Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VIII(NEW) EXAMINATION – SUMMER 2019

Subject Code: 2184004 Date:15/05/2019

Subject Name: Design of Hydraulic Structures

Time:10:30 AM TO 01:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

			MARKS
Q.1	**(a)**	Explain the term 'Cavitation' in Ogee spillway.	**03**
	(b)	Discuss briefly the following points for the site selection of a concrete gravity dam: (i) Foundation; (ii) Topography; (iii) Site for spillway; (iv) Reservoir and catchment area	**04**
	(c)	Fig 1 below shows the section of a gravity dam, compute: (i) water pressure in horizontal and vertical directions; (ii) Uplift Pressure; (iii) Self-weight of the dam/m length. Consider the density of concrete γ_{conc} = 24KN/m^3 and that of for water = 10KN/m^3.	**07**

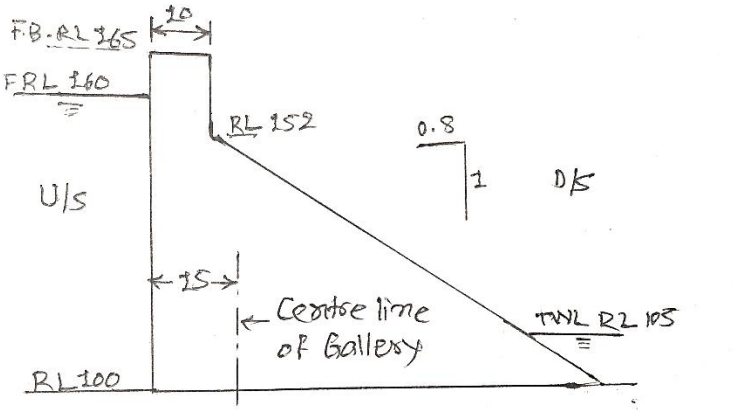

Fig. 1 Q.1(c) Figure NOT TO Scale

Q.2	**(a)**	What is the phreatic line in an earthen dam?	**03**
	(b)	State the different purposes of locating a phreatic line.	**04**
	(c)	Find the coordinates of a phreatic line for an earth dam of homogeneous section without filter at d/s toe. The following data are to be considered for the dam: (i) Top width of the dam = 8m (ii) Free Board = 3m (iii) Maximum head of water = 22m (iv) Angle α (the side slope make with the horizontal) = 30˚ (v) Correction factor for α = 30˚ is Δa/(a+Δa) = 0.36 Also find the seepage discharge for the same section when permeability coefficient is known as K = 4.2x10^{-6} m/s.	**07**
		OR	
	(c)	Check the stability of the d/s slope of an earth dam from the following data: (i) Top width of the dam = 7.5m	**07**

(ii) Maximum head of water = 22m
(iii) F. B. = 3m
(iv) u/s slope = 1:3 & d/s slope = 1:2.5
(v) Horizontal length of filter = 22m.
Assume the properties of soil for the dam as follows:
(i) Average unit weight under steady seepage = 20 KN/m^3
(ii) Coefficient of permeability = $4.5x10^{-6}$ m/s
(iii) Angle of internal friction between the soil particles $\phi = 25^\circ$ and average cohesion C= 18 KN/m^2.
(iv) Density of water γ_w = 10 KN/m^3.
Assume foundation of the dam to be impervious and friction between the consecutive sides of the slices is negligible. Take the area of N diagram a_N = 12 cm^2; area of T diagram a_T = 4.8cm^2 and that of pore water pressure diagram a_U = 1.9cm^2. Consider the scale of the drawing as 1 cm = 5m and the angle subtended at the centre of rotation by arc $\delta = 48^\circ.6$. The radius of arc = 67.52 m. Whether this section is safe?

