

**BACHELOR OF CIVIL ENGINEERING (EVENING) EXAMINATION 2018 (Old)**

(Fifth Year; Second Semester, Old)

**HYDRAULIC STRUCTURES**

Time: Three Hours

Full Marks 100  
(50 marks for each part)*Use a separate Answer-Script for each part*

No. of questions	Part I (50 Marks)	Marks
<p><i>Answer ANY TWO questions from this part. Assume suitable values for the parameters if not supplied.</i></p>		
1	(a) What is spillway? What is dynamic force of spillway? What are the factors, which affect the design of spillway?	2+2+4=8
	(b) What are the major components of spillway? What are the factors, which affect the coefficient of discharge over spillway?	1+3=4
	(c) An overflow ogee spillway of height 13m is discharging water with a head of 2m over the crest. A reverse curvature of radius 4m, 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.	13
2	(a) What is 'Hydraulic Jump'? Explain briefly. What is advantage of 'Hydraulic Jump'? What are the different depths in 'Hydraulic Jump'?	2+3+2=7
	(b) Write down the assumptions made in the momentum formula for 'Hydraulic Jump'? Discuss the effect of inclined bed, in the change in momentum for 'Hydraulic Jump'.	3+3=6
	(c) Derive the expression for 'Sequent Depth' in 'Hydraulic Jump', through momentum formula.	12
3	(a) Write and explain the Laplacian equation regarding two-dimensional seepage. What are the assumptions for developing the 'Laplacian Equation' regarding seepage flow?	2+5=7
	(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'.	1+6+1=8
	(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 = $5 \times 10^{-4}$ 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)	2+8=10

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No. of questions	Part-II	Marks
<p><i>Answering of Question no. 1 is mandatory and any two questions from remaining three. Assume reasonable values of data, if not supplied.</i></p>		
1	<p>(i) Write the points that have to be kept in mind during selection for port location.</p> <p>(ii) How will you select the scour depth?</p> <p>(iii) What is Mass Curve and how it is used?</p> <p>(iv) What are function of Marginal Bund and Guide Bank?</p> <p>(v) Write down the function of divide wall of a barrage.</p> <p>(vi) What are forces (Major &amp; Minor) those are considered for stability analysis of gravity dams in full reservoir condition?</p>	3 2 2 3 2 2
2.	<p>Fig. 1 shows the sectional elevation of a concrete gravity dam. Calculate without considering earthquake forces (a) the maximum vertical stresses at the heel and toe; (b) the major principal stress at toe and (c) the intensity of shear stress on a horizontal plane near toe of the dam.</p>	8+8+2
<div style="text-align: center;"> <p>Fig. 1 Cross section of a gravity dam</p> </div>		

Ref. No. Ex/CE/S/T/507/2018(Old)

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No. of questions	Part- <b>II</b>	Marks
3. (i)	Draw a beach profile upto offshore showing all features and elevation.	4
(ii)	Explain the function of jetties with figure. Write about different types of important jetties with figure and brief description.	10
(iii)	What is dock? What are advantages of wet docks.	4
4.		
(i)	Draw a typical layout of canal head regulator with proper location.	3
(ii)	What is Nodal point and why it is important for section of barrage axis of an alluvial river.	4
(iii)	Write the steps for planning, layout, design, construction and operation of barrage.	10
(iv)	What is the minimum height of freeboard for a barrage?	1