

Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.TECH/CE/SEM-7/CE-705/2012-13**

**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 :

$10 \times 1 = 10$

- 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 will
  - d) none of these.



- iii) Barrage constructed across alluvial rivers help in
  - a) controlling flood
  - b) restoring river regime
  - c) ensuring monsoon storage
  - d) all of them.
- iv) In a barrage project, a divide wall is provided to
  - a) separate the lowest crest 'undersluice side' from the higher crest 'weir side'
  - b) separate the higher crest 'undersluice side' from the lower crest 'weir side'
  - c) keep the cross current s away from barrage side
  - d) serve none of these purpose.
- v) Bligh's theory, accounts IOr.
  - a) hydrostatic force only
  - b) hydrodynamic force only
  - c) both (a) and (b)
  - d) none of these.
- vi) A gravity dam is subjected to hydrodysiamma pressure , caused by
  - a) the rising of the reservoir when the flood wave enters into it
  - b) the rising wave in the reservoir due to high wind
  - c) the increase in the water pressure, momentarily caused by horizontal earthquake, acting towards the reservoir.
  - d) the increase in the water pressure, momentarily caused by horizontal earthquake acting towards the dam.



- vii) River training works are done for training the flow of river. Which of the following does not come under the river training works carried on during the construction of a barrage ?
- a) Guide bunds                      b) Marginal bunds
- c) Canal head regulator      d) Gryoynes.
- viii) The hydrodynamic pressure due to horizontal earthquake acceleration according to Von Karman formula acts at a distance of
- a)  $4H/3\pi$  above the base
- b)  $3H/4\pi$  above the base
- c)  $4H/3\pi$  below the top surface
- d)  $3H/4\pi$  below the top surface.
- ix) The term 'piping' used in connection with diversion structure on permeable soil is associated with
- a) drainage of seepage water
- b) measurement of uplift pressure
- c) failure initiated by boiling
- d) consolidation of foundation.
- x) If no downstream cutoff is provided, then the exit gradient calculated according to Khosla's theory is
- a) infinity
- b) a function of the effective head
- c) unity
- d) zero.



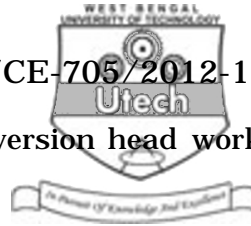
- xi) Phreatic line in seepage analysis is defined as the line on which the pressure is
- greater than atmosphere
  - equal to atmosphere
  - less than atmosphere
  - varying.
- xii) When the seepage taken place through the body of earthen dam it loaded to
- development of the pore pressure in the dam body
  - reduce in the shear strength of the dam
  - reduce in the shear stress of the dam
  - (a) & (b) both.

#### **GROUP - B**

##### **( Short Answer Type Questions )**

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

2. What are the limitations of Bligh's Creep Theory for sub-surface flow below a weir on permeable foundation ? What are the fundamental aspects in which it differs from Khosla's Theory ?
3. Explain the wave pressure distribution on the upstream face of a gravity dam. Determine the force exerted by the waves on the upstream face of a concrete gravity dam due to winds blowing with a velocity of 70 km/hr over a fetch of 80 km.
4. What are grout curtains ? How do they affect the stability of a gravity dam ?



5. Sketch a neat diagram of a layout of a diversion head work and show the different components on it.
6. Why canal fall/drops are necessary in canal system ? State the various types of falls long with sketches also state the suitability of each type.
7. What are the forces acting on a gravity dam ? Briefly illustrate each of them.

### GROUP - C

#### ( Long Answer Type Questions )

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

8. The particulars of a concrete gravity dam resting over a rocky foundation are given below :
  - \* RL of top of dam = 145.0 m
  - \* Freeboard = 3 m
  - \* Upstream face inclined at a slope of 0.25 (H) : 1 (V) from RL 120.0 m up to the base.
  - \* Downstream face sloped at 0.8 (H) : 1 (V) from RL 140.0 m up to the base.
  - \* RL of base = 110.0 m.
  - \* Top width = 6 m.
  - a) Calculate the forces acting on the dam due to self weight, hydrostatic thrust and uplift pressure.
  - b) Determine the stability of the dam when the reservoir is full.
  - c) Determine the stresses induced in the dam in reservoir full condition.

6 + 5 + 4



9. a) What are the different causes of failure of weir on a permeable foundation ? Discuss the different remedial measures that can be adopted to avoid such failures.
- b) A hydraulic diversion structure is founded on sand to withstand water of 4 m depth. The floor length is 22 m with two piles of depth 6 m and 8 m at the upstream and downstream ends respectively. The structure is constructed at a distance of 6 m from the upstream end of the floor. The specific gravity of floor material is 2.24.
- i) Calculate the average hydraulic gradient.
- ii) Calculate the uplift pressures at distances of 6 m, 12 m and 18 m from the upstream end of the floor.
- iii) Find the thickness of the floor at these points.

$$(4 + 3) + (2 + 3 + 3)$$

10. a) What criteria would govern the selection of a gravity dam ?
- b) Briefly discuss the different conditions for drawing the flownet diagram.
- c) Explain the differences between aqueduct and super-passage with neat sketch.
- d) Briefly highlight on the function of a launching apron.

$$5 + 3 + 5 + 2$$



11. Write short notes on any *three* of the following : 3 × 5

- a) Nearsity of cross Drainage Work
- b) Divide well and their function
- c) Undersluices and their function
- d) Rockfill dam
- e) Relif wells.

12. With the help of neat sketches illustrate : 3 × 5

- a) Ogee spillway
- b) Trough spillway
- c) Side channel spill way.

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