Heaven's Light is Our Guide

DEPARTMET OF CIVIL ENGINEERING
RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering THIRD Year EVEN SEMESTER Examination, 2020

CE 3221
Hydrology

Full Marks: 72 **Time: 3 Hours**

N.B.:-
(i) Answer any SIX questions, taking THREE from each section.
(ii) Figure in the margin indicate full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data missing.

SECTION-A

Q.1 (a) What are the basic data required for hydrological studies? Explain 'hydrologic equation'. 4.00

(b) Describe different correlations of rainfall records with diagram. How can you represent rainfall data graphically? 4.00

(c) A semicircle of diameter 20 km with an equilateral triangle of side 20 km below its diameter is a close approximation to a river basin. The position coordinates of 5 raingauge stations A, B, C, D and E located within the basin with respect to a coordinate axes system whose x-axis and origin are coincident with diameter and centre of the circle are (5, 5), (-5, 5), (-5, -5), (5, -5) and (0, 0) km respectively. If the rainfall record at these raingauges are 85, 92, 77, 80 and 105 mm respectively, determine the average depth of rainfall using Thiessen polygon method. 4.00

Q.2 (a) What is evapotranspiration? Enumerate the factors affecting evapotranspiration. 3.00

(b) 'A fan-shaped catchment produces greater flood intensity' - Justify the statement. 3.00

(c) How can you determine infiltration by double ring infiltrometer? 3.00

(d) Determine the return period (recurrence interval T) of a flood, which has a 10% risk of being flooded (i) in the next 100 years, and (ii) in the next 50 years. 3.00

Q.3 (a) Explain briefly the method of stream gauging by area-velocity method. 3.00

(b) How can you adjust stage-discharge rating curve? Explain with neat sketch. 3.00

(c) Distinguish between MPF and PMP. 3.00

(d) The following data are obtained by stream gauging of a river: 3.00

Main gauge staff reading (m):	9.6	9.6
Auxiliary gauge staff reading (m):	9.32	8.63
Discharge (cumec):	4.50	8.45

What should be the discharge when the main gauge reads 9.6 and the auxiliary gauge reads 9.02 m.

Q.4 (a) Write short notes on: (i) Intermittent and perennial streams, and (ii) Isochrones. 4.00

(b) Discuss the steps of derivation of unit hydrograph. 3.00

(c) The design storm of a water shed has the depths of rainfall of 4.9 and 3.9 cm for the consecutive 1-hr periods. The 1-hr UG can be approximated by triangle of base 6 hr with a peak of 100 cumec occurring after 2 hr from the beginning. Compute the flood hydrograph assuming an average loss rate of 9 mm/hr and constant base flow of 10 cumec. What is the area of water shed and its coefficient of runoff? 5.00

SECTION B

Q.5 (a) Define 'ground water' How much do we depend on ground water? Write down advantages of ground water over surface water. 4.00

(b) Explain the movement of ground water and factors affecting the flow of ground water. 4.00

(c) Water is flowing through a vertical plane, which width is 3 times greater than height. The gradient of pressure is 880 m horizontal to 2.20 m vertical. If the discharge flowing through the fine sand is 8.50×10^{-3} m^3/s and hydraulic conductivity of fine sand is 5 m/day. Find the dimension of the vertical plane. 4.00

Q.6 (a) Distinguish between: (i) specific yield and specific capacity, and (ii) Aquifer and aquiclude. 3.00

(b) Write down Dupuit-Forchheimer assumptions for ground water movement. Derive steady static discharge equation for an artesian aquifer. 5.00

(c) In an artesian aquifer of 8 m thick a 10 cm diameter well is pumped at a constant rate of 100 litres/minute. The steady state drawdown observed in two wells located at 10 m and 50 m distances from the centre of the well are 3 m and 0.05 m respectively. Compute the transmissibility and the hydraulic conductivity of the aquifer. 4.00

Q.7 (a) Write short notes on: (i) Advantages of open wells, (ii) Storage co-efficient. 3.00

(b) Describe the design of well screen, selection of screen material and design of slot size for deep tubewell. 4.00

(c) From analysis of a boring data for constructing a deep tubewell in RUET, it was found that the coarse sand layer lies between 120 to 148 ft from the ground level. If the desired discharge is 900 lpm, diameter of well is 18 cm, then find the length of screen and check the entrance velocity for (i) when artesian aquifer, and (ii) when water table aquifer. 5.00

Q.8 (a) Define flood routing. Describe the identification of areas for ground water recharge and quality of source water. 4.00

(b) Classify artificial recharge. Describe most suitable recharge method of ground water for Bangladesh. 4.00

(c) When 3.68 million m^3 of water was pumped out from an unconfined aquifer of 6.2 km^2 areal extent, the water table was observed to go down by 2.6 m. What is the specific yield of the aquifer? During a monsoon season if the water table of the same aquifer goes up by 10.8 m, what is the volume of recharge? 4.00

The End

Heaven's Light is Our Guide

DEPARTMET OF CIVIL ENGINEERING

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering **Third Year Even Semester** Examination, **2019**

CE 3221

Hydrology

Full Marks: 72 **Time: 3 Hours**

N.B.:-
(i) Answer any **SIX** questions, taking **THREE** from each section.
(ii) Figure in the margin indicate full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data missing.

SECTION-A

Q.1 (a) Explain with the help of a neat sketch the hydrologic cycle in nature, indicating its various phases. 4.00

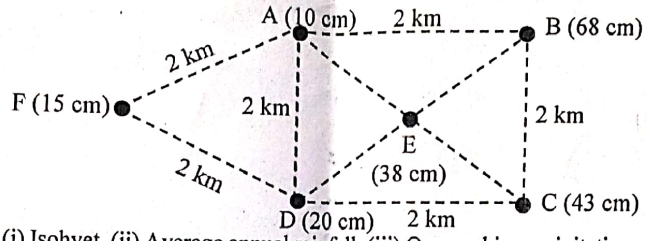
(b) What are the functions of hydrology in water resources development? 4.00

(c) Explain 'hydrologic equation'? What are the basic data required for hydrological studies? 4.00

Q.2 (a) Explain the methodology for rain-gauge installation. 4.00

(b) Write a short note on probable maximum precipitation (PMP). Describe the methods of estimating PMP. 3.00

