Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE – SEMESTER VIII(OLD) – EXAMINATION – WINTER 2017**

**Subject Code: 180601 Date: 10-11-2017**

**Subject Name: DESIGN OF HYDRAULIC STRUCTURES**

**Time: 02:30 pm to 05:00 pm Total Marks: 70**

**Instructions:**

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

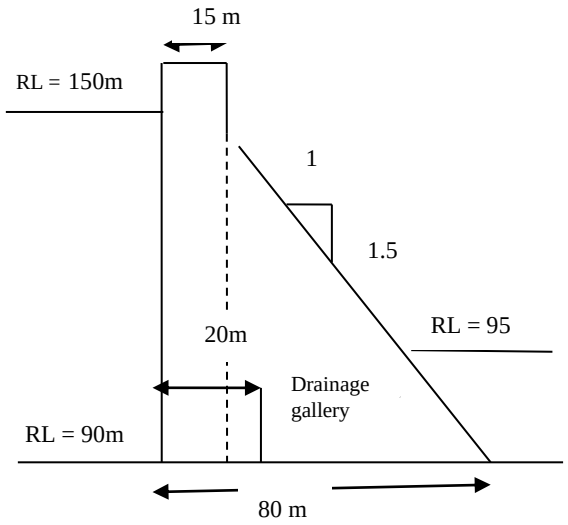
**Q.1** **(a)** Enlist various types of dams in Gujarat. Also discuss the importance and salient features of Narmada dam. **07**

**(b)** Figure shows the section of gravity dam (non overflow section) built of concrete. Compute the following: **07**

i. Water pressure iii. Uplift pressure

ii. Earth quake pressure iv. Weight of dam

Consider specific weight of concrete = 24 KN/$m^3$, fetch = 12km, $\alpha_h$ = 0.19

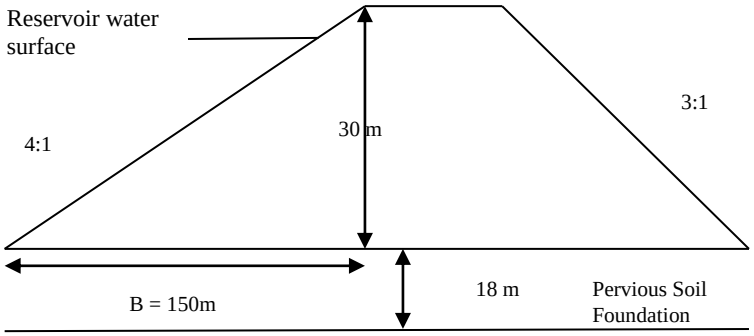



**Q.2** **(a)** Discuss about the foundation treatment in gravity dams. **07**

**(b)** Define phreatic line in earthen dams. Also discuss procedure for locating phreatic line in a homogeneous earth dam with a horizontal drainage filter. **07**

**OR**

**(b)** For the given dam section, check the stability of the foundation against shear for the u/s portion of the dam. The foundation consists of pervious material up to a depth of 18 m below the base of the dam. The unit weight of the dam material & foundation are 20 KN/$m^3$ and 18 KN/$m^3$ respectively. Average cohesion and angle of internal friction for foundation are 5.2 KN/$m^2$ and $24^0$ respectively. **07**




**Q.3** **(a)** Define critical slip circle and method of locating critical slip circle in earthen dams. **07**

**(b)** Explain the following terms: **07**

i. Fluming
ii. Standing waves
iii. Friction blocks

**OR**

**Q.3** **(a)** Differentiate between the following: **07**

i. High and low dam
ii. Chute and ogee spillway

**(b)** A horizontal apron of 25 m length a sheet pile is provided at 20 m distance from the upstream end. The sheet pile is of 5 m depth. The weir on the floor stores water up to 4 m height. Calculate uplift pressures on both faces of the sheet pile just below the floor and also at lower end of the sheet pile. **07**

**Q.4** **(a)** Design only crest and cistern for an unflumed, straight glacies, non-meter fall for the following data: **07**

Full supply discharge u/s =15 cumec
d/s
full supply levels u/s = 40.00 m
d/s = 39.10 m
full supply depth u/s = 1.40 m
d/s = 39.10m
bed width u/s = 9.00 m
d/s = 9.00 m
bed levels u/s = 38.9 m
d/s = 37.10 m
safe exit gradient = 1/5

**(b)** Write short note on following for earthen dams: **07**

i. Cut off trench
ii. d/s drainage system

**OR**

**Q.4** **(a)** Why it is necessary to protect the stream bed below spillway? What energy dissipation methods you suggest? **07**

**(b)** Draw a cross section of an earthen dam with the following data: **07**

i. R.L of natural surface at site = 150 m
ii. R.L of FRL = 168.30 m
iii. R.L of HFL = 171.50 m
iv. Slope of saturation line as 4:1

Assume other data. If designed section is unstable, suggest final section after modification.

