Department of Civil Engineering, NIT Hamirpur (H.P.)
End Semester Examination -2023

Design of Hydraulic Structures (CE-411)

Branch: B.Tech (Civil Engineering)   **Semester:7th**
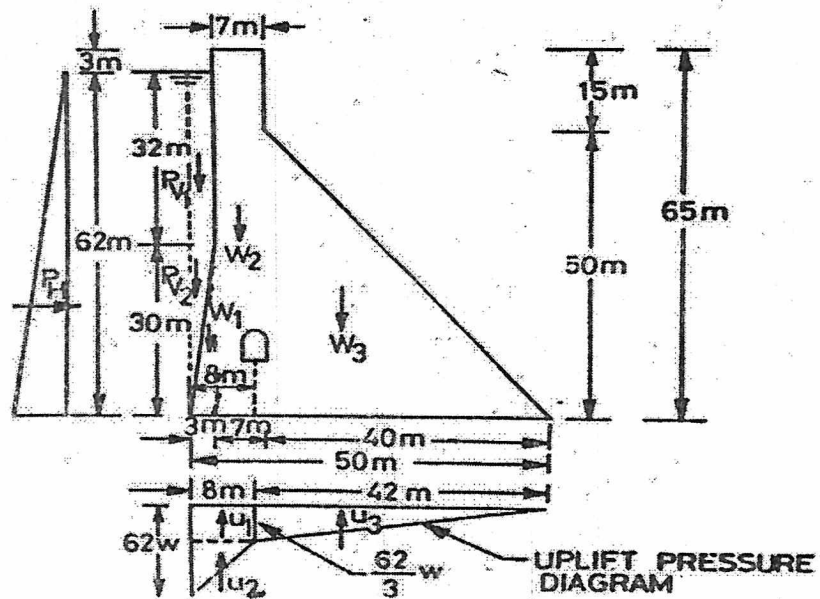**Time: 3 Hours**   **Max Marks: 50**

Note: All questions are compulsory.

1. Define Hydraulic jump. What are the different types of jumps based on the Froude number? (4)

2. Differentiate between
   a) Syphon aqueduct and Canal syphon (2)
   b) Level crossing and inlet-outlet structure (2)

3. Derive an expression for seepage analysis for two dimensional flow and state assumptions made in the seepage analysis for earth dam? (6)

4. A barrage is to be constructed on a river having a high flood discharge of about 7900 cumecs, with the given data as follows:

   Average bed level of the river =259 m
   High Flood level (before construction of barrage) = 265.2 m
   Permissible afflux = 1 m
   Pond Level =262.6 m
   Prepare a complete hydraulic design for the undersluice section for high flood condition with figures, on the basis of hydraulic jump theory and Khosla's theory. A safe exit gradient of 1/6 may be assumed. 0.5 metres retrogression and 20% discharge concentration may be assumed where non-unioform flow is likely to occur. Assume any other data if not given. (10)

5. Write short notes with neat sketches for the following:
   (a) Sarda Type Fall
   (b) Trapezoidal Notch Fall
   (c) Ogee Spillway
   (d) Shaft Spillway

   (8)

6. (a) What is an elementary profile of a gravity dam? Find the width of elementary gravity dam whose height is 100 m. Specific gravity of dam material 2.2 and seepage coefficient at the base C=0.8. (3)

(b) How does Khosla's theory differ from Bligh's theory with regard to the design of weirs on permeable foundation? (4)

7. A river discharges 1300 m³/sec of water at high flood level of RL=106. A weir is constructed for flow diversion with a crest length of 235 m and total length of concrete floors as 40 m. The weir has to sustain the under seepage at a maximum static head of 2.5 m. The silt factor and the safe exit gradient for the river bed material are 1.1 and 1/6 respectively. Determine the depth of cut-off required at the d/s end of the concrete floor. Take the level of d/s concrete floor as RL=100. Check for exit gradient. (4)

8. Determine the forces due to self-weight, water pressure and uplift pressure on the non-overflow gravity dam as shown in Figure. Take specific weight = 24 kN/m³ and specific weight of water (w) = 9.81 kN/m³.

(7)