(c) Find the mean precipitation for the area shown in figure below by Thiessen Polygon method. The area is compound of a square plus an equilateral triangular plot of side 2 km. Rainfall readings are in cm at the various station indicated. 5.00



Q.3 (a) Write short notes on (i) Isohyet, (ii) Average annual rainfall, (iii) Orographic precipitation, and (iv) Rain-gauge density. 4.00

(b) Explain normal ratio method of estimating the missing rainfall data. 4.00

(c) Determine the optimum number of rain gauge station required to install in the watershed if the normal annual rainfall recorded at different stations are 800, 1020, 850, 470, 710 and 390 mm. Assume the allowable error in the mean value is 10%. 4.00

Q.4 (a) Define Unit hydrograph. What are the properties of unit hydrograph? 4.00

(b) Discuss the assumptions and limitations of the unit hydrograph. 4.00

(c) The ordinate of 3-hr unit hydrograph are given as under. Find the ordinates of 9-hr unit hydrograph. 4.00

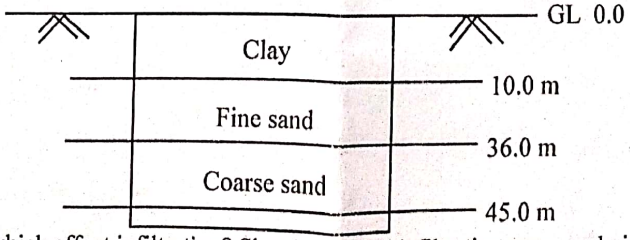
Time (hr)	0	3	6	9	12	15	18	21
3-hr OUH (m^3/s)	0	50	75	150	80	50	30	0

SECTION B

Q.5 (a) Distinguish between (i) Specific yield and specific retention, (ii) Water table aquifer and artesian aquifer, and (iii) Zone of aeration and zone of saturation. 6.00

(b) How will you select the screen length in tube-well construction? 3.00

(c) A bore well log is shown in figure below, and an yield of around 900 lpm is expected. Design location and length of screen (for artesian condition) of the water well with piezometric head 6 m below ground level. 3.00



Q.6 (a) What are the factors which affect infiltration? Sketch a typical infiltration curve and give its equation. 4.00

(b) Explain the method of determining infiltration by Double-ring infiltrometer. 4.00

(c) The total observed runoff volume during a 6-hr storm with a uniform intensity of 1.5 cm/h is 21.6×10^6 m^3. If the area of the basin is 300 km^2, find the average infiltration rate for the basin. 4.00

Q.7 (a) What are the advantages of ground water compared to surface water? 4.00

(b) Derive an expression for steady state discharge of well fully penetrating into unconfined aquifer. 4.00

(c) An artesian aquifer 30 m thick has a porosity of 25% and bulk modulus of compression 2000 kg/cm^2. Estimate the storage coefficient of the aquifer. What fraction of this is attributable to the expansibility of water? 2.1×10^9 kg/m^2 4.00

Q.8 (a) What is ground water recharge? Why artificial recharge is done? Discuss the selection of artificial recharging area. 4.00

(b) Mention various methods of artificial ground water recharge. Discuss the most popular method with advantages. 4.00

(c) Discuss the parameters for water well design. 4.00

Heaven's Light is Our Guide

DEPARTMENT OF CIVIL ENGINEERING

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering **THIRD** Year **EVEN Semester** Examination, 2018

CE 3221

Hydrology

Full marks: 72 **Time: 3 Hours**

N.B:-
(i) Answer any **SIX** questions, taking **THREE** from each section.
(ii) Figures in the margin indicate full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data missing.

SECTION-A

Q.1(a) Discuss the practical applications of hydrology in the field of water resources engineering. 4.00

(b) Write short notes on: (i) Isohyet, (ii) Mean monthly rainfall, (iii) Orographic precipitation, and (iv) Hyetograph. 4.00

(c) Determine the optimum number of rain gauges station required to install in the watershed of 500 sq. km, if the normal annual rainfall recorded at different stations are given as under: 4.00

Station	A	B	C	D	E	F
Rainfall (mm)	800	1040	780	450	650	350

Assume the allowable error in mean value is 10%.

Q.2.(a) Explain the method of determining infiltration by Double–ring infiltrometer. 4.00

(b) Recommend measures to reduce reservoir evaporation. 4.00

(c) The total observed runoff volume during a 6 hr. storm with a uniform intensity of 1.5 cm/h is 21.6×10^6 m^3. If the area of the basin is 300 km^2, find the average infiltration rate for the basin. 4.00

Q.3(a) Classify the runoff and explain their mechanism. 4.00

(b) Define the followings: (i) Isochrones, (ii) Effluent stream, (iii) bank storage, and (iv) Drainage divide. 4.00

(c) Discuss the various factors which affect the runoff from a basin. 4.00

Q.4(a) Explain briefly the method of stream gauging by area-velocity method. 4.00

(b) Draw the qualitative diagrams of stage-discharge rating curve for (i) Tista river, and (ii) Ganges river. 3.00

(c) A surface float took 10 sec to travel a straight run of a stream of 20 m. What is the approximate mean velocity of the stream? If the velocity rod had been used, what time it would have taken to travel the same run? 5.00

SECTION-B

Q.5(a) Distinguish between: (i) Confined aquifer and water table aquifer, (ii) Transmissivity and storativity, and (iii) Artesian well and flowing well. 5.00

(b) What are the assumptions in the analysis of steady radial flow into well? 3.00

(c) Determine the storage coefficient of an aquifer from the following data: porosity = 35%, thickness of aquifer = 30 m, bulk modulus of water, $K_w = 2.1$ GN/m^2, modulus of elasticity of the soil skeleton, $E_s = 3 \times 10^8$ N/m^2. 4.00

Q.6(a) What are the advantages of ground water compared to surface water? 3.00

(b) Derive an expression for steady state discharge of well fully penetrating into unconfined aquifer. 4.00

(c) A pumping test was carried out on a new irrigation bore well penetrating fully into a confined aquifer at a rate of 25 lit/s. The drawdown measured in an observation well located at 47 m from the pumping well during the test is as given below. Determine T and S of the aquifer using Coper-Jacob method.

