

B.Tech 6th Semester Exam., 2022

(New Course)

DESIGN OF HYDRAULIC STRUCTURES

Time : 3 hours

Full Marks : 70

Instructions :

- (i) The marks are indicated in the right-hand margin.
- (ii) There are **NINE** questions in this paper.
- (iii) Attempt **FIVE** questions in all.
- (iv) Question No. 1 is compulsory.

1. Choose the correct answer (any seven) :

2×7=14

- (a) In a well-drained soil, the useful moisture for plant growth essentially comes from
- (i) gravity water
- (ii) capillary water
- (iii) hygroscopic water
- (iv) water of adhesion

- (b) Irrigation frequency is a function of
- (i) crop only
- (ii) soil, crop and climate
- (iii) soil, crop, climate and fertilizer
- (iv) soil and climate
- (c) The outlet discharged factor is the duty at the head of
- (i) main canal
- (ii) branch canal
- (iii) watercourse
- (iv) distributary
- (d) The system of irrigation practiced on hill slopes is
- (i) contour farming
- (ii) check irrigation
- (iii) border method of irrigation
- (iv) sprinkler irrigation

- (e) For irrigation of orchards, the best method is
- (i) free flowing method
 - (ii) basin method
 - (iii) furrow method
 - ~~(iv) sprinkling method~~
- (f) For no tension to develop in the gravity dam, the eccentricity e of the resultant force should be
- (i) less than $b/3$
 - (ii) less than $b/4$
 - ~~(iii) less than $b/6$~~
 - (iv) less than $b/12$
- (g) In gravity dam design, the horizontal silt and water pressure are assumed as equivalent to that of a fluid with a mass density, in kg/m^3 , of
- (i) 1925
 - (ii) 360
 - (iii) 1000
 - ~~(iv) 1360~~

- (h) The freeboard in a dam depends on the height of the wave which in turn depends on
- (i) wind velocity
 - (ii) fetch
 - (iii) depth of water in the reservoir
 - (iv) both wind velocity and fetch
- (i) As a result of the construction of a diversion structure across a river, there will be a rise in the flood level on the upstream side of the structure and it is called as
- (i) freeboard
 - (ii) uplift
 - (iii) aggradation
 - (iv) afflux
- (j) Lacey's equations can be used for the design of
- (i) unlined channels only
 - (ii) lined channels only
 - (iii) both lined and unlined channels
 - (iv) neither lined nor unlined channels

2. What is meant by gravity dam? What are the main points to be considered while selecting a site for a gravity dam construction? Determine the dimensions of the elementary profile of a low gravity dam. 14
3. Enumerate the different methods which may be used for designing the canal transition for flumed canal and condition under which can be used. Describe in detail a method of designing canal transitions when water depth may or may not remain constant. 14
4. For an elementary profile of a dam, the data available are the following :
- Limiting height of a masonry dam = 90 m
 Weight of masonry = 2400 kg/m^3
 Uplift intensity factor = 0.67
 Factor of safety = 2.0
 Specific weight of water = 9810 N/m^3
- Determine safe limiting stress ignoring uplift and also determine H and bottom width when uplift intensity factor and factor of safety are given. 14
5. (a) Discuss in brief various methods of surface irrigation. 7
- (b) What do you understand by contour farming? Compare it with wild flooding method. 7

6. (a) What do you understand by crop rotation? What are its advantages? 7
- (b) Explain the terms 'duty' and 'delta'. Derive the relationship between the two. 7
7. (a) What is a siphon spillway? Sketch a saddle siphon spillway and explain the functions of its various component parts. 7
- (b) Write short notes on the following : 7
- (i) Permanent wilting point
 (ii) Ultimate wilting point
 (iii) Ogee spillway
 (iv) Culturable command area
 (v) Volute siphon spillway
 (vi) Barrage
 (vii) Silt excluder
8. Design an ogee spillway for concrete gravity dam for the following data : 14
- Average riverbed level = 250.0 m
 RL of spillway crest = 350 m
 Slope of d/s face of gravity dam = 0.75 : 1
 Design discharge = 6500 cumecs
 Length of spillway = 5 spans with a clear length of 9 m each
 Thickness of each pier = 2 m

9. In a farm land irrigated by system of pumps from wells, the area irrigated is 50 hectares. Water pumped from wells is conveyed through a canal to the farms. Efficiency of water conveyance is 85% and pumps work at 12 hours/day. Available moisture holding capacity of the soil is 20 cm per meter depth and average root zone depth is 1 m. Water application efficiency is 80%. Irrigation is started when moisture extraction level of 50% of available moisture is reached. Peak rate of moisture used by plants is 5 mm. Calculate irrigation period in days and total pumping capacity required in litre/minute. 14