**Q.5** **(a)** Describe various design principles of cross regulator and head regulator. **07**

**(b)** For the following given data of an ogee spillway, recommended a suitable energy dissipater: **07**

i. Maximum reservoir level = 165 m
ii. Bed level of river = 142 m
iii. Highest flood level on d/s = 147 m
iv. Maximum flood discharge = 6500 cumec
v. Effective length of spillway = 525 m

Assume there is no head loss in flow over spillway upto the foot of spillway.

**OR**

**Q.5** **(a)** Explain energy dissipation arrangement for the following cases: **07**

i. TWC coincides HJC
ii. TWC always above HJC
iii. HJC partially higher & partially lower than TWC

**(b)** Describe the method of checking the stability of earthen dam foundation against horizontal shear. **07**

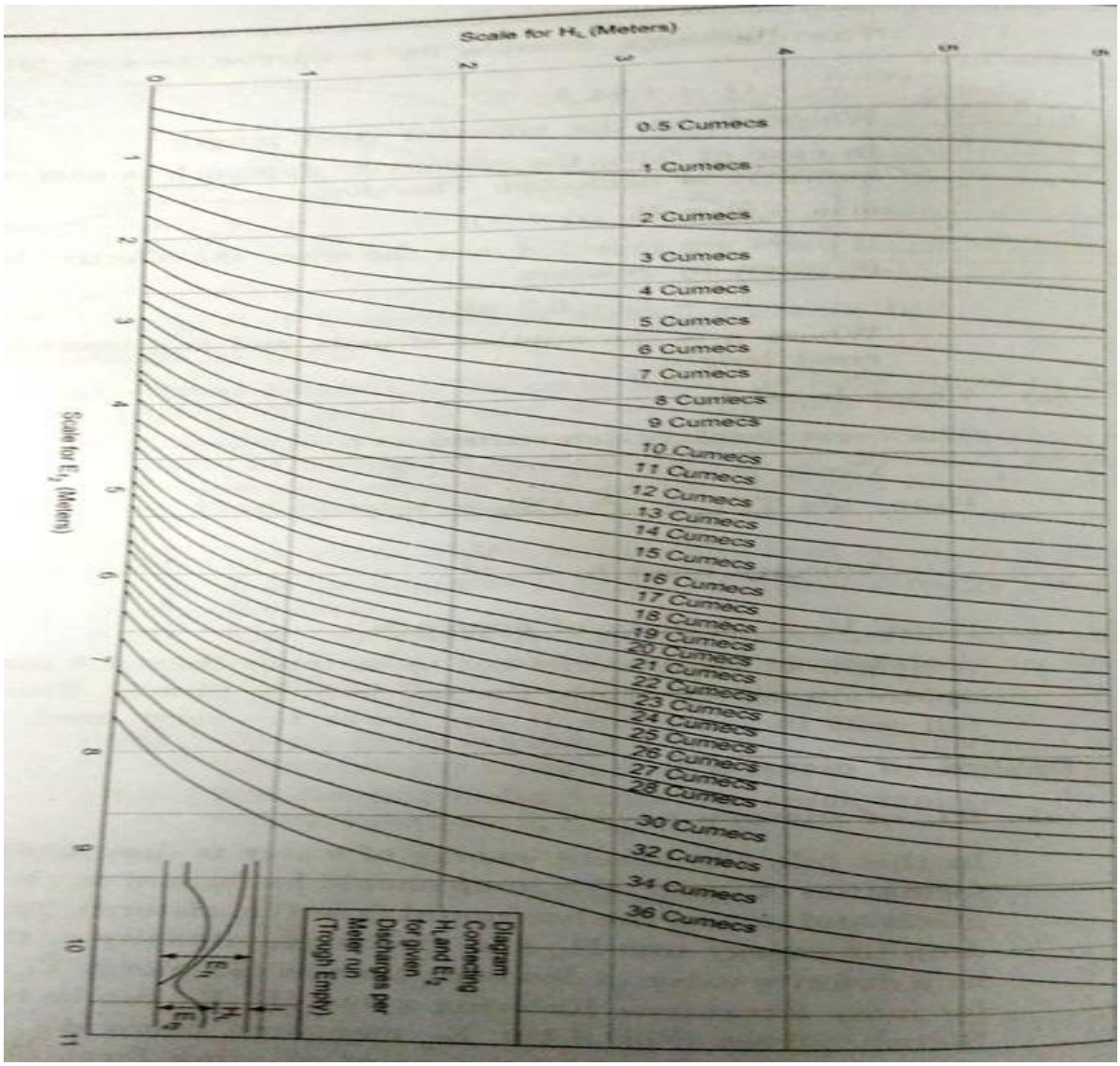



Fig: Blench Curve

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