Time (t) in hrs.	0.5	1.8	2.7	5.4	9.0	12.0	18.0	30.0	54.0
Drawdown (s) in m	0.09	0.29	0.42	0.60	0.72	0.79	0.91	1.20	1.25

Q.7(a) What do you understand by data curve, type curve, and matching? 4.00

(b) Describe the methods of ground water recharge. 4.00

(c) What are the objectives of water well design? Discuss the types of water well. 4.00

Q.8 (a) Discuss the Theis method of determining the aquifer parameters using the pumping test data. 4.00

(b) Discuss the parameters for water well design. 5.00

(c) Do you think drilling a large diameter well mean proportionally large yields? Explain. 3.00

The End

Heaven's Light is Our Guide

DEPARTMET OF CIVIL ENGINEERING

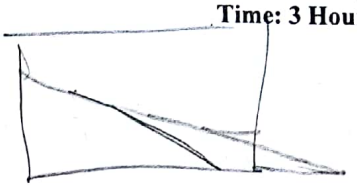
RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering **Third** Year **Even Semester** Examination, **2017**

CE 3221

Hydrology

Full Marks: 72 **Time: 3 Hours**



N.B.:-
(i) Answer any **SIX** questions, taking **THREE** from each section.
(ii) Figure in the margin indicate full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data missing.

SECTION-A

Q.1 (a) Write short notes on: (i) isochrones, (ii) Influent stream, (iii) Interflow, and (iv) Catchment area. 4.00

(b) Discuss the various factors which affect the runoff from a basin. 4.00

(c) The total observed runoff volume during a 6 hr storm with a uniform intensity of 1.5 cm/hr is 2.16×10^6 m^3. If the area of the basin is 300 km^2, find the average infiltration rate for the basin assuming there are no other losses. 4.00

Q.2 (a) List the various factors which affect the runoff from a basin. 5.00

(b) Explain how a current meter rating curve is prepared. 3.00

(c) A river is dry for 5% days of a year. A crop requires 115 days water supply from this river for its base period of 120 days. What is the probability that crop will fail in a year? What is the probability of failure in 4 years? 4.00

Q.3 (a) Discuss the factors which affect infiltration. Sketch a typical curve of infiltration and give its equation. 4.00

(b) Define pan coefficient. Why is it needed to determine? 4.00

(c) What is the evaporation, if 4.75 litres of water is removed from an evaporation pan of diameter 1.22 m and the simultaneous rainfall measurement is 8.8 mm? 4.00

Q.4 (a) Describe with the help of a neat sketch any three methods of separation of base flow from the hydrograph of runoff. 3.00

(b) Describe the limitations of unit hydrograph. 4.00

(c) The successive three hourly ordinates of a 6-hr UG for a particular basin are 0, 15, 36, 17.5, 8.5, 3 and 0 cumec respectively. The flood peak observed due to a 6 hr storm was 150 cumec. Assume a constant base flow of 6 cumec and an average storm loss of 6 mm/hr, determine the depth of storm rainfall and the stream flow at successive 3 hr interval. 5.00

SECTION B

Q.5 (a) What are the factors that influence the selection of a site for a stream gauging station? 5.00

(b) What is a flow rating curve? Explain its use. Sketch a typical flow rating curve. 3.00

(c) A cofferdam is designed for a 25 year flood and constructed. If it takes 5 years to complete the construction of main dam, what is the risk that the cofferdam may fail before the end of the construction period? What return period in the design of cofferdam would have reduced the risk to 10%? 4.00

Q.6 (a) What are the assumptions in the analysis of steady radial flow into well? 3.00

(b) Distinguish between: (i) Aquiclude and Aquitard, and (ii) Aquifer and Aquifuge. 4.00

(c) In a homogeneous isotropic confined aquifer of constant thickness of 20 m, porosity of 20% and permeability of 15 m/day, two observation wells 1200 m apart indicate piezometric heads of 5.4 m and 3.0 m respectively. Assuming uniform flow, average grain diameter of sand 1 mm and viscosity of water = 0.01 cm^2/sec, state (i) whether Darcy's law is applicable? (ii) what is the average flow velocity in pores? 5.00

Q.7 (a) What do you understand by data curve, type curve, and matching? 3.50

(b) Derive an expression for steady state discharge of well fully penetrating into confined aquifer. 3.50

(c) The drawdown measured in an observation well located at a distance of 100 m from a pumped well is recorded below: 5.00

Time, t (days)	0.001	0.005	0.01	0.05	0.10	0.50	1.0	5.0	10.0
Drawdown, s (m)	0.083	0.196	0.249	0.376	0.431	0.559	0.614	0.742	0.797

The well is confined aquifer and pumping rate from the well is 1000 m^3/day. Determine the aquifer parameters using the Cooper-Jacob method.

Q.8 (a) How will you select the screen length in tube-well construction? 3.00

(b) Enumerate the process of water well drilling? 2.00

(c) Distinguish between open wells and Bore wells. 3.00

(d) Discuss the methods of Ground water recharge. 4.00

The End

Heaven's Light is Our Guide

DEPARTMET OF CIVIL ENGINEERING

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering **Third** Year **Even Semester** Examination, **2016**

CE 3221
Hydrology

Full Marks: 72 **Time: 3 Hours**

N.B.:-
(i) Answer any **SIX** questions, taking **THREE** from each section.
(ii) Figure in the margin indicate full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data missing.

SECTION-A

Q.1 (a) Explain with the help of a neat sketch the hydraulic cycle in nature, indicating its various phases. 4.00
(b) What are the functions of hydrology in water resources development? 4.00
(c) Explain normal ratio method of estimating the missing rainfall data. 4.00

Q.2 (a) Explain the methodology for rain-gauge installation. 4.00
(b) Write down the advantages of recording type rain-gauge over non-recording type rain-gauge. 4.00
(c) Determine the number of additional rain gauges required (if any) to be installed in a watershed of 500 km^2 area. The normal annual rainfall recorded at various stations are as follows: 4.00

Station	A	B	C	D	E	F
Rainfall (mm)	500	1000	750	650	450	300

Assume allowable error as 10%.

