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 hydrodysiama 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

a) greater than atmosphere
b) equal to atmosphere
c) less than atmosphere
d) varying.

xii) When the seepage taken place through the body of earthen dam it loaded to

a) development of the pore pressure in the dam body
b) reduce in the shear strength of the dam
c) reduce in the shear stress of the dam
d) (a) & (b) both.

GROUP – B

(Short Answer Type Questions)

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

8. The particulrs 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) : I (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 respenctively. 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 wtith 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.