Q.3 **(a)** State the different losses occurring in an unlined canal. **03**

(b) State the step wise procedure for designing a trapezoidal section of a lined canal when Discharge, velocity, side slope or angle θ, Bed slope & Rugosity coefficient are known. **04**

(c) Design a trapezoidal lined canal section for a discharge of 120 m^3/s at a bed slope of 1/4200 and a side slope of 1:1.25 (V:H). **07**
Given: Rugosity coefficient N = 0.018 & velocity = 1.5m/s

OR

Q.3 **(a)** Explain the term 'Tractive force' related to the canal flow. **03**

(b) Explain in detail the Bed load and Suspended load **04**

(c) What is a synthetic unit hydrograph? **07**
A synthetic unit hydrograph is to be developed for an ungauged catchment area for which there is no information of any kind. An adjoining catchment is thoroughly gauged. It has 3-h UH with a peak of 140m^3/s appearing 37 h from the start of rainfall excess. Determine the Snyder's coefficients of the hydrograph to be used for the adjoining ungauged catchment for formulation of 3 h UH.

Area(A); Gauged catchment	**2718 km^2**
Basin length along the river (l)	**148 km**
Centroid length (l_c) along the river.	**76 km**

Q.4 **(a)** State the factors affecting the storm water flow. **03**

(b) Explain the Rational method for estimation of storm water flow for sewer design. **04**

(c) The drainage area of one sector of a town is 40 hectares. The classification of the surfaces of this area is as follows: **07**

Percentage of total surface area	Types of surface	Runoff coefficient
20	**Hard pavement**	**0.86**
25	**Roof surface**	**0.82**
15	**Unpaved street**	**0.30**
28	**Garden & lawns**	**0.15**
12	**Wooded area**	**0.05**

If the time of concentration for the area is 35 minutes, find the maximum runoff discharge. Use the Rational formula for finding the intensity of rainfall.

OR

Q.4 **(a)** Define the terms:(i) ordinary floods and (ii) standard projected flood **03**

(b) Explain briefly the causes of flood and the term probable maximum flood. **04**

(c) State the procedure for the location of hydraulic jump formation of a sloping glacis weir and water height at that point for the known data of u/s TEL; d/s TEL; Head loss, H_L & discharge intensity q $m^3/s/m$. **07**

Q.5 **(a)** Explain the term Cross Drainage works. **07**

Classify the different CD works depending upon the relative levels and discharges.

Explain briefly with neat sketch the 'syphon aqueduct'.

(b) What is canal fluming? **07**

With the help of Mitra's hyperbolic method of canal transition, design the fluming portions of an aqueduct from the following data:

(i) For Contraction Transition:

Normal bed width of trapezoidal section of canal = B_N = 24m; and Flumed width, B_F = 14m; Splay = 1:2

(ii) For Expansion Transition:

Normal bed width of trapezoidal section at outlet = B_N = 24m; Flumed width, B_F = 14m; Splay = 1:3. Assume the depth of water remains same in the fumed portion. Length of fluming section L_f is to be found out in each transition.

OR

Q.5 **Attempt** : (**Any Four**) **14**

(i) Differentiate between low & high concrete gravity dam.

(ii) Functions of cross regulator and head regulator.

(iii) List the design features of an ogee spillway and describe the procedure for locating the d/s profile of the same.

(iv) Limitations of Bligh's creep theory.

(v) Find the exit gradient for a weir founded on permeable soil having Bligh's coefficient, C = 9. Consider the structure as shown in Fig.2. Whether the structure remains safe against piping action?

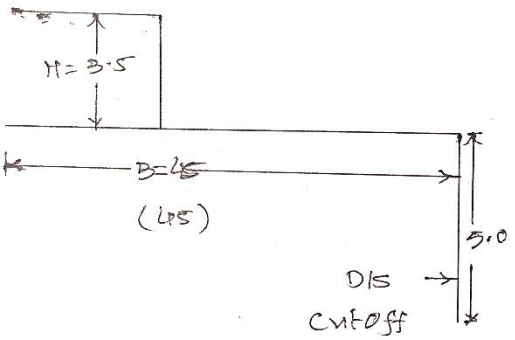

Fig.2 Q.5 OR (V)

Figure NOT TO scale

All Dimensions are in 'meter'.

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