Q.3 (a) Define pan co-efficient. Why is it needed to determine? 4.00
(b) Recommend measures to reduce reservoir evaporation. 4.00
(c) What is the evaporation, if 4.75 litres of water is removed from an evaporation pan of diameter 122 cm and the simultaneous rainfall measurement is 8.8 mm? 4.00

Q.4 (a) Describe with the help of a neat sketch any three methods of separation of base flow from the stream flow hydrograph. 4.00
(b) Describe the procedure to develop unit hydrograph. 4.00
(c) Determine the mean flow velocity of stream water, using two-point method, the data recorded using current meter are given as under. Assume the value of $a = 0.3$ and $b = 0.05$. 4.00

Depth at	Revolutions	Time (second)
0.2d	35	50
0.8d	25	55

SECTION B

Q.5 (a) Write short notes on: (i) Influent stream, (ii) Isochrones, and (iii) Bank storage. 3.00
(b) Discuss the various factors which affect the runoff from a basin. 5.00
(c) The Horton's infiltration equation for a basin is given by $f = 6 + 16e^{-2t}$, where f is in mm/h and t is in hours. If a storm occurs on this basin with an intensity of more than 22 mm/h, determine the average infiltration rate for first 75 minutes. 4.00

Q.6 (a) Define ground water. How much do we depend on ground water? 3.00
(b) Write short notes on: (i) Leaky aquifer, (ii) Vedose zone, and (iii) Artesian aquifer. 3.00
(c) What are the advantages of ground water over surface water? 3.00
(d) Find the amount of ground water flow in m^3/day, through fine sand when cross section of the soil sample is 85m x 25m and travelling path length is 800 m. Use the hydraulic conductivity $k_h = 5$ m/day. 3.00

Q.7 (a) What are the basic differences between PVC plastic and steel casing material in construction. 3.00
(b) How will you select the screen length in tube-well construction? 3.00
(c) Derive an expression for steady state discharge of well fully penetrating into confined aquifer. 3.00
(d) In an artesian aquifer of 8 m thick, a 10 cm diameter well is pumped at a constant rate of 100 lit/minute. The steady state drawdown observed in two wells located at 10 m and 50 m distance from the centre of the well are 3 m and 0.05 m, respectively. Compute the transmissibility and the hydraulic conductivity of the aquifer. 3.00

Q.8 (a) What do you mean by ground water recharge? How will you identify the areas to be recharged? 3.00
(b) Write the advantages of artificial ground water recharge. 3.00
(c) Describe the methods of ground water recharge. 4.00
(d) A well with a radius of 0.5 m, completely penetrates an unconfined aquifer of thickness 50 m and $k = 30$ m/day. The well is pumped so that the water level in the well remains at 40 m above the bottom. Assuming that the pumping has essentially no effect on water table at $r = 500$ m, what is the steady-state discharge. 2.00

The End

Heaven's light is our Guide

DEPARTMENT OF CIVIL ENGINEERING

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering **THIRD** year **SIXTH SEMESTER** Examination, 2015

CE 307

Hydrology

Full Marks: 70 **Time: 3 Hours**

N.B.:-
(i) Answer SIX questions, taking THREE from each section.
(ii) Figure in the margin indicates full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data not given.

SECTION-A

Q.1	(a)	Explain the methodology for rain-gauge installation.	4.00
	(b)	Explain normal ratio method of estimating the missing rainfall data.	3.67
	(c)	A rainfall of certain high intensity is expected to occur once in 20 years. What is the chance of occurrence in any year? What is the probability that it may occur in the next 12 years?	4.00
Q.2	(a)	Define pan coefficient. Why it is needed to determine?	3.67
	(b)	Explain the method of determining infiltration by Double-ring infiltrometer.	4.00
	(c)	For a small catchment, the infiltration rate at the beginning of rain was observed to be 90 mm/hr and decreased exponentially to a constant rate of 8 mm/hr after 2.5 hr. The total infiltration during 2.5 hr was 50 mm. Develop the Horton's equation for the infiltration rate at any time t < 2.5 hr.	4.00
Q.3	(a)	On what factors the average annual rainfall of a place depends upon? What is the index of wetness?	3.67
	(b)	Describe the three methods of determining the average depth of rainfall over an area.	4.00
	(c)	The Horton's infiltration equation for a basin is given by $f = 6 + 16e^{-2t}$, where f is in mm/hr and t is in hours. What are the values of initial infiltration rate f_0, final constant infiltration rate f_c and constant k. If a storm occurs in this basin with an intensity of 22 mm/hr, determine the depth of infiltration for the 45 minutes and the average infiltration for the second 75 minutes.	4.00
Q.4	(a)	What are the factors that influence the selection of a site for a stream gauging station?	4.00
	(b)	What is stage-discharge rating curve? Explain its use. Sketch a typical stage-discharge rating curve.	3.67
	(c)	The mean daily flows at a gauging station for a period of 7 days are 7, 27, 58, 41, 31, 20 and 13 m^3/sec, respectively. What is the total volume of stream flow in hectare-metres? If the drainage area at the site is 100 km^2, what is the runoff volume in cm?	4.00

SECTION-B

Q.5	(a)	Describe with the help of a neat sketch any three methods of separation of base flow from the stream flow hydrograph.	3.67
	(b)	Write down the limitations of unit hydrograph.	3.00
	(c)	The design storm of a watershed has the depths of rainfall of 4.9 and 3.9 cm for the consecutive 1 hr periods. The 1-hr UG can be approximated by a triangle of base 6 hr with a peak of 50 cumec occurring after 2hr from the beginning. Compute the flood hydrograph assuming an average loss rate of 9 mm/hr and constant base flow of 10 cumec.	5.00
Q.6	(a)	Define flood. Describe the causes of flood in Bangladesh.	2.67
	(b)	Define (i) Standard Project flood (ii) Maximum Probable flood (iii) Design flood.	3.00
	(c)	Describe rational method for estimation of the design flood.	2.00
	(d)	The analysis of a 30 year flood data at a point on a river yielded $\bar{x}$ = 1200 m^3/sec and S_x = 650 m^3/sec. For what discharge would you design the structure at this point to provide 90% assurance that the structure would not fail in the next 50 years? The values of $\overline{y_n}$ and Δ_n for a record length of n years are given below:	4.00

n	30	35	50	100
$\overline{y_n}$	0.53622	0.54034	0.54854	0.56002
Δ_n	1.11238	1.12847	1.16066	1.20649

