Ref. No. Ex/CE/T/422/2018 (Old)

BACHELOR OF CIVIL ENGINEERING EXAMINATION 2018 (Old)

(Fourth 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
		*Answer any **TWO** questions from Part II.* *Assume suitable values for the parameters if not supplied.*	
1	(a)	What is 'Canal Fall' structure? What is the necessity of the same?	2+3=5
	(b)	Design and provide a neat sketch of a siphon type well drop canal fall structure for the following design data: Fall = 4.0m General ground level = +160.36m RL Full supply depth = 75cm Bed level at u/s = +159.83m RL Discharge = 1.2 Cumecs Bed width = 2.4m Assume Darcy's Coefficient of friction 0.012 and Length of the pipe 12m.	15+5=20
2	(a)	Write the expression of 'Froude Number'. Derive the expression for critical depth of flow. What are the advantages of 'hydraulic jump'?	1+2+2=5
	(b)	What are the assumptions made in the momentum formula for 'Hydraulic Jump'? Discuss the effect of inclined bed, on the depth estimating equation of 'Hydraulic Jump', derived for horizontal bed. What would be the type of hydraulic jump in case of critical flow?	3+3+1=7
	(c)	Derive the expression of 'loss of energy' due to 'Hydraulic Jump', using momentum formula for horizontal bed.	13
3	(a)	Define 'Freeboard' for Hydraulic Structures. Also define 'Fetch' and 'Effective Fetch'. How do you estimate 'Effective Fetch'? Explain Briefly.	2+3+5=10
	(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: • 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/H_0) against Embankment Slope is as follows:	15

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

Form A: Paper-setting Blank

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B.E.CIVIL ENGG FOURTH YEAR SECOND SEMESTER (OLD) 2018

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

SUBJECT: HYDRAULIC STRUCTURES

(Name in full)

Time: ~~Two hours~~/ Three hours/~~Four hours/Six hours~~ **Full Marks ~~30~~/100**

(~~15~~/50 marks for each part)

Use a separate Answer-Script for each part

1. Answer ANY TWO questions.
2. Assume reasonable values of data if not supplied.
3. No code etc. will be needed to answer the questions of this part

Part –II

No. of Question			Marks
Q.1	a)	Differentiate between natural and artificial harbours.	5
	b)	Illustrate classification of harbour according to its utilitiies	5
	c)	A masonry dam, 12m high, is trapezoidal in section with a top width of 1m 9m. The face exposed to water has a batter of 1H:12V. Test the stability of the dam for water thrust, self weight and uplift. Also find the hydrodynamic force on upstream face of the dam by any suitable method.	8+7=15
Q.2	a)	At which end (u/s or d/s) of a dam undermining should start and why?.	3
	b)	A hydraulic structure has a horizontal floor distance between u/s and d/s pile lines of 25m. The lengths of u/s and d/s pile lines are 7 m and 9.5m respectively and the working head is 5m. Draw the hydraulic grade line and determine the floor thickness at 5m, 10m and 15m from u/s pile line using Bligh's and Lane's methods, Also find the safety of the hydraulic structure against piping failure assuming any appropriate soil condition.	15
	c)	Illustrate the purpose of fender and also mention materials by which it can be made and the use of such materials In this case.	7
Q.3	a)	Illustrate the necessity of construction of breakwater and state the factors on which its height depends.	2+3=5
	b)	Illustrate Composite type breakwater with the help of a neat sketch.	5
	c)	The head regulator of a canal has three openings, each 3m wide. The water is flowing between the upper and lower gates. The vertical opening of the gate is 1.0m. The head on the regulator is 0.45m. If the upstream water level rises by 0.2 m find by how much the upper gate must be lowered to maintain the canal discharge unaltered	10
	d)	Illustrate the effect of vertical component of earthquake force on a dam.	5