

**HYDRAULICS STRUCTURES
(CIVL 4144)**

Time Allotted: 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

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

**Group – A
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) Khosla's safe exit gradient for design of weirs will be the lowest for the soil type
(a) fine sand (b) coarse sand
(c) shingle (d) gravels.
- (ii) Silt excluders are constructed
(a) on river bed downstream of head regulator
(b) on river bed upstream of the head regulator
(c) on canal bed downstream of canal head regulator
(d) on canal bed upstream of canal head regulator.
- (iii) Silt storage in the reservoir is same as
(a) dead storage (b) live storage
(c) effective storage (d) total storage.
- (iv) 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.
- (v) The dams that are often called as spillways
(a) overflow dams (b) diversion dams
(c) non-overflow dams (d) rigid dams.
- (vi) For the stability of a structure against seepage pressure according to Khosla's creep theory, the critical gradient is
(a) Zero (b) 0.25 (c) 0.50 (d) 1.0.
- (vii) 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.

- (viii) The factor that does not try to destabilise a masonry gravity dam is
(a) water seeping below the foundation of the dam
(b) generation of waves by high winds
(c) deposition of silt in dead storage zone of reservoir
(d) water standing against the downstream face of the dam.
- (ix) The undersluices in a diversion headwork are provided with a crest level
(a) same as the rest of the weir (b) lower than the rest of the weir
(c) higher than the rest of the weir (d) same as the crest of canal regulator.
- (x) The maximum permissible eccentricity for no tension at the base of a gravity dam is
(a) $B/2$ (b) $B/3$ (c) $B/4$ (d) $B/6$.

Group - B

2. (a) Draw and explain with diagram various types of diversion weirs.
[[CO1](Remember/LOCQ)]
(b) Mention at least three effects for construction of weir or barrages on a river regime. [[CO3](Understand/LOCQ)]
7 + 5 = 12
3. (a) Differentiate between a weir & a barrage with the help of neat sketches.
[[CO1](Remember/LOCQ)]
(b) What are the various criteria to be followed for investigation, planning, and layout before construction of weir or barrage? Explain briefly.
[[CO3](Understand/IOCQ)]
4 + 8 = 12

Group - C

4. (a) What are the causes of failures of hydraulic structures on permeable foundations and what remedies are suggested to prevent them?
[[CO1](Remember/LOCQ)]
(b) A flownet for seepage flow through soil below a hydraulic structure gives $N_f=3$; $N_d=30$ and total head causing the flow = 10 m. What is the quantity of flow per metre run occurring under the structure? Take $k=10^{-6}$ m/s.
[[CO2](Analyze/HOCQ)]
9 + 3 = 12
5. (a) Write short note on Failure by piping. [[CO1](Understand/IOCQ)]
(b) Explain briefly Khosla's exit gradient concept, Bligh's creep theory, Lane's weighted creep theory. [[CO3](Understand/LOCQ)]
3 + 9 = 12

Group - D

6. What is the difference between dam and reservoir? How dam can be classified according to the material used for dam construction, according to use and according to

hydraulic design. Describe about the usefulness and ill-effects of dam construction.
[[CO1) (Remember/LOCQ]]

(2 + 6 + 6) = 12

7. (a) Write short note on homogenous and zoned type dams.
[[CO1) (Remember/LOCQ]]
- (b) An earthen dam made of homogenous material has the following data.
Level of top of dam = 230m
Level of deepest riverbed = 200m
HFL of reservoir = 210m
Width of top of dam = 12m
Upstream slope = 5:1
Downstream slope = 3:1
Determine the phreatic line for this dam section and also the discharge through the dam. [[CO2)(Analyze/HOCQ]]

5 + 7 = 12

Group - E

8. (a) Draw typical cross-section of a concrete gravity dam. Define the elementary profile of a gravity dam. [[CO3) (Remember/LOCQ]]
- (b) A flow net is plotted for a homogenous earthen dam of height 22 m and freeboard 2 m. The results obtained are –
Number of potential drops = 10
Number of flow channels = 4
The dam has a horizontal filter of 25 m length at the downstream end and coefficient of permeability is 5×10^{-4} cm/s. Calculate the discharge per m run of the dam. [[CO2) (Analyze/HOCQ]]

(3 + 4) + 5 = 12

9. The cross-section of a gravity dam is shown in figure (1) 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 .
[[CO3) (Analyze/HOCQ]]

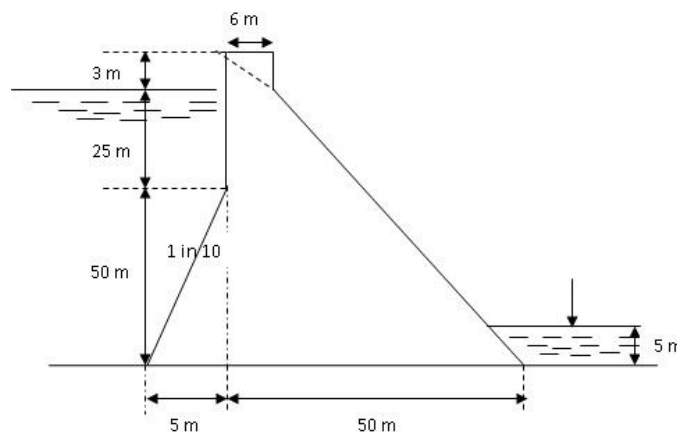


Fig.1

(4 + 2 + 6) = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	50%	28.57%	21.43%

Course Outcome (CO):

After the completion of the course students will be able to

1. Understand the design of water resources systems utilizing the basic principles of the hydrologic cycle and the watershed.
2. Know about the concepts of movement of ground water beneath the earth.
3. Understand the value of probability and statistical analysis in deriving precipitation and stream flow data and hydrograph theories.
4. Impart the knowledge of irrigation techniques, efficiencies, optimal irrigation of the fields, consumptive water requirements of the crops and crop types.
5. Understand the distribution systems for canal irrigation and the basics of design of unlined and lined irrigation canals system.
6. Master the concept of water logging and drainage systems.

*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question

Department & Section	Submission link:
Google Classroom joining Code	lez6kh6
Google Classroom joining Link	https://classroom.google.com/c/MTQ4MzQwMTM0NDA2
Answer Script Upload Link	https://classroom.google.com/c/MTQ4MzQwMTM0NDA2/a/NDY5MjUxMTUyNDg5/details