Q.7	(a)	Distinguish between (i) Specific yield and specific retention, (ii) Water table aquifer and artesian aquifer, (iii) Hydraulic conductivity and transmissibility (iv) Darcy velocity and actual velocity.	6.00
	(b)	State and explain Darcy's law.	2.67
	(c)	In an area of 100 ha, the water table dropped by 4.5 m. If the porosity is 30% and the specific retention is 10%, determine (i) the specific yield of the aquifer and (ii) change in groundwater storage.	3.00
Q.8	(a)	List out the assumptions made in the analysis of steady radial flow into well.	2.00
	(b)	Derive an expression for steady state discharge of a well in a confined aquifer.	3.00
	(c)	Explain with a neat sketch the Cooper and Jacob method of determining the aquifer parameter.	2.67
	(d)	A well is pumped at a constant rate of 8 liters/sec. A match of the well function [u versus $w(u)$] with drawdown versus time data from an observation well located at a distance of 450 m from the pumped well has produced the following matching values: u = 1, $w(u)$ =1, s = 0.21 m, and r^2/t = 2055 m^2/minute. Calculate the transmissibility and storage coefficient of the aquifer. Also estimate the drawdown in the well at the end of 10 days of pumping.	4.00

u	6×10^{-4}	7×10^{-3}
$W(u)$	4.54	4.39

Heaven's Light is Our Guide

DEPARTMENT OF CIVIL ENGINEERING

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering **THIRD** year **SIXTH SEMESTER** Examination, 2014

CE 307

Hydrology

Full Marks: 70 **Time: 3 Hours**

N.B.:-
(i) Answer SIX questions, taking THREE from each section.
(ii) Figure in the margin indicates full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data missing.

SECTION-A

Q.1	(a)	Explain 'hydrologic equation'. What are the basic data required for hydrological studies?	3.67
	(b)	Write short notes on: (i) A.A.R, (ii) Rain-gauge density, (iii) Double mass curve, and (iv) Depth-area-duration curve.	4.00
	(c)	Neighboring rain gauge stations A, B, C, D, E and F have normal rainfalls of 610, 554, 468, 606, 563 and 382 mm respectively. During a storm stations A, B, C, E and F have reported rainfalls of 22, 29, 35, 13 and 25 mm respectively, and station D did not report as it was inoperative. Estimate the missing storm rainfall at D by the arithmetic average and normal ratio method.	4.00
Q.2	(a)	Briefly describe the factors affecting infiltration rate.	3.67
	(b)	Define pan coefficient and why it is needed to determine.	4.00
	(c)	Calculate the amount of water lost by evaporation if: (i) amount of precipitation = 12 mm, (ii) quantity of surface inflow = 120 mm, (iii) ground water flow amount = 75 mm, (iv) surface outflow = 13 mm, and (v) storage decreases by 5 mm.	4.00
Q.3	(a)	Distinguish between (i) ϕ - index and w-index, (ii) Infiltration capacity and infiltration rate, and (iii) Evaporation and Transpiration.	4.00
	(b)	Define a T-hour UH. What is the probability that a 5-year flood will occur at least once during the next 3 years?	2.67
	(c)	The Horton's infiltration equation for a basin is given by $f = 6 + 16e^{-2t}$, where f is in mm/hr and t is in hours. What are the values of initial infiltration rate f_0, final constant infiltration rate f_c and constant K? If a storm occurs in this basin with an intensity of 22 mm/hr, determine the depth of infiltration for the 45 minutes and the average infiltration for the second 75 minutes.	5.00
Q.4	(a)	Is evapotranspiration same as consumptive use? Explain.	3.67
	(b)	Recommend measures to reduce reservoir evaporation.	4.00
	(c)	Hourly rainfalls of 2.5, 6 and 3 cm occur over a 20 ha area consisting 4 ha of ϕ = 5 cm/hr, 10 ha of ϕ = 3 cm/hr and 6 ha of ϕ = 1 cm/hr. Derive hourly values of net rain.	4.00

SECTION-B

Q.5	(a)	Explain how the stage-discharge rating curve for a stream-gauging station is prepared.	3.67
	(b)	Draw the qualitative diagrams of stage-discharge rating curve for (i) Mohananda river, and (ii) Brahmaputra river.	3.00
	(c)	A surface float took 10 sec to travel a straight run of a stream of 20 m. What is the appropriate mean velocity of the stream? If a velocity rod had been used, what time it would have taken to travel the same run?	5.00
Q.6	(a)	Describe with the help of a neat sketch the four methods of separation of base flow from the hydrograph of runoff.	4.00
	(b)	What are the limitations of unit hydrograph?	3.67
	(c)	The ordinates of 3-hr unit hydrograph are given as under. Find out the ordinates of 9-hr unit hydrograph.	4.00

Time (hr)	0	3	6	9	12	15	18	21
3-hr OUH (m^3/s)	0	50	75	150	80	50	30	0

Q.7	(a)	Define ground water. Describe the scope of groundwater study.	2.67
	(b)	Distinguish between (i) Zone of aeration and Zone of saturation, (ii) Aquifer and Aquiclude, (iii) Data curve and Type curve, and (iv) Darcy velocity and actual velocity.	6.00
	(c)	An artesian aquifer 30 m thick has a porosity of 25% and bulk modulus of compression 2000 kg/cm^2. Estimate the storage coefficient of the aquifer. What fraction of this is attributable to the expansibility of water?	3.00
Q.8	(a)	What are the assumptions for Theis equation for unsteady radial flow to a well?	1.67
	(b)	Define well hydraulics. Write a short note on "movement of ground water".	2.00
	(c)	Explain with a neat sketch the Cooper and Jacob method of determining the aquifer parameter?	4.00
	(d)	A well is pumped at the constant rate of 8 litres/sec. A match of the well function [u versus w(u)] with drawdown versus time data from an observation well located at a distance of 450 m from the pumped well has produced the following matching values: u = 1, w(u) = 1, s = 0.21 m, and r^2/t = 2055 m^2/minute. Calculate the transmissibility and storage coefficient of the aquifer. Also estimate the drawdown in the well at the end of 10 days of pumping.	4.00

u	w(u)
6×10^{-3}	4.54
7×10^{-3}	4.39

The End

Heaven's Light is Our Guide

DEPARTMENT OF CIVIL ENGINEERING

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering **Third** year **Sixth Semester** Examination, 2013

CE 307

Hydrology

Full marks: 70 **Time: 3 Hours**

N.B:- (i) Answer any **SIX** questions, taking **THREE** from each section.
(ii) Figure in the margin indicate full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data missing.

