

BE (CIVIL ENGINEERING) THIRD Year SECOND SEMESTER EXAMINATION 2018

(1st/2nd Semester/Repeat/Supplementary /Spl. Supplementary /Old/Annual/Bi-Annual)

SUBJECT: HYDRAULIC STRUCTURES

Time: Three hours

Full Marks 100

Use a separate Answer-Script for each part

No. of Question	Part -I (35 Marks)	Marks
	<i>Attempt all questions</i> <i>Assume reasonable values of data, if not supplied</i>	
Q.1((a)	Illustrate the functions of a 'Diversion Head work and indicate its components with the help of a neat sketch.	4+4=8
(b)	Illustrate the functions of a 'Divide Wall" and also state its design considerations	7
Q.2	An impervious floor of a dam is 25m long with sheet piles at both ends. Upstream head is 4.0m above the base of the dam and downstream head is at the base. The upstream pile is 4.5 m deep and downstream pile is 7.5m deep. Find uplift pressure and floor thickness at 5.0m, 10m, 15m and 20m from the upstream pile line. Use both Bligh's and Lane's methods and compare the results. Given that the dam is built on fine sand for $C = 15$ (Bligh) and $C = 8.5$ (Lane). Compare the results obtained by the two methods.	10
Q.3	A gravity dam 10m high is trapezoidal in section with top with of 1.0m and bottom width of 9.0m. Find out factor of safety against overturning. Take weight of masonry = 2200 kg/m^3 . Upstream Head=8m, Downstream head=2m	10

BACHELOR OF CIVIL ENGINEERING EXAMINATION 2018
(Third Year; Second Semester)

Ref. No. Ex/CE

HYDRAULIC STRUCTURES

Time: Three Hours

Full I

Part I: 3
Part II: 3
Part III: 3

Use a separate Answer-Script for each part

No. of questions	Part II (35 Marks)
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Answer Question 1 as COMPULSORY and ANY ONE Question from 2, 3 & 4, in this part.
Assume suitable values for the parameters if not supplied.

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|-----------------------------------|--|------------------|-------|-------|-------|-------|-----|-----|-----------------------------------|-------|-------|-------|-------|-------|-------|
| 1 | Derive the expression of 'Initial Depth' in 'Hydraulic Jump', using momentum formula for horizontal bed. Also explain the impact on 'Hydraulic Jump', if the bed is inclined. | | | | | | | | | | | | | | |
| 2 | <p>(a) What are the factors, which affect the design of spillway? What are the factors that affect the value of Coefficient of discharge? Explain briefly.</p> <p>(b) What are the major components of spillway? Make a list of different types of spillway.</p> <p>(c) An overflow ogee spillway of height 13m is discharging water with a head of 2 m over the crest. A reverse curvature of radius 4.5 m, subtending an angle of 60° at the centre, is provided at the spillway bottom. Assuming the discharge coefficient for the spillway as 2.2, determine the magnitude and direction of the dynamic force on the reversed curved portion of the spillway.</p> | | | | | | | | | | | | | | |
| 3 | <p>(a) Define 'Freeboard' for Hydraulic Structures. Also define 'Fetch' and 'Effective Fetch'. How do you estimate 'Effective Fetch'? Explain Briefly.</p> <p>(b) Compute 'Freeboard and the top elevation of the dam for the following details:
 Full reservoir level = 335.00m; Maximum water level = 337.20m
 Effective fetch: For normal freeboard = 3.66km & minimum freeboard = 4.00km
 Wind velocity over land for normal freeboard = 160km/hr
 Average depth of reservoir: For normal freeboard = 29.0m & minimum freeboard = 31.2m.
 Embankment slope = 2.25(H):1(V) along with the following coefficients:</p> <ul style="list-style-type: none"> • The upstream face surface roughness = 0.75 • The ratio of wind velocity over water surface to the wind velocity over land surface for effective fetch 2 and 4 as 1.16 and 1.24 respectively • Variation of the Relative Run-up (R/H₀) against Embankment Slope is as follows: <table border="1" style="margin-left: 20px;"> <tr> <td>Embankment slope</td> <td>0.1</td> <td>0.2</td> <td>0.3</td> <td>0.4</td> <td>0.5</td> <td>0.6</td> </tr> <tr> <td>Relative Run-up, R/H₀</td> <td>0.368</td> <td>0.752</td> <td>1.200</td> <td>1.600</td> <td>1.968</td> <td>2.272</td> </tr> </table> | Embankment slope | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | Relative Run-up, R/H ₀ | 0.368 | 0.752 | 1.200 | 1.600 | 1.968 | 2.272 |
| Embankment slope | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | | | | | | | | | |
| Relative Run-up, R/H ₀ | 0.368 | 0.752 | 1.200 | 1.600 | 1.968 | 2.272 | | | | | | | | | |
| 4 | <p>(a) Write and explain the Laplacian equation regarding two-dimensional seepage. What are the assumptions for developing the 'Laplacian Equation' regarding seepage flow?</p> <p>(b) Define 'Isotropic Soil'. Write down the steps and derive the equation for determination of seepage discharge through 'Isotropic Soil'; also write down the equation for the same through 'Non-Isotropic Soil'.</p> <p>(c) What is 'Phreatic Line'? Determine the phreatic line, graphically, for the earth dam (details given below) with a horizontal filter of length equal to 25m, provided inward from the downstream toe of the dam, also determine the discharge passing through the dam. The earth dam made of homogeneous and isotropic soil, which have the following details:
 Coefficient of permeability of dam material = 5×10⁻⁴ cm/sec; Level of top of dam= 200.0m;
 Level of deepest river bed = 178.0m; H.F.L. of reservoir= 197.5m; Width of the top of dam= 4.5m
 U/s Slope= 3(H):1(V); D/s Slope= 2(H):1(V)</p> | | | | | | | | | | | | | | |

**B.E. CIVIL ENGINEERING THIRD YEAR
SECOND SEMESTER EXAM 2018**

~~(1st/2nd Semester/Repeat/Supplementary/Spl. Supplementary/Old/Annual/Bi-Annual)~~

SUBJECT: HYDRAULIC STRUCTURE

(Name in full)

PAPER XXXX

Time: ~~Two hours/ Three hours/Four hours/Six hours~~

Full Marks ~~30/100~~

(15/30 marks for this part)

Use a separate Answer-Script for each part

No. of Question	Part - III	Marks
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- *Maintain neatness.*
- *Assume reasonable data if required and if it is not supplied.*



- All drawings-must be drawn by pencil
- No Code will be allowed with the students to answer the questions

(1)(a) What are the requirements of a harbour? Classify harbours with a tree structure. 3+2+(2×5)

Briefly write short note on any two:

- (i) Natural Harbours,
- (ii) Commercial Harbours,
- (iii) Fishery Harbours,
- (iv) Semi natural Harbours,
- (v) Artificial roadsteads.

(b) What are the usual defects which are noticed in the construction of many harbours? 5

Or

Name the main functions which are likely to be carried out by an ideal port authority.

(c) Discuss very briefly on some of the recent trends in water transportation. 5

(d) What are the drawbacks of water transportation? 5

Or

What are the advantages of water transportation?

End of the Question