

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:

12 × 1 = 12

Choose the correct alternative for the following

- (i) In case of weirs on permeable foundations, the d/s pile is provided at
(a) to reduce the uplift pressure on floor (b) to prevent undermining
(c) to increase vertical creep (d) both a and b
- (ii) A barrage differs from a weir because it has
(a) No crest (b) Adjustable gates
(c) Higher heights (d) No foundation
- (iii) The backwater effect of weir is best called
(a) retrogression (b) afflux
(c) ponding (d) backwater curve
- (iv) What device is placed in front of head regulator for silt removal?
(a) Weir (b) Undersluices
(c) Silt excluder (d) Silt extractor
- (v) The small openings made in the huge body of a concrete gravity dam such as sluices and inspection galleries can be assumed to be causing only local effects without any appreciable effect on the distribution of stresses as per the principle of
(a) St. Venant (b) Laplace
(c) Reynold (d) St. Franchis
- (vi) Which failure occurs when the minimum stress exceeds the allowable compressive stress of the dam material?
(a) Overturning (b) Crushing
(c) Sliding (d) Hydraulic Jump
- (vii) 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

- (viii) The process of laying and compacting earth in layers by power rollers under OMC for construction of earthen dams is known as
 (a) Rolled filled method (b) Hydraulic filled method
 (c) Compaction (d) OMC method
- (ix) 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
- (x) The cross-section of a gravity dam is generally
 (a) Rectangular (b) Circular
 (c) Trapezoidal (d) Triangular

Fill in the blanks with the correct word

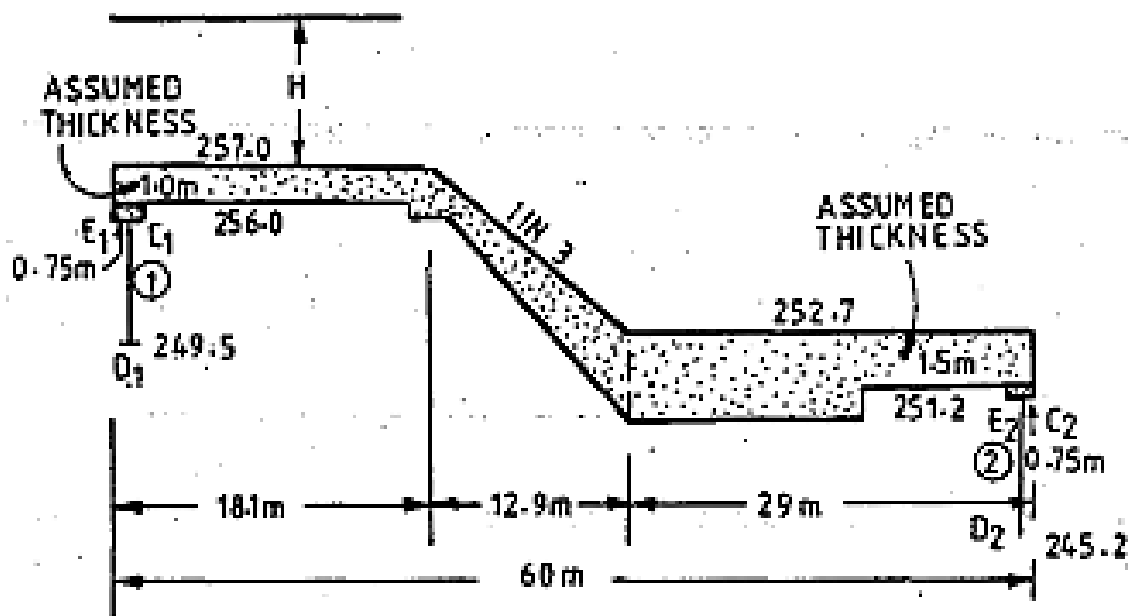
- (xi) The blanket in earth dam is provided at _____
- (xii) _____ is the arrangement made near top of dam for passage of excess water from the reservoir.
- (xiii) Gravity dam is most suitable when the foundation is _____
- (xiv) The factor of safety against overturning in case of gravity dam generally varies between _____.
- (xv) The main force acting on a gravity dam is _____.

Group - B

2. (a) What is a barrage? How does a barrage differ from a weir, explain with neat sketches. [[CO1](Remember/LOCQ)]
 (b) Short note on Components of diversion headwork. [[CO4](Remember/LOCQ)]
6 + 6 = 12
3. (a) Short note on: Guide bank and Marginal bunds. [[CO4](Remember/LOCQ)]
 (b) Why embankments are provided in diversion headwork? What are functions of Spurs/Gryones? [[CO4](Remember/LOCQ)]
5 + 7 = 12

Group - C

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



[[CO3](Analyse/HOCQ)]

- (b) Differentiate between Bligh's creep theory and Lane's weighted creep theory.

