



Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.Tech(CE)/SEM-7/CE-705/2009-10**

**2009**

**HYDRAULIC STRUCTURES**

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 )**

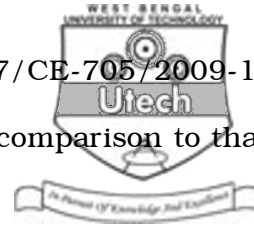
1. Choose the correct alternatives for any *ten* of the following :

10 × 1 = 10

- i) In a barrage project, a divide wall is provided to
  - a) separate the lower crest 'under sluice side' from the higher crest 'weir side'
  - b) separate the higher crest 'under sluice side' from the lower crest 'weir side'
  - c) keep the cross-currents away from the barrage body
  - d) serve none of these.



- ii) The hydraulic jump that develops usually in barrages and canal head regulators, is of the type
- a) strong jump
  - b) steady jump
  - c) oscillating and weak jump
  - d) undular jump.
- iii) The value of Khosla's critical exist gradient for usually met alluvial sandy soils of our country is about
- a) 0
  - b) 1
  - c)  $\infty$
  - d)  $\frac{1}{4}$  to  $\frac{1}{6}$  .
- iv) The back water effect of a weir is best called
- a) retrogression
  - b) afflux
  - c) back water curve
  - d) none of these.
- v) The discharge passing over an ogee spillway per unit length of its apex line is proportional to
- a)  $H$
  - b)  $H^2$
  - c)  $H^{1/2}$
  - d)  $H^{3/2}$  .
- vi) The safety valve of a dam is its
- a) drainage gallery
  - b) inspection gallery
  - c) spillway
  - d) outlet sluice.



- vii) The base width of a rock-fill dam, in comparison to that of an earthen dam is
- a) much larger
  - b) much smaller
  - c) sometimes larger, sometimes smaller
  - d) almost equal.
- viii) Which one of the following spillways is best suited to earthen dams ?
- a) Ogee spillway
  - b) Side channel spillway
  - c) Chute spillway
  - d) Almost equal.
- ix) Leakage through the transverse joints in a gravity dam is prevented by
- a) shear keys
  - b) key ways
  - c) water stop
  - d) none of these.
- x) The vertical component of an earthquake wave, which produces adverse effects on the stability of a dam is, when it is acting in
- a) upward direction
  - b) downward direction
  - c) both (a) and (b)
  - d) none of these.
- xi) Earth dams are
- a) rigid dams
  - b) non-rigid dams
  - c) overflow dams
  - d) diversion dams.



- xii) The most preferred soil for the central impervious core of a zoned embankment type of an earthen dam is
- a) highly impervious clay
  - b) highly pervious gravel
  - c) coarse sand
  - d) clay mixed with fine sand.
- xiii) When the reservoir is full, the slope which is most likely to slide is
- a) upstream slope
  - b) downstream slope
  - c) both (a) and (b)
  - d) none of these.

**GROUP – B**

**( Short Answer Type Questions )**

Answer any *three* of the following.

3 × 5 = 15

2. Write short note on any *one* of the following : 5
- a) Effect of weir on river regime
  - b) Silt excluder.
3. Explain Bligh's Creep theory in brief. 5
4. Explain how water seeping below the body of a hydraulic structure can cause its failure by (i) piping (ii) direct uplift.  $2\frac{1}{2} + 2\frac{1}{2}$
5. State the difference between weir and barrage. 5
6. What do you mean by 'canal drop' ? Why are canal drops constructed in a canal system ? 5



7. Explain the differences between aqueduct and super-passage with neat sketch. 5
8. Write a short note on  
Straight drop spillway or Overfall spillway. 5

**GROUP – C**

( Long Answer Type Questions )

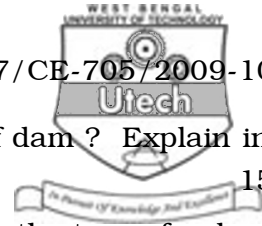
Answer any *three* of the following.  $3 \times 15 = 45$

9. Show the component parts of a diversion headwork with a neat sketch and mention the functions of them in brief. 15
10. a) What is limiting height of a low dam. Differentiate between low and high gravity dams.
- b) A concrete gravity dam has the following data :
- Maximum water level = 300.00
- Bed level = 220.00
- R.L. of top of dam = 304.00
- U/S face vertical
- D/S slope of 0.67 : 1 starts at RL of 295.00
- Centreline of drainage gallery is 8.0 m from U/S face
- Consider only weight, uplift and water pressure.
- Calculate the maximum vertical stresses at the toe and heel of the dam assuming 100% uplift pressure at the heel and 50% at the gallery and zero at the toe. 5 + 10



11. a) Briefly describe the function of a launching apron.
- b) What are drawbacks of Blighs theory.
- c) The figure shows the profile of a weir. The elevation is shown in m. Determine the corrected uplift pressure at the key points ( E1, C1, D1, E2, C2, D2, E3, C3, D3 ) and the exit gradient ( Assume any data required ).
12. a) Derive the equation for phreatic line when dam section is homogeneous ( without filter ) and the d/s face makes an angle 30 to 60 degree with the horizontal.
- b) A flow net is plotted for a homogeneous earthen dam of height 22 m and freeboard 2 m. The results obtained are
- No of potential drop = 10
- No of flow channels = 4
- The dam has a horizontal filter of 30 m length at the downstream end and the coefficient of permeability of the dam material is  $5 \times 10^{-4}$  cm/sec. Calculate the discharge per m run of the dam.

10 + 5



13. What are the factors for selection of site of dam ? Explain in detail. 15
14. What are the factors effecting the selection the type of a dam ? Explain in detail. 15

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