[3 Hours]   **[Total marks: 80]**

Note:

1) Question No. 1 is compulsory.
2) Attempt any **Three** questions out of remaining **Five** questions.
3) Assume suitable data wherever necessary.
4) Draw neat and clean sketches wherever necessary.

Q. 1. Explain the following: (20)

a. Reservoir Losses

b. Thin cylinder theory of arch dam

c. Classification of dams based on hydraulic design

d. Types of the galleries provided in gravity dam

Q. 2 a. Explain briefly causes of failures in earth dams.   (10)

b. Explain the procedure for the design of drainage filters for earth dam.   (10)

Q. 3 a. Briefly explain the various forces acting on a gravity dam.   (10)

b. A concrete gravity dam has water depth 80m and free board of 4m, d/s slope 2:3, and tail water is nil. Upstream face of dam is vertical and drainage gallery is located 8m from u/s face. u/s pressure is 100% at heel, 50% at gallery and zero at toe. Weight of concrete is 2.4 t/m^3. Consider only weight, water pressure and uplift determine maximums vertical stresses at the toe and heel of dam.   (10)

Q. 4 a. Design the ogee spillway with the following data: (10)

i) Height of spillway crest above river bed =100m,

ii) Design discharge= 12000cumecs,

iii) Number of spans= 6,

iv) Clear distance between piers= 15m, Thickness of pier=3m,

v) Slope of d/s face of the overflow section 0.8:1,

vi) Neglect end contractions and C_d=2.20.

b) Describe various types of vertical gates used for spillways.   (10)

Q.5 a. Explain the advantages and disadvantages of buttress dam. (10)

    b. Differentiate between low and high gravity dam. Derive the expression for the limiting height of a low gravity dam. (10)

Q.6 Write short notes on: (20)

    a) Seepage control measures in earth dam

    b) Bligh's creep theory

    c) Classification of Canal Falls

    d) Characteristics of Phreatic line

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