[[CO2](Remember/LOCQ)]

7 + 5 = 12

5. (a) A weir floor has: Upstream floor = 10 m; Downstream floor = 20 m; Upstream sheet pile depth = 4 m; Intermediate sheet pile depth = 5 m; Downstream sheet pile depth = 6 m. Find total creep length.

[[CO3](Apply/HOCQ)]

- (b) A weir is built on permeable soil. The head of water (H) = 4 m. Bligh's creep coefficient (C) = 15.

Find the required creep length (L).

[[CO3](Apply/HOCQ)]

- (c) State the advantages of Lane's weighted creep theory over Bligh's creep theory.

[[CO4](Remember/LOCQ)]

4 + 4 + 4 = 12

Group - D

6. (a) An earthen dam made of homogenous material has the following data.

Level of top of dam = 220m

Level of deepest riverbed = 180 m

HFL of reservoir = 150m

Width of top of dam = 8m

Upstream slope = 2.5:1

Downstream slope = 1.5:1

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

[[CO4](Analyse/HOCQ)]

- (b) Short note on Zoned and Diaphragm type of earthen dam.

[[CO2](Remember/LOCQ)]

7 + 5 = 12

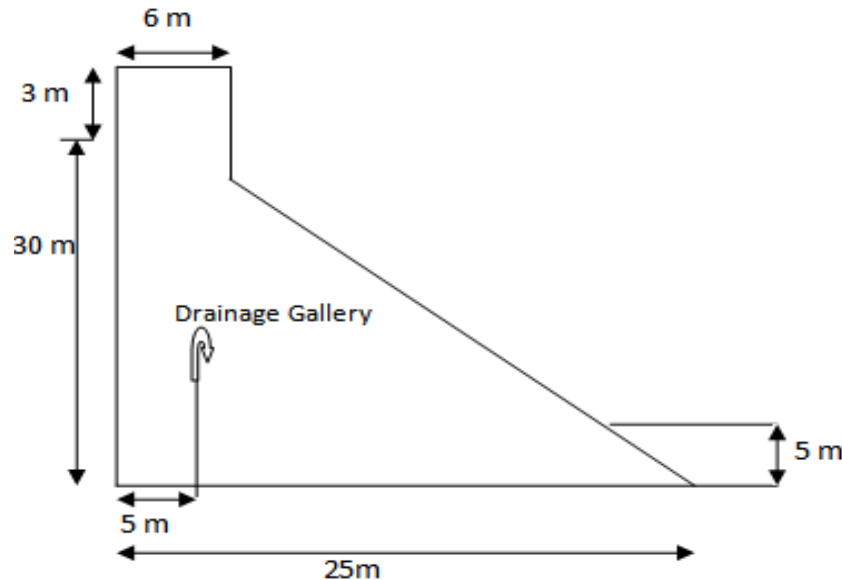
7. (a) Describe briefly the causes of failure of earthen dam with neat sketches and also the remedial measures to be adopted to prevent them.

[[CO2](Remember/LOCQ)]

- (b) What are advantages of concrete gravity dam over other types of dams?
 [[CO4](Remember/LOCQ)]
9 + 3 = 12

Group - E

8. (a) Determine the uplift force at the base of the dam as shown in figure for following cases:
 (i) No drains
 (ii) With drains a distance of 5 m from upstream
 (iii) Tension crack up to 2 m from upstream end without drains



- (b) Discuss in details the various forces acting on a gravity dam. [[CO6](Apply/HOCQ)]
 [[CO6](Remember/LOCQ)]
7 + 5 = 12

9. (a) Find Factor of Safety against sliding and check safety if Weight of dam is 7000 kN; Water pressure is 3500 kN; Uplift pressure is 1500 kN; Coefficient of friction $\mu=0.6$.
 [[CO6](Analyse/HOCQ)]
 (b) Find the total water pressure per unit length of a gravity dam if the depth of water is 20 m.
 [[CO6](Analyse/HOCQ)]
 (c) Find maximum and minimum stress at toe and heel of a gravity dam if base width is 16 m; weight of the dam is 4000 kN and eccentricity is 1.5 m.

[[CO6](Analyse/HOCQ)]
3 + 3 + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	50	0	50