53 (CE 711) HDLG

2018

HYDROLOGY

Paper : CE 711

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

Answer Question ***No. 1*** *and* ***any four*** *from the rest.*

1. Write short notes on ***any five*** of the following : 5×4=20

   (a) Methods of estimation of missing annual precipitation at a station.

   (b) Assumption of unit Hydrograph theory.

   (c) Rating curve

   (d) Rational method of estimating peak discharge.

   (e) Darey's law for estimating ground water discharges.

Contd.

(f) Hydrologic channel routing.

(g) Method of reduction of peak discharge of flood.

2. (a) Describe *any one* type of Self-Recording Rainfall Gauge (SRRG) with an indicative sketch. What are the advantages of an SRRG over an ordinary Rain Gauge? 4+2=6

(b) Write an expression for determining the optimal number of rain-gauge stations in a catchment for a specified allowable degree of error. Describe with the aid of a sketch the isohyetal method of estimating average rainfall over a catchment. 4+4=8

(c) From Thiessen Polygons drawn for a storm over a catchment of area 685km^2, the following data were obtained :

Station No.	P_1	P_2	P_3	P_4	P_5	P_6	P_7
Bisectional area (km^2)	25	125	80	90	120	115	130
Measured precipitation (mm)	10	10	20	17	25	40	12

Show by calculation that the average catchment precipitation would be 21·04 *mm*. 6

3. *(a)* List the important direct and indirect methods of measuring discharge in a river. Describe *any one* type of automatic stage recorder by providing a suitable sketch. What is rating curve? 4+4+2=10

(b) Describe the single and double-point method of measuring velocity of a stream using current meter. 4

(c) In a river carrying a discharge of 60 m^3/s, the stage at station *A* was 2·5*m* and the water surface slope was 1 in 3000. If during a flood, the stage at the same station was found to be the same, i.e. 25*m*, but the water surface slope was assessed as being 1 in 1500, then what would be the estimated value of discharge? 6

4. *(a)* Define a unit Hydrograph (UH). What is an S-curve? Find an expression of the equilibrium discharge of an S-curve. 3+3+2=8

(b) Derive a 12 hour UH from the following ordinates of a 4 hour UH for the same catchment. 6

Time (H)	0	4	8	12	16	20	24	28	32	36	40	44
Ordinates (m^3/s)	0	20	80	130	150	130	90	52	27	15	5	0

(c) Define a Synthetic Unit Hydrograph (SUH). What physical catchment Descripters would be needed for deriving an SUH for an ungauged catchment on the Gaurang River near Kokrajhar by the method recommended by Central Water Commission in India. 4+2=6

5. (a) What are the different methods of estimating the magnitude of a flood peak? Describe Dicken's empirical formula for estimating the peak discharges. 2+4=6

(b) The design discharge of a hydraulic structure on a river is 350 m^3/s. If the available flood data for the river is for 20 years and the mean and standard deviation of the annual flood series are 121 and 60 m^3/s respectively, show by using Gumsel's method of flood frequency analysis that the return period of the design flood is 100 years. Adopt the values of the reduced mean and reduced standard deviation corresponding to a sample size of 21 as 0·5236 and 1·0628 respectively. 4

(c) What is flood routing and what are its applications? Starting with the continuity equation describe the procedure of modified Pul's method of reservoir routing. 2+2+6=10

6. (a) Define with the help of suitable sketches *(i)* an unconfined aquifer, *(ii)* an artesian aquifer and *(iii)* perched water table. Define porosity and hydraulic conductivity of an aquifer. 6+6=12

(b) Derive an expression for estimating steady flow into a well fully penetrating a water table aquifer. Estimate the steady flow in a 30*cm* diameter well completely penetrating a confined aquifer of depth 20*m* and permeability 45*m*/day when the drawdown at the well is 3·0 *m* and the radius of influence is 300*m*. 4+4=8

7. (a) Describe with sketches the formation of different bed-forms during sediment-transport with increasing Froude Number. Define aggrading, degrading and meandering in alluvial flood plains. 6+6=12

(b) Why is training a river necessary? Describe with an indicative sketch the type and layout of river training that you saw in the Gaurang River on the downstream of the bridge near Don-Bosco School in Kokrajhar.

4+4=8

8. (a) Describe various engineering measures that are adopted for reducing damage from floods in a flood prone area.

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(b) What are likely causes of urban flooding in India? Write a note on a recurrent flooding of Kokrajhar town. Write a note on flood havoc in the state of Assam or Bihar. 4+4+4=12