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B.Tech-7
HydStr

HYDRAULIC STRUCTURES

Full Marks :70
Time :3 Hours

Answer SIX questions Including question No. 1 which is compulsory
The figure in the right hand margin indicates marks

1.Answer all the following questions: [2x10]

(a) Compute design discharge, if full supply discharge is 10 cumec and capacity factor is 0.8

(b) List out the factors affecting *Duty*

(c) Define *Well Loss* and *Specific yield.*

(d) State the *causes* of water logging.

(e) State the use of *Galleries* in Gravity dam.

(f) Draw a practical profile of a low gravity dam

(g) Define *Consumptive use efficiency* and state the *factor* affecting Consumptive use.

(h) State the Terzaghi's criteria of filter design in earthen dams.

(i) As per IS1893-2002, write the formula for " design horizontal seismic coefficient" (A_h) adopted for gravity dam design.

(j) Write the relationship between Duty, Delta and Base period of the crop (mention the unit of these variables used in the equation). Define Kordepth .

2.(a)Design a Lacey's regime channel flowing through material of average diameter 0.328mm, for the following data:

Culturable command area = 100000 hectares
Intensity of irrigation = 40% (Rabi season) and 30% (Kharif season)
Outlet discharge factor = 1800 hec / cumec (Rabi) and 800 hec/ cumec (Kharif)
Assume conveyance loss = 10% (05)

(b) Compare Kennedy's and Lacey's silt theories. Why is Lacey's conception superior to that of Kennedy's? (05)

3. (a) After how many days will you supply water to soil (clay loam) in order to ensure efficient irrigation of the given crop, if

Field capacity of soil = 27%, Permanent wilting point = 14%, Dry density of soil = 15kN/m^3, effective depth of root zone = 75cm, and daily consumptive use of water for the given crop = 11mm. (05)

(b) A 2.0 m wide rectangular channel was carrying a flow with a velocity of 2.0 m/s . Due to sudden operation of a downstream gate a positive surge of velocity 4.5 m/s and travelling upstream was generated. If the depth of flow after the passage of the surge is 3.6m, calculate the velocity of flow after the passage of the surge. What was the discharge before the passage of the surge? (05)

4.(a) State and explain the causes of failure of earthen dam. (05)

(b) Explain, with neatly drawn schematic diagram, the functioning of syphon aqueduct. (05)

5. (a) A weir across an alluvial river has a horizontal floor of length 60m and retain 6 m of water under full pond condition. If the downstream sheet pile is driven to a depth of 6 m below the average bed level, calculate the exit gradient. Further, assuming a porosity of foundation soil as 30% and the relative density of soil particle as 2.7, estimate the critical exit gradient and the factor of safety of the system with respect to the exit gradient. (05)

(b)Explain Khosla's method of independent variables. How do you apply corrections for the followings: (i) thickness of floor, (ii) inclination of the floor and (iii) interference of piles. (05)

6(a) A round crested spillway passes a design discharge of 1 m3/ sec per meter length. The coefficient of discharge (c_d)may be taken as Cd = 0.7. If height of the crest above the downstream stilling basin floor level is 10m, design the (i) depth and (ii) length of the stilling basin. Depth of flow in the stream on the downstream of spillway is 1 m at the design discharge of 1 m^3 / sec. Enquire if the bed of the stilling basin has to be depressed. (05)

(a) What are the functions of spillway? Enumerate various types of spillways. (05)

7(a) What do you understand by a head regulator? State functions of a distributary head regulator and a cross-regulator. (05)

(b)Calculate the seepage, per meter length, through the body of a homogeneous earthen dam retaining water up to 12 m with height of the dam 14m, top width of the dam 4 m and u/s and d/s slope (H: V) of the dam are 2.5: 1 and 2:1 respectively. Take the permeability of the soil as $8*10^{-3}$ cm / sec. (05)

8(a)A masonry dam 10m high is trapezoidal in section with a top width of 1 m and bottom width of 8.25 m. The face exposed to water has a batter of 1: 10. Calculate the following:

(i) Factor of safety against *overturning* and *sliding*. (ii) Calculate shear stress at toe and heel of the dam.

Assume coefficient of friction as 0.75, unit weight of masonry as 2240 kg/ m^3, and permissible stress of joint = 14 kg/cm^2. (05)

(b)Distinguish clearly between a low gravity dam and high gravity dam. Derive the expression used for such a distinction. (05)