B.E. CIVIL ENGINEERING THIRD YEAR
SECOND SEMESTER EXAM 2019
HYDRAULIC STRUCTURE

Time: Three hours   **Full Marks: 100**

Use a separate Answer-Script for each part

Page : 1 of 1

1. Answer Q.1 and anyone from the rest.
2. Assume reasonable values of data if not supplied.
3. No code etc. will be needed to answer the questions of this part

No. of Question   Part –I (35 Marks)   Marks

Q.1 a) State salient functions of a Diversion Headwork.   3
.b) What is the importance of a fish-ladder in Diversion Head Work?   7
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 up -stream water level rises by 0.2 m find by how much the upper gate must be lowered to maintain the canal discharge unaltered.   10

Q.2 A concrete gravity dam is shown in FIG.1 (not to scale). Considering reservoir full condition determine hydrostatic pressure, hydrodynamic pressure, Uplift force, weight of the dam, horizontal inertial earthquake force and vertical inertial earthquake force. Earthquake forces may be taken as 0.1g and 0.05g respectively for horizontal and vertical directions, g being acceleration due to gravity.   15
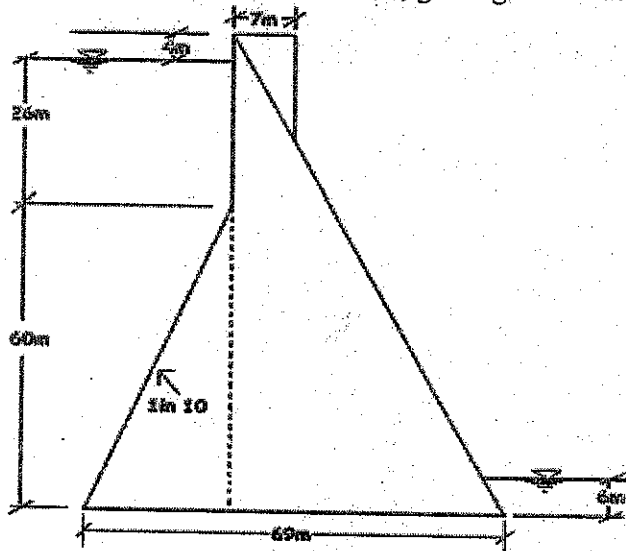

FIG-1

Q.3 a) Explain simple profiles of Khosla's method with neat sketches.   8
b) A hydraulic structure has a horizontal floor with a distance of 25m between u/s and d/s pile lines The lengths of u/s and d/s pile lines are 5 m and 7.5m 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 method, Also find the safety of the hydraulic structure against piping failure considering fine sand at the base.   7

BACHELOR OF CIVIL ENGINEERING EXAMINATION 2019
(Third Year; Second Semester)
HYDRAULIC STRUCTURES

Time: Three Hours

Full Marks 100

Part I: 35 Marks
Part II: 35 Marks
Part III: 30 Marks

Use a separate Answer-Script for each part

No. of questions		Part II (35 Marks)	Marks
		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.*	
1	(a)	Write the expression of 'Froude Number'. Derive the expression for critical depth of flow. What are the advantages of 'hydraulic jump'	2+2+1=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 if the 'Froude Number' is Zero?	2+2+1=5
2	(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
3		Design and draw (on a graph sheet) an Ogee spillway for low tail water, to be constructed on the good condition rock, using the following design data: Height of the spillway crest from reservoir bed = 105m; No. of spans = 5; Length of each clear span = 10.0m; Thickness of each pier = 2.5m; D/s slope = 1 (V): 0.8 (H); Design discharge = 8000 Cumecs; Assume the followings: U/s Profile $y= [0.126H_d] - [\{0.4315H_d^{0.375}\}(x+0.27H_d)^{0.625}] + [\{0.724(x+0.27H_d)^{1.85}\} / H_d^{0.85}]$; D/s profile $x^{1.85} = 2(H_d)^{0.85}y$; $K_p = 0.01$ and $K_a = 0.1$.	18+7=25
4	(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:	15+5=20

Embankment slope table (within Question 2(b)):

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

Design data (within Question 4(b)):

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.

B.E. CIVIL ENGINEERING THIRD YEAR
SECOND SEMESTER EXAM 2019
(~~1st /~~2nd Semester~~/Repeat/Supplementary /Spl. Supplementary /Old/Annual/Bi-Annual~~)
SUBJECT: HYDRAULIC STRUCTURE
(Name in full)
PAPER ××××

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

- *Maintain neatness.*
- *Assume reasonable data if required and if it is not supplied.*
- Answer all questions.
- All drawings-must be drawn by pencil
- No Code will be allowed with the students to answer the questions

1. What are the drawbacks of water transportation?   5
   Or
   What are the advantages of water transportation?
2. What are the requirements of a harbour?   5
   Or
   Write short notes on Harbour site investigation.
3. What are the requirements of a port?   5
4. (i) Classify different types of harbour with a tree structure.   3 + 1 + 1
   (ii) Name two examples of Indian natural harbour.
   (iii) Name one example of Indian semi-natural harbor and one example of a foreign semi-natural harbour.
5. Write short notes on any one between: 5
   "Harbour of refuge" and "Commercial harbour".
6. Write short notes on any one between: 5
   "Natural roadstead" and "Naturally circumscribed roadstead".

End of the Question