

Bihar Engineering University, Patna
End Semester Examination - 2022

Course: B.Tech.
Code: 101505

Semester: V
Subject: Hydrology & Water resource engineering

Time: 03 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.

Q.1 Choose the correct option/answer of the following (Any seven question only): [2 x 7 = 14]

- (a) In the hydrological cycle the average residence time of water in the global
 - (i) Atmospheric moisture is larger than that in the global rivers
 - (ii) Oceans is smaller than that of the global ground water
 - (iii) Rivers is larger than that of the global ground water
 - (iv) Oceans is larger than that of the global ground water
- (b) The double mass curve technique is adopted to
 - (i) check the consistency of rain gauge records
 - (ii) find the average rainfall over a number of years
 - (iii) find the number of rain gauges required
 - (iv) estimate the missing rainfall data
- (c) An Isohyet is a line joining points having
 - (i) equal evaporation value
 - (ii) equal barometric pressure
 - (iii) equal height above the MSL
 - (iv) equal rainfall depth in a given duration
- (d) Which instrument is used for measurement of Evapotranspiration ?
 - (i) Lysimeter
 - (ii) Atmometer
 - (iii) Phytometer
 - (iv) Hygrometer
- (e) A hydrograph is a plot of
 - (i) Rainfall intensity against time
 - (ii) Stream discharge against time
 - (iii) Cumulative rainfall against time
 - (iv) Cumulative runoff against time
- (f) The total rainfall in a catchment of area 1200 km² during a 6-h storm is 16 cm while the surface runoff due to the storm is 1.2 x 10⁸ m³. The ϕ index is
 - (i) 0.1 cm/h
 - (ii) 1.0 cm/h
 - (iii) 0.2 cm/h
 - (iv) cannot be estimated
- (g) The discharge per unit drawdown at the well is known as
 - (i) Specific Capacity
 - (ii) Specific storage
 - (iii) Specific retention
 - (iv) Specific yield
- (h) The relationship between the duty D in hectare/cumec, the water depth Δ in centimetre, and base period B in days, is given by:
 - (i) $D = \frac{8.64 \times B}{\Delta}$
 - (ii) $D = \frac{864 \times B}{\Delta}$
 - (iii) $D = \frac{8.64 \times \Delta}{B}$
 - (iv) $D = \frac{864 \times \Delta}{B}$
- (i) The Garret's diagrams are based on:
 - (i) Lacey's theory
 - (ii) Khosla's theory
 - (iii) Bligh's theory
 - (iv) Kennedy's theory
- (j) During the maintenance of an earthen dam, the apparent seepage through the foundation of the dam is best taken care of, by providing:
 - (i) a chimney drain
 - (ii) a rock toe
 - (iii) a drain trench along the downstream toe
 - (iv) an upstream in pervious cutoff

- Q.2 (a) Differentiate between: (i) confined and unconfined aquifer and (ii) aquiclude and aquitard [7]
- (b) A 20 cm diameter well fully penetrates a confined aquifer of thickness 25 m when the well is pumped at a 200 litres/minute. The steady state drawdown in two observation wells located at 10 m and 100 m distance from pumping well are found to be 3.5 m and 0.05 m, respectively. Calculate the permeability and transmissivity of the aquifer. [7]

- Q.3 (a) Explain evapotranspiration and factors affecting evapotranspiration. [7]
 (b) A storm with a 15 cm precipitation produces a direct runoff of 8.7 cm. The time distribution of storm is as follows: [7]

Time from start (in hrs)	1	2	3	4	5	6	7	8
Rainfall in each hr (cm)	0.6	1.35	2.25	3.45	2.7	2.4	1.5	0.75

Estimate the value of ϕ -index for the storm.

- Q.4 (a) Describe the salient characteristics of precipitation in India. [7]
 (b) The normal annual precipitation of five raingauge stations P, Q, R, S and T are respectively 125 cm, 102 cm, 76 cm, 113 cm, and 137 cm. During a particular storm, the precipitation recorded by stations P, Q, R and S are 13.2 cm, 9.2 cm, 6.8 cm and 10.2 cm respectively. The instrument at station T was inoperative during that storm. Estimate the rainfall at station T during that storm. [7]

- Q.5 (a) Discuss in brief various methods of surface irrigation. [6]
 (b) A sandy loam soil holds water at 140 mm/m depth between field capacity and permanent wilting point. The root depth of the crop is 30 cm and the allowable depletion of water is 35%. The daily water use by the crop is 5 mm/day. The area to be irrigated is 60 hectare and water can be delivered at 28 litre per second. The surface irrigation application efficiency is 40%. There are no rainfall and ground water contribution. Determine i) allowable depletion depth between irrigations; ii) frequency of irrigation; iii) net application depth of water and iv) volume of water required. [8]

- Q.6 (a) Define Paleo Irrigation and Kor Watering. [4]
 (b) Define Sprinkle Irrigation and Furrow Irrigation. [4]
 (c) A water course has a culturable command area of 5000 hectare out of which intensities of perennial sugarcane and rice crop are 25% and 50% respectively. The Duty of these crops at the head of water course are 1000 hectare/cumecs and 1500 hectare/cumecs respectively. Find the discharge required if the peak demand is 125% of the average requirement. [6]

- Q.7 (a) What is meant by canal lining and also discuss its advantages? [5]
 (b) A watershed has five non-recording rain gauges, installed in its area. The amount of rainfall recorded for one of the years is given below [9]

Rain Gauge Stations	P	Q	R	S	T
Annual Rainfall in cm	100	120	190	125	95

Find the required optimum number of non-recording and recording rain gauges for this watershed. Assume an error of 10% in the estimation of mean rainfall.

- Q.8 (a) Explain the forces acting on the gravity dam. [7]
 (b) Explain the causes and effects of waterlogging. [7]

- Q.9 (a) Discuss in detail the application of unit hydrograph. [7]
 (b) Following are the ordinates of a storm hydrograph of a river draining a catchment area of 423 Km² due to a 6-h isolated storm. Derive the ordinates of a 6-h unit hydrograph for the catchment. [7]

Time from start of storm (h)	-6	0	6	12	18	24	30	36	42	48
Discharge (m ³ /s)	10	10	30	87.5	115.5	102.5	85	71	59	47.5
Time from start of storm (h)	54	60	66	72	78	84	90	96	102	-
Discharge (m ³ /s)	39	31.5	26	21.5	17.5	15	12.5	12	12	-