SECTION-A

Q.1 (a) Explain the scope of hydrology in water resources development. 3.67

(b) Write short notes on: (i) Hydrologic equation (ii) Depth-area-duration curve (iii) Rain-gauge density and its effect on the accuracy of rainfall data. 4.00

(c) A catchment has six raingauge stations. In a year, the annual rainfall recorded by gauges are as follows: 4.00

Station	A	B	C	D	E	F
Rainfall (cm)	82.6	102.9	180.3	110.3	98.8	136.7

For a 10% error in the estimation of the mean rainfall, calculate the optimum number of stations in the catchment.

Q.2 (a) Write short notes on: (i) Isochrones (ii) Bank storage (iii) Influent stream. 3.00

(b) Recommend measures to reduce reservoir evaporation. 3.67

(c) The cumulative depth of infiltration in an experiment on a tube infiltrometer is observed to follow the equation $F = 0.165t^{0.65}$, where F is in cm and t is in minutes. Determine the equation for infiltration rate and the average infiltration rate. 5.00

Q.3 (a) What are the factors that influence the selection of site for a stream gauging station? 5.00

(b) Sketch a typical stage-discharge rating curve. 1.67

(c) Following velocities were recorded in a station with a current meter. 5.00

Depth above bed (m):	0	1	2	3	4
Velocity (m/sec):	0	0.8	1.0	1.2	1.2

Find the discharge per unit width of stream near the point of measurement. Depth of flow at that point was 5.0 m.

Q.4 (a) Define hydrograph. Draw a single peaked hydrograph and indicate its various phases. 5.00

(b) Explain when multiple-peaked hydrograph is resulted from a basin. 1.67

(c) The storm of a watershed has a depth of rainfall of 4.9 and 3.9 cm for the consecutive 1 hr period. The 1-hr UG can be approximated by a triangle of base 6 hr with a peak of 50 cumec occurring after 2 hr from the beginning. Compute the flood hydrograph assuming an average loss rate of 9 mm/hr and constant base flow of 10 cumec. 5.00

SECTION-B

Q.5 (a) Describe with the help of a neat sketch any three methods of separation of base flow from the hydrograph of runoff i.e. stream flow hydrograph. 5.00

(b) Write down the limitations of unit hydrograph theory. 4.67

(c) What do you understand by a "3 hour unit hydrograph"? 2.00

Q.6 (a) Define flood routing. What are the uses of flood routing? 2.67

(b) Define maximum probable flood and design flood. Write down the procedure to estimate the design flood for any return period using Gumbel's distribution. 4.00

(c) The analysis of a 30 year flood data at a point on a river yielded $\bar{x} = 1200\ m^3/s$ and $S_x = 650\ m^3/s$. For what discharge would you design the structure at this point to provide 95% assurance that the structure would not fail in the next 50 years? The values of $\bar{y}_n$ and σ_n for a record length of n years are given below: 5.00

n	30	35	50	100
$\bar{y}_n$	0.53622	0.54034	0.54854	0.56002
σ_n	1.11238	1.12847	1.16066	1.20649

Q.7 (a) Classify sub-surface water by a neat sketch. 1.67

(b) Distinguish between: (i) Confined aquifer and water table aquifer (ii) Specific yield and specific retention (iii) Artesian well and flowing well (iv) Darcy velocity and actual velocity. 6.00

(c) A well of 0.5 m diameter penetrates fully into a confined aquifer of thickness 20 m and hydraulic conductivity 8.2×10^{-4} m/s. What is the maximum yield expected from this well if the drawdown in the well is not to exceed 3 m? The radius of influence may be taken as 200 m. 4.00

Q.8 (a) List out the assumptions made in the analysis of steady radial flow into well. 2.00

(b) Derive an expression for steady state discharge of a well in an unconfined aquifer. 4.00

(c) A 30 cm well penetrating a confined aquifer is pumped at a constant rate of 1200 lpm. The drawdown at an observation well at a radial distance of 30 m is as follows: 5.67

Time (min)	1.0	2.5	5	10	20	50	100	200	500	1000
Drawdown (m)	0.2	0.5	0.8	1.2	1.8	2.5	3.0	3.7	4.4	5.0

Calculate the aquifer parameters by using Cooper and Jacob method.

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Heaven's Light is Our Guide

DEPARTMENT OF CIVIL ENGINEERING

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering Third year Sixth Semester Examination, 2012

CE 307

Hydrology

Full marks: 70 Time: 3 Hours

N.B.: (i) Answer any SIX questions, taking THREE from each section.
(ii) Figure in the margin indicate full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data missing.
(v) Necessary graphs and figure will be supplied.

SECTION-A

Q.1 (a) Explain the scope of hydrology in water resources development. 3.67
(b) Write down the points that should be kept in view for installing the raingauge. 4.00
(c) During the construction period of 10 years of a reservoir, a culvert/dam is required to be constructed with a capacity to take care of 5 year floods. What is the probability that (i) the flood will not occur at all and (ii) it will occur twice during the construction period? 4.00

Q.2 (a) Discuss the various factors which affect runoff from a basin. 3.67
(b) Explain: "Current metre rating curve". How is it prepared? Sketch a typical rating curve. 4.00
(c) Following velocities were recorded in a stream with a current meter. 4.00

Depth above bed (ft):	0	0.7	1.4	2.1	2.8
Velocity (m/sec):	0	2.62	2.94	3.16	3.28

Find the discharge per unit width of stream near the point of measurement by two-point method. Depth of flow at the point was 3.5 metre.

