

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

Sixth semester B.Tech examinations (S), September 2020

**Course Code: CE302****Course Name: DESIGN OF HYDRAULIC STRUCTURES**

Max. Marks: 100

Duration: 4 Hours

**Use of Khosla's charts are permitted in the exam hall****Assume suitable data wherever necessary****PART A***Answer any two full questions, each carries 15 marks.*

Marks

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|---|---|-----|
| 1 | a) Explain the Khosla's theory of independent variables.  | (6) |
|   | b) Explain the components of unlined canal sections with sketches.  | (5) |
|   | c) Explain the causes of failure of weirs on permeable soils.   | (4) |
| 2 | a) A hydraulic structure built on fine sand has the following details:<br>Total length of the floor = 29 m, a weir at 6 m from u/s end, effective head of water 4 m, sheet pile at u/s end 5 m deep, sheet pile at d/s end 6 m deep, intermediate piles of 3 m depth at 12 m from u/s end. Determine: a) Average hydraulic gradient, b) Uplift pressures at points A = 6 m, and B = 20 m from upstream end and corresponding thicknesses of floor using Bligh's theory. Specific gravity of floor material is 2.24. | (6) |
|   | b) Compare Kennedy's theory and Lacey's theory for design of canals through alluvial soils.   | (4) |
|   | c) Explain the different types of canal falls   | (5) |
| 3 | a) Using Lacey's theory, design a regime channel for a discharge of 43 cumecs, side slopes $\frac{1}{2}$ : 1 and silt factor 1.1.   | (6) |
|   | b) Explain the different types of aqueducts.  | (4) |
|   | c) What are the general considerations for canal alignment?   | (5) |

**PART B***Answer any one full question, each carries 50 marks.*

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|---|---|------|
| 4 | a) Design a suitable cross drainage work, for the following data at the crossing of a canal and a drainage. | (25) |
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**Canal:**

Full supply discharge = 42 cumecs

Full supply level = 192.7 m

Canal bed level = 191.0 m

Canal bed width = 26 m

Trapezoidal canal section with 1.5 H: 1 V slopes

Canal water depth = 1.7 m.

**Drainage:**

High flood discharge = 340 cumecs.

High flood level = 189.0 m

High flood depth = 2.7 m.

General ground level = 191.5 m.

- b) Prepare the following drawings (not to scale) (25)
- i) Half plan at top and half at foundation level.
  - ii) Section through the centre line of the drain.
- 5 a) Design a Sarda Type fall with drop of 1.4 m for a canal carrying a discharge of 35 cumecs with the following data: (25)
- Bed level upstream = 104 m
  - Bed level downstream = 102.6 m
  - Side slopes of channel = 1:1
  - Full supply level upstream = 105.6 m
  - Bed width u/s and d/s = 27 m
  - Safe exit gradient = 1/5
- b) Prepare the following drawings (not to scale) (25)
- i) Half plan at top and half at the foundation level.
  - ii) Section through the centre line of the canal.

**PART C**

*Answer any two full questions, each carries 10 marks.*

- 6 a) Explain chute spillway and side channel spillway. (4)
- b) List the forces acting in a gravity dam. (2)
- c) What is a stilling basin? Explain Type I and Type II stilling basins. (4)
- 7 a) What are the functions of gallery in a gravity dam? (2)
- b) With the help of a neat sketch, derive the expression for thickness of arch ring at (4)

a depth 'h' m below the water surface in the reservoir.

c) What is meant by elementary profile of a gravity dam? (4)

8 Check the stability of the gravity dam with the following data: (10)

Reduced level of the dam at the base = 90 m

Height of dam = 250 m

Maximum water surface elevation = 336 m

Top width = 8 m

Upstream face is vertical and downstream face is vertical up to elevation 330 m and has a slope of 0.8 horizontal to 1 vertical below this elevation. Assume no tail water and no drainage galleries. Density of concrete is  $24 \text{ kN/m}^3$  and coefficient of friction is 0.75.

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