



Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.TECH(CE)/SEP.SUPPLE/SEM-7/CE-705/2012**

**2012**

**HYDRAULIC STRUCTURE**

Time Allotted : 3 Hours

Full Marks : 70

*The figures in the margin indicate full marks.*

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

**GROUP – A**

**( Multiple Choice Type Questions )**

1. Choose the correct alternatives for any *ten* of the following :

10 × 1 = 10

- i) Barrages constructed across alluvial rivers help in
  - a) controlling floods
  - b) restoring river regime
  - c) ensuring monsoon storage
  - d) all of these.



- ii) In a diversion headworks project, the canal head regulator is usually aligned
- a) parallel to the barrage axis
  - b) perpendicular to the divide wall
  - c) parallel to the divide wall
  - d) none of these.
- iii) According to Khosla's theory, the exit gradient in the absence of a downstream cutoff is
- a) zero
  - b) infinity
  - c) unity
  - d) very large.
- iv) When the reservoir is full, the maximum compressive force in a gravity dam is produced
- a) at the toe
  - b) at the heel
  - c) within the middle third of base
  - d) at the centre of base.
- v) The most suitable material for the central impervious core of an earth dam is
- a) clay
  - b) coarse sand
  - c) silty clay
  - d) clay mixed with fine sand.



- vi) The highest dam in India is
- a) Massanjore                      b) Hirakud
  - c) Bhakra                          d) Maithon.
- vii) Khosla's theory of independent variables is applicable to structure founded on
- a) rock                              b) clay
  - c) sands                            d) concrete.
- viii) For a barrage or a weir, critical  $G_E$  is
- a) greater than designed  $G_E$
  - b) equal to designed  $G_E$
  - c) less than designed  $G_E$
  - d) none of these.
- ix) A cross-regulator is provided on a main canal to
- a) minimise the amount of silt entering the branch canal
  - b) let maximum silt to be carried into the branch canal
  - c) carry canal across a drain
  - d) none of these.



- x) The upstream face of an earth dam is
- an equipotential line
  - a stream line
  - a phreatic line
  - a streak line.
- xi) Silt excluders are constructed on the
- river bed upstream of head regulator
  - river bed downstream of head regulator
  - canal bed upstream of head regulator
  - canal bed downstream of head regulator.
- xii) If 'h' is the ordinate of hydraulic gradient line above the top of the floor and  $G$  is specific gravity of floor material, then the thickness of floor is given by the formula
- $\frac{h}{G+1}$
  - $\frac{h-1}{G-1}$
  - $\frac{h}{G-1}$
  - $\frac{h-1}{G}$ .

### GROUP – B

#### ( Short Answer Type Questions )

Answer any *three* of the following.

$3 \times 5 = 15$

2. Write short notes on any *one* of the following :

$1 \times 5$

- Silt Extractor
- Scouring Sluices at weirs.



3. What is meant by 'afflux' and how does it effect the design of weir and barrages ? 2 + 3
4. a) Define critical exit gradient.  
b) What is safe exit gradient ?  
c) Estimate Critical GE for a alluvial soil with porosity 0.6 and specific gravity 2.65. What will be safe exit gradient for this soil following Khosla ? 2 + 1 + 2
5. What is meant by 'Canal Falls' ? Why are canal falls constructed in a canal system ? Enumerate the various types of canal falls used in the irrigation canal system. 2 + 2 + 1
6. What are the different types of Earth dam those are usually constructed ? Enumerate the cause of failure of earth dam. 2 + 3
7. Discuss the phenomenon of Hydraulic Jump with reference to energy dissipation below overflow spillways.

**GROUP – C**

**( Long Answer Type Questions )**

Answer any *three* of the following. 3 × 15 = 45

8. Show the component parts of a diversion head-works with a neat sketch and mention the functions of them in brief.

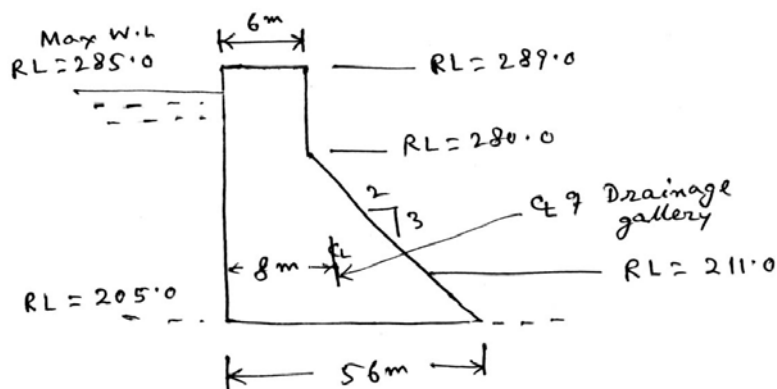


9. An impervious floor of a weir on a permeable soil is 16 m long and has sheet piles at both the ends. The upstream piles is 4 m deep and the downstream is 5 m deep. The weir creates a net head of 2.5 m. Neglecting thickness of the weir floor calculate the uplift pressure at the junction of the inner faces of the piles with the weir floor by using Khosla's theory. Use Khosla's curve.
10. a) What is meant by 'cross drainage works' ?
- b) Discuss the various types of cross drainage works used in canal system by drawing a neat sketch of each type of structure.
11. a) An overfall spillway crest is 100.0 m above river bed for design flood is 12 m and the river bed is sound rock. Suggest a suitable energy dissipator.
- b) Distinguish between controlled and uncontrolled spillways. Write a short note on overfall spillway.
12. Briefly describe the factors affecting the selection of a dam.



13. Briefly describe the factors affecting the selection of a site for construction a dam.

14. The following figure shows the section of gravity dam (non-overflow portion) built of concrete.



Calculate (neglecting earthwork effects)

- The max. vertical stresses at the heel and toe of the dam.
- The major principal stress at the toe of the dam.
- The intensity of shear stress on a horizontal plane near the toe.

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