Q.3 (a) Explain the followings: (i) Standard Project Flood, (ii) Maximum Probable Flood and (iii) Design Flood. 3.00
(b) Define recurrence interval as applied to annual floods or rainfall. 2.67
(c) From the analysis of available data on annual flood peaks of a small stream for a period of 35 years, the 50 year and 100 year flood have been estimated to be 660 m^3/s and 740 m^3/s using Gumbel's method. Estimate the 150 year flood for the stream. The value of $\bar{y}_n$ and σ_n for a record length of n years are given below: 6.00

n	35	50	100	150
$\bar{y}_n$	0.54034	0.54854	0.56002	0.56461
σ	1.12847	1.16066	1.20649	1.22534

Q.4 (a) Define flood routing. What are the uses of flood routing? 2.67
(b) The following inflow hydrograph of a specified channel reach is given. Compute the followings through channel-routing (i) Outflow hydrograph, (ii) Attenuation, (iii) Travel time in hour. 9.00

Time (h)	0	12	24	36	48	60	72	84
Inflow(m^3/s)	32	35	78	262	332	278	230	188
Time (h)	96	108	120	132	144	156	168	180
Inflow(m^3/s)	152	123	100	80	69	58	51	46

Assume k=24 hours and x=0.20

SECTION-B

Q.5 (a) Explain the basic propositions of unit hydrograph theory. 4.00
(b) What are the limitations of unit hydrograph? 3.67
(c) The ordinate of 3-hr unit hydrograph are given as under. Find out the ordinates of 9-hr unit hydrograph. 4.00

Time (hr)	0	3	6	9	12	15	18	21
3-hr QUH (m^3/sec)	0	50	75	150	80	50	30	0

Q.6 (a) Evaporation is less on a humid day; why? 1.67
(b) How infiltration capacity rate can be measured using a double ring infiltrometer? Describe with neat sketch. 5.00
(c) The infiltration capacity in a basin is represented by Horton's equation as $f_p = 3.0 + e^{-2t}$, where f_p is in cm/h and t is in hours. Assuming the infiltration to take place at capacity rates in a storm of 60 minutes duration, estimate the depth of infiltration in (i) the first 30 minutes and (ii) the second 30 minutes of the storm. 5.00

Q.7 (a) Distinguish between the followings: (i) Vadose zone and phreatic zone, (ii) Specific yield and specific retention, (iii) Hydraulic conductivity and Transmissibility. 4.67
(b) State and explain darcy's law. 3.00
(c) In a homogeneous isotropic confined aquifer of constant thickness of 30 m, specific retention of 4%, hydraulic conductivity of 20 m/day and specific yield of 16%, two observation wells 1000 m apart indicate piezometric heads of 7.6 m and 5.4 m, respectively above m.s.l. Determine the actual velocity in pores and Reynolds number for the flow assuming uniform flow, average grain diameter of sand 1 mm and $\nu_{water} = 0.01$ cm^2/sec. 4.00

Q.8 (a) Derive an expression for the steady state discharge of a well in an unconfined aquifer. 5.67
(b) A 30 cm well penetrating a confined aquifer is pumped at a constant rate of 700 lpm. The drawdown at an observation well at a radial distance of 100 m is as follows: 6.00

Time in days	0.001	0.005	0.01	0.05	0.10	0.50	1.0	5.0	10.0
Drawdown in m	0.083	0.196	0.249	0.376	0.431	0.559	0.618	0.743	0.797

Determine the aquifer parameters using the Chow's method.

Heaven's Light is Our Guide

DEPARTMENT OF CIVIL ENGINEERING

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering Third year Sixth Semester Examination, 2011

CE 307

Hydrology

Full marks: 70 **Time: 3 Hours**

N.B:- (i) Answer any SIX questions, taking THREE from each section.
(ii) Figure in the margin indicate full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data missing.

SECTION-A

Q.1 (a) Define "Hydrology". Explain the hydraulic cycle in nature including its various phase with the help of a neat sketch. 4.67

(b) Explain the methodology of rain-gauge installation. 3.00

(c) A watershed has a network of fire rain gauges. Annual rainfall record by these gauges is given for a year as: 4.00

Raingauge:	1	2	3	4	5
Annual rainfall:	50	82	73	64	105

Calculate the optimum number of rain-gauges for this watershed for a 10% error in estimate of mean annual rainfall.

Q.2 (a) What factors you consider in selecting a site for a rain-gauge station? 5.00

(b) Explain a method for estimating the missing rainfall data at a station in a basin. 2.67

(c) A major river basin is divided into four sub-basins with areas of 920, 705, 1075 and 1605 km^2. If the average annual rainfall on these sub-basins is 73, 85, 112 and 100 cm, respectively. What is the average annual rainfall for the basin as a whole? 4.00

Q.3 (a) Discuss the functions which affect infiltration. 3.00

(b) Sketch a typical curve of infiltration and give its equation. 2.67

(c) For a small catchment, the infiltration rate at the beginning of rain was observed to be 90 mm/hr and decreased exponentially to a constant rate of 8 mm/hr after 2.5 hr. The total infiltration during 2.5 hr was 50 mm. Develop the Horton's equation for the infiltration rate at any time t < 2.5 hr. 6.00

Q.4 (a) Discuss the various factors which affect runoff from a basin. 4.00

(b) Explain briefly the evapotranspiration process. What are the factors which affect evapotranspiration? 2.67

(c) A basin has an area of 26500 km^2, perimeter 965 km and length of thalweg 230 km. Determine (i) Form factor (ii) Elongation ratio (iii) Circularity ratio. 5.00

SECTION-B

Q.5 (a) Define hydrograph. Draw a single peaked hydrograph and indicate its various phases. 3.67

(b) Describe with the help of a neat sketch any three methods of separation of base flow from the hydrograph of runoff indicating the situations under which you advocate them. 3.00

(c) The runoff data at a stream gauging station for a flood are given below. The drainage area is 40 km^2. The duration of rainfall is 3 hours. Derive the three-hr unit hydrograph for the basin and plot the same. 5.00

	1-3-1970								2-3-1970							
Date and Time (hr)	2	5	8	11	14	17	20	23	2	5	8	11	14	17	20	23
Discharge cumec	50	47	75	120	225	290	270	145	110	90	80	70	60	55	51	50

Q.6 (a) Explain the terms: (i) Transmissibility (ii) Specific yield (iii) Storage coefficient and (iv) Cone of depression. 4.00

