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 : $10 \times 1 = 10$

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) $\propto$ 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 × 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 $5 \infty 10^{-4}$ 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