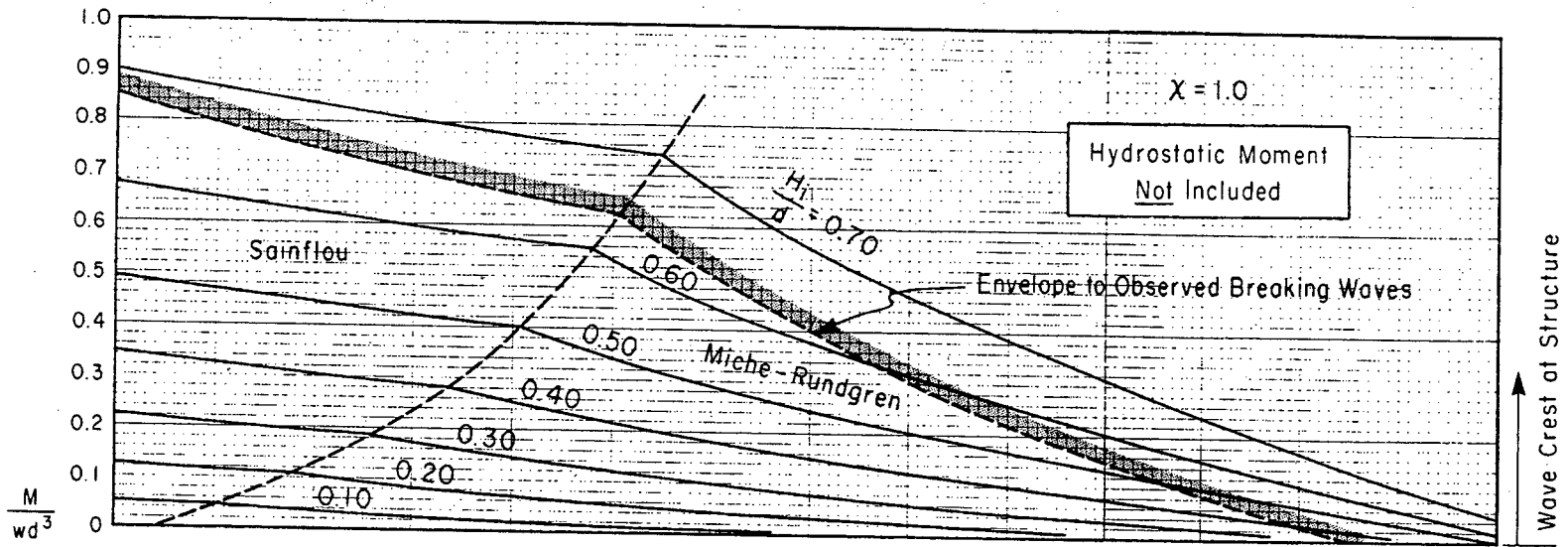
4=





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

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3.  
 Figure 3-22. Nonbreaking wave moment;  $\chi = 1.0$ .