



Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.Tech (CE)/SEM-7/CE-705/2010-11**  
**2010-11**  
**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.*

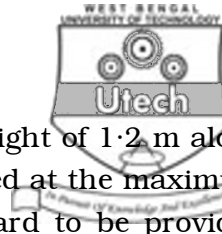
**GROUP – A**  
**( Multiple Choice Type Questions )**

1. Choose the correct alternatives for any *ten* of the following :  $10 \times 1 = 10$
- 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.

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- 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) Hydraulic jump phenomenon leads to
- a) increase of energy of the flowing water
  - b) decrease of energy of the flowing water
  - c) development of scour on the D/s side
  - d) none of these.
- x) 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.
- xi) The upstream face of an earth dam is
- a) an equipotential line
  - b) a streamline
  - c) a phreatic line
  - d) a streak line.



xii) In a gravity dam a maximum wave height of 1.2 m along with a wind set-up of 0.2 m is expected at the maximum reservoir level. The minimum freeboard to be provided in the case is

- a) 1.4 m                                      b) 1.6 m
- c) 1.8 m                                      d) 2.0 m.

xiii) The discharge passing over an ogee spillway is given by

- a)  $CLH^{3/2}$                                       b)  $CHL^{3/2}$
- c)  $CLH^{5/2}$                                       d)  $CLH^{1/2}$ ,

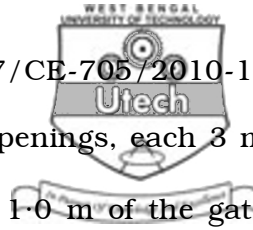
where,  $L$  is effective length of spillway crest and  $H$  is the total head over the spillway crest including velocity head.

#### GROUP – B

##### ( Short Answer Type Questions )

Answer any *three* of the following.                       $3 \times 5 = 15$

2. What is headwork ? What are the functions of diversion headwork ? What are its components ?
3. Distinguish between weir and barrage. What are the types of weir ?
4. What are under-sluices ? Give the functions of under-sluices.
5. Discuss the failure of hydraulic structures on pervious foundation. How can they be remedied ?



6. The head regulator of a canal has three openings, each 3 m wide. Water flows through an opening of 1.0 m of the gate from the sill level of the head regulator. The head on the regulator is 0.45 m. If the upstream water level rises by 0.20 m, find how much the gates must be lowered to maintain the canal discharge unaltered.
7. Write in short about 'Rockfill dam'.

**GROUP – C**

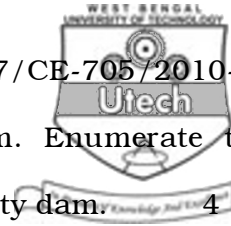
**( Long Answer Type Questions )**

Answer any *three* of the following.  $3 \times 15 = 45$

8. a) Discuss in brief various causes of failure of weir and their remedies. 8
- b) Show the component parts of typical diversion headworks with a neat sketch. 7
9. a) Differentiate between the following :
- i) Diversion dam and gravity dam 4
- ii) Rigid dam and non rigid dam 4
- b) Write a short note on foundation problem for dams and their remedies. 3



- c) Discuss the various factors affecting the choice of type of dam. 4
10. a) What are cross-drainage works ? What is their necessity ? State how various types of cross-drainage works are classified. 2 + 2 + 4
- b) Distinguish between controlled and uncontrolled spillways. Write a short note on ogee-shaped spillway. 4 + 3
11. A horizontal impervious floor of a weir on permeable soil is 25 m long and has a sheet pile at both the ends. The upstream pile is 5 m deep and downstream pile is 6 m deep. The weir creates a neat head of 3 m. The thickness of weir floor is 1 m.
- a) Calculate the uplift pressure at the junction of the inner face of the pile with the bottom of the weir floor, by using Khosla's theory. 11
- b) Also determine the exit gradient and find whether the section provided is safe against uplift and piping if it is founded on fine sand with permissible exit gradient  $1/6$ . 4



12. a) State the suitability of gravity dam. Enumerate the factors governing the choice of a gravity dam. 4 + 5
- b) Discuss in brief various modes of failure of gravity dam. 6
13. a) Explain the method of stability analysis of upstream and downstream slopes. 7
- b) What is meant by piping in an earthen dam ? State the condition under which piping is likely to occur. 2 + 2
- c) Explain the various methods of controlling seepage through an earthen dam. 4
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