Bihar Engineering University, Patna

B.Tech. 5th Semester Examination, 2023

Course: B.Tech. *Time: 03 Hours*

Code: 101505 *Subject: Hydrology & Water Resources Engineering* *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 ***Answer any seven of the following:-*** **[2 x 7 = 14]**

(a) Precipitation that falls near the equator is most likely to fall with time is known as
(i) Snow on the ocean (ii) Snow on to glacier
(iii) Rain on to land (iv) Rain on to the road

(b) The term base flow denotes
(i) Delayed groundwater flow reaching a stream
(ii) Delayed groundwater and snowmelt reaching a stream
(iii) Delayed groundwater and interflow
(iv) The annual minimum flow in a stream

(c) The total rainfall in a catchment of area 1200 km^2 during a 6-h storm is 16 cm and surface runoff due to the storm is 1.2×10^8 m^3. The Φ index is
(i) 0.1 cm/h (ii) 1.0 cm/h
(iii) 0.2 cm/h (iv) Can't be estimated with the given data

(d) A 90 km^2 catchment has the 4-h unit hydrograph which can be approximated as a triangle. If the peak ordinate of this hydrograph is 10 m^3/s the time base is
(i) 120 h (ii) 64 h
(iii) 50 h (iv) None of these

(e) The geologic formation which is neither porous nor permeable and hence no yield of ground water is termed as
(i) aquiclude (ii) aquifer
(iii) aquitard (iv) aquifuge

(f) The Probability of a 10-year flood to occur at least once in 6 years is
(i) 35 % (ii) 53% (iii) 41 % (iv) 60 %

(g) Darcy's law is valid in a porous media flow if the Reynolds number is less than unity, this Reynold number is defined as
(i) (discharge velocity × maximum grain size)/μ
(ii) (actual velocity × average grain size)/ V
(iii) (discharge velocity × average grain size)/ν
(iv) (discharge velocity × pore size)/ν

(h) How that area will be irrigated with if looping is there in ridge line?
(i) Side slope canal (ii) Contour canal
(iii) Watershed canal (iv) Field channel

(i) Kor-watering is the irrigation water supplied to a crop
(i) at the time of its sowing (ii) just before harvesting
(iii) about three weeks after sowing (iv) about three weeks before harvesting

(j) The instrument to measure wind velocity is
(i) current meter (ii) atmometer
(iii) aerometer (iv) anemometer

Q.2 (a) Explain various methods of obtaining mean precipitation with equations. **[7]**

(b) The normal annual rainfall of stations A, B, C and D in a catchment are 809.7, 675.9, 762.8, 920.1 mm respectively. In the year 2023, the station D was inoperative while stations A, B, C recorded annual rainfall of 911.1,722.3, 798.9 mm respectively. Use normal ratio method to estimate the missing rainfall data at D in the year 2023. **[7]**

Q.3 (a) Discuss various factors affecting evaporation. What are the possible sources of error in the measurement of the rainfall. [7]

(b) The following meteorological data pertain to a large reservoir with water spread area 15 km^2. The data represents the average values for the day. Water temperature = 24°C, Air Temperature = 26°C, Atmospheric pressure 752 mm of mercury, wind speed at 0.5 m above G.L =25.3 km/h, relative humidity=46 %. Estimate average daily evaporation from the reservoir and evaporation loss from the reservoir for a period of one week using Meyer's and Rohwer's equations. [7]

Q.4 (a) What is runoff? Explain with sketch different types of catchments. [7]

(b) Explain the rainfall-runoff relationship using regression analysis (any one method). [7]

Q.5 (a) Define "unit hydrograph". What are the assumptions, uses and limitations of unit hydrograph theory? [7]

(b) A 6h storm produced rainfall intensity of 7, 18, 25, 12, 10 and 3 mm/h in successive one hour interval over a basin of 800 sq.km. the resulting runoff is observed to be 2640 hectare-metres. Determine the ϕ index for the basin. [7]

Q.6 (a) Explain with equations of various types of irrigation efficiencies. [7]

(b) The gross commanded area for an irrigation canal is 20,000 hectares out of which out of which 75% is culturable CA. Intensity of irrigation is 40% for rabi and 10% for rice. If Kor period is 4 weeks for rabi and 2.5 weeks for rice, determine outlet discharge. Outlet factors for rabi and rice may be taken as 1800 ha/cumec and 775 ha/cumec respectively. Also calculate delta for each case. [7]

Q.7 (a) What is canal? List its type and explain with neat sketch its classification based on alignment. [7]

(b) Explain different storage zones of reservoir with neat sketch. [7]

Q.8 (a) Define the following: (i) GCA (ii) CCA (iii) intensity of irrigation (iv) Time factor (V) capacity factor (vi) crop rotation. [6]

(b) Design an irrigation channel in alluvial soil according to Lacy's silt theory for the following data: Full Supply discharge = 10 cumecs, Lacys's Silt Factor= 0.9, side slope of channel = ½(H): 1(V). Also determine bed slope of the channel. [8]

Q.9 (a) Explain (i) Invesitagion for reservoir site (ii) Economic Height of Dam. [7]

(b) What are flow irrigation and lift irrigations? Explain types of flow irrigation. [7]