(b) State Darcy's Law and its limitations. 3.67

(c) A 25 cm well penetrates 30 m below static water level (GWT). After a long period of pumping at a rate of 1800 lmp, the drawdowns in the observation well at 13 m and 38 m from the pumped well are 1.2 m and 0.5 m, respectively. Determine (i) the transmissibility of the aquifer (ii) the drawdown in the pumped well assuming R = 300 m. 4.00

Q.7 (a) What is a flow rating curve? Explain its uses. Sketch a flow rating curve. 4.00

(b) Write the application of unit hydrograph. 2.67

(c) The ordinate of a 4-hour unit hydrograph are given below. Derive the ordinates of a 8-hr unit hydrograph by the S-curve method. 5.00

Time (hr)	0	4	8	12	16	20	24	28	32	36	40	44
4-hr unit hydrograph (cumec)	0	24	82	159	184	151	103	64	36	17	6	0

Q.8 (a) Define aquifer. Describe different types of aquifer with sketches. 4.00

(b) Write down the assumptions on which Dupit's theory of flow for unconfined aquifer is based. 3.67

(c) An artesian aquifer 30 m thick has a porosity 25% and bulk modulus of compression 2000 kg/cm^2. Estimate the storage coefficient of the aquifer. What fraction of this is attributable to the expansibility of water? Assume, Bulk modulus of elasticity of water 2.4 x 10^4 kg/cm^2. 4.00

Heaven's Light is Our Guide

DEPARTMENT OF CIVIL ENGINEERING

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering THIRD year SIXTH SEMESTER Examination, 2010

CE 307

Hydrology

Full Marks: 70 Time: 3 Hours

N.B.:
(i) Answer SIX questions, taking THREE from each section.
(ii) Figure in the margin indicates full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data missing

SECTION-A

Q.1(a) Explain with the help of a neat sketch the hydraulic cycle in nature, indicating its various phases. 5.67

(b) From the analysis of available data on annual flood peaks of a small stream for a period of 35 years, the 50 year and 100 year flood have been estimated to be 660 m^3/s and 740 m^3/s using Gumbel's method. Estimate the 200 year flood for the stream. The values of mean $\bar{y}_n$ and standard deviation σ_n for different period of flood data are as follows: 6.00

Period n	35	50	100
$\bar{y}_n$	0.54034	0.54854	0.56002
σ_n	1.12847	1.16066	1.20649

Q.2(a) Recommend measures to reduce reservoir evaporation. 5.67

(b) During a daily routine observation, 10.8 liters of water was added to bring the water surface in the evaporation pan to the stipulated level and the nearby rain gauge measured 3.6 mm of rainfall. What was the evaporation recorded for the day if the diameter of the pan is 122 cm? 6.00

Q.3(a) List the various factors which affect the runoff from a basin. 5.67

(b) A basin has an area of 26560 km^2, perimeter 965 km and length of the thalweg 230 km. Determine: (i) form factor (ii) compactness coefficient (iii) elongation ratio and (iv) circularity ratio. 6.00

Q.4(a) What are the factors that influence the selection of a site for a stream gauging station? 4.00

(b) Explain "current meter rating curve". Sketch a typical rating curve. 3.67

(c) Following velocities were recorded in a stream with a current meter. 4.00

Depth above bed (m):	0	1	2	3	4
Velocity (m/sec):	0	0.5	0.7	[illegible]	0.8

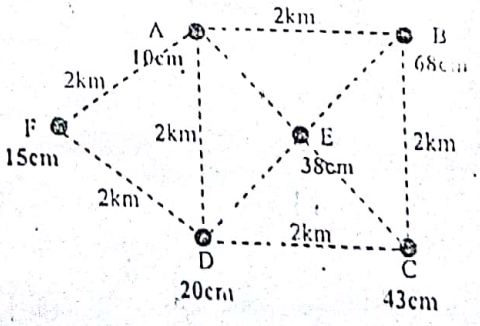
Find the discharge per unit width of stream near the point of measurement. Depth of flow at the point was 5 meter.

SECTION-B

Q.5(a) Explain how you would determine the optimum number of rain-gauge to be erected in a given basin. 3.67

(b) What factors should be considered in selecting a site for a rain-gauge station? 3.67

(c) Find the mean precipitation for the area shown in figure below by Thiessen polygon method. The area is compound of a square plus an equilateral triangular plot of side 2 km. Rainfall readings are in cm at the various station indicated. 5.00



Q.6(a) Enumerate the various water losses. 2.67

(b) What are the factors which affect infiltration? Sketch a typical curve of infiltration and give its equation. 4.00

(c) The cumulative depth of infiltration in an experiment on a tube infiltrometer is observed to follow the equation $F = 0.165t^{0.65}$, where F is in cm and t is in minutes. Determine the equation for infiltration depth and the average infiltration rate. 5.00

Q.7(a) Explain the terms: (i) Transmissibility (ii) Specific yield (iii) Storage coefficient and (iv) Cone of depression. 4.00

(b) State Darcy's law and its limitations. 3.67

(c) A 30cm well fully penetrates into a confined aquifer 30m deep. After a long period of pumping at a rate of 1200 lpm, the drawdown in the wells 20m and 45m from the pumping well are found to be 2.2m and 1.8m respectively. Determine the transmissibility of the aquifer. What is the drawdown in the pumped well? 4.00

Q.8(a) Define unit hydrograph. Describe with the help of a neat sketch any three methods of separation of base flow from the hydrograph of runoff. 4.00

(b) What do you mean by design flood? What are the methods to determine the maximum flood discharge? 2.67

(c) The following are the ordinates of a 3-hour unit hydrograph. Derive the ordinates of 6-hour unit hydrograph and plot the same. 5.00

Time (hr)	3-hr UGO (cumec)	Time (hr)	3-hr UGO (cumec)
0	0	15	9.4
3	1.5	18	4.6
6	4.5	21	2.3
9	8.6	24	0.8
12	12.0		

Class Test -1
CE 3221

Marks: 20
Time: 20 min

1. Differentiate between Aquitard, Aquifuge and Aquiclude. (6)
2. Define the terms: i) Transmissibility ii) Specific yield iii) Storage coefficient (6)
3. An artesian aquifer 30 m thick has a porosity of 26% and elastic modulus of 0.26 GN/m^2. Estimate the storage coefficient of the aquifer. What fraction of this is attributable to the expansibility of the water? