HYDRAULIC STRUCTURES (CIVL 4241)

Time Allotted: 2½ hrs Full Marks: 60

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 4 (four) from Group B to E, taking one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group - A

1.	. Answer any twelve:								
		Choose the correct alternative for the following							
	(i)	The two main causes of failure of hydraulic structures on the pervious foundation are (a) Overturning and uplift (b) Undermining and uplift (c) Overturning and piping (d) Seepage and seggregation							
	(ii) In a diversion headwork project, the canal head regulator is usually aligned (a) parallel to barrage axis (b) perpendicular to the divide wall (c) parallel to the divide wall (d) 45° to the divide wall								
	(iii)	Value of Khosla's critical exit gradient for usually met alluvial sandy soils of our country is about (a) 0 (b) 1 (c) ∞ (d) 1/4 to 1/6							
	(iv)	The hydraulic structures constructed across a river and supplies water to the off-taking canal is called (a) Weir (b) canal headwork (c) diversion headwork (d) Undersluices							
	(v)	ne hydraulic jump occurs during which of the following types of flow?) Shooting (b) Laminar) Streaming (d) Critical							
	(vi)	The central core of the zoned embankment type earth dam (a) checks the seepage (b) prevents piping (c) gives stability to the central impervious fill (d) distribute the load over a large area							
	(vii)	Which type of dam is suitable on shallow pervious foundations? (a) Zoned embankment type (b) Diaphragm type (c) Homogenous type (d) Both Homogenous and Non- Homogenous type Which of the following spillway is least suitable for an earthen dam (a) Ogee spillway (b) Chute spillway (c) Shaft spillway (d) Side channel spillway							
	(ix)	Silt excluders are constructed, while silt ejectors are constructed							
	(x)	The discharge through a Cipolletti weir is given by (a) $\frac{2}{3}C_d\sqrt{2g}LH^{3/2}$ (b) $\frac{8}{15}C_d\sqrt{2g}\tan\frac{\theta}{2}H^{3/2}$ (c) $\frac{8}{15}C_d\sqrt{2g}\tan\frac{\theta}{2}H^{5/2}$ (d) $\frac{2}{3}C_d\sqrt{2g}LH^{5/2}$							
	Fill in the blanks with the correct word								
	(xi)	xi) The blanket in earth dam is provided at							
	(xii)	i) is the arrangement made near top of dam for passage of excess water from the reservoir.							
	(xiii)	(xiii) The maximum permissible eccentricity for no tension at the base of a gravity dam is							
	(xiv)	Gravity dam is most suitable when the foundation is							
	Group - B								

2. (a) Discuss the various causes of failure of diversion headworks and how they can be prevented.

[(CO4)(Remember/LOCQ)]

(b) Short note on River Training works with figure.

[(CO4)(Remember/LOCQ)]

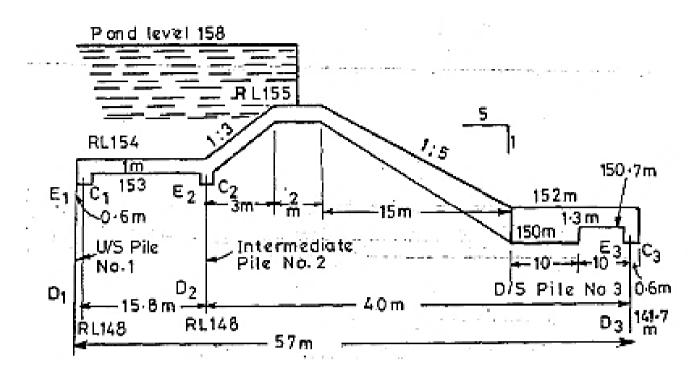
- 3. (a) Short note on: Vertical Drop Weir, Rockfill Weir, Concrete Sloping Weir.
 - (b) Short note on Site selection of diversion headwork.

[(CO4)(Remember/LOCQ)]
[(CO4)(Remember/LOCQ)]

9 + 3 = 12

Group - C

4. (a) Determine the percentage pressure at various key points of the accompanying figure applying Khosla's theory.

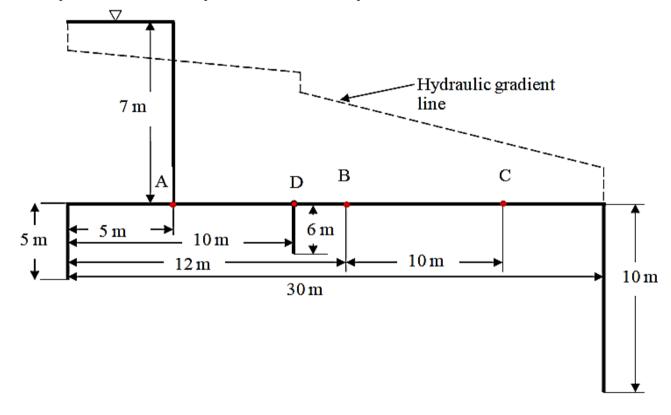


(b) Explain briefly Khosla's exit gradient concept.

[(CO3)(Analyse/HOCQ)] [(CO2)(Remember/LOCQ)]

8 + 4 = 12

5. The figure shows the section of a weir on permeable foundation. Calculate the average hydraulic gradient according to Bligh's creep theory, Lane's weighted creep theory. Also find the uplift pressure at points A, B, C and D as shown in figure and the floor thickness requires at these points. Locate the point where the required floor thickness is same from both the theories.



[(CO3)(Analyse/HOCQ)]

(6+6)=12

Group - D

- 6. (a) Short note on Classification of Dams.
 - (b) Describe about the usefulness and ill-effects of dam construction.

[(CO5)(Remember/LOCQ)]

[(CO5)(Remember/LOCQ)]

[(CO1)(Remember/LOCQ]

6 + 6 = 12

- 7. (a) Short note on: Hydraulic Failure of earthen dam; Structural failure of earthen dam.
 - (b) An earthen dam made of homogenous material has the following data.

Level of top of dam = 250m

Level of deepest riverbed = 200 m

HFL of reservoir = 210m

Width of top of dam = 10m

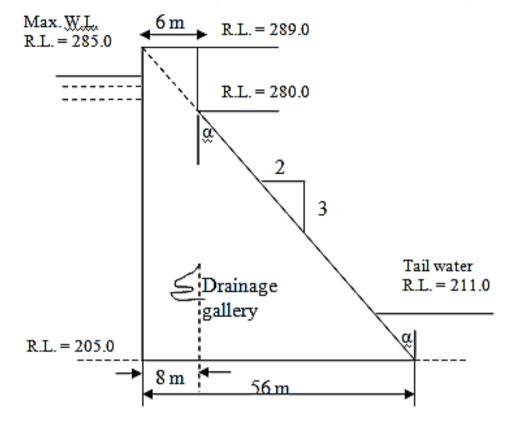
Upstream slope = 4:1

Downstream slope = 3:1

Determine the phreatic line for this dam section and also the discharge through the dam.

[(CO4)(Analyse/HOCQ)]

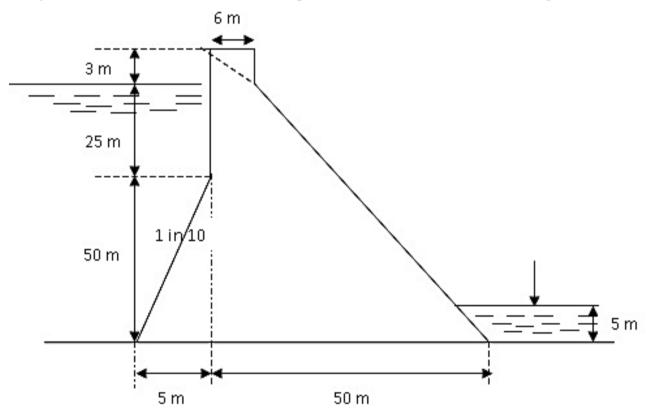
8. The cross-section of a gravity dam is shown in figure. Determine the maximum vertical stresses at heel and toe; the major principal stress at toe; the intensity of shear stress on a horizontal plane near the toe. Assume weight of concrete = 24 kN/m^3 .



[(CO6)(Analyse/HOCQ)]

12

9. The cross-section of a gravity dam is shown in figure. Determine the maximum vertical stresses at heel and toe; the major principal stress at toe; the intensity of shear stress on a horizontal plane near the toe. Assume weight of concrete = 24 kN/m^3 .



[(CO6) (Apply/IOCQ)]

12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	46.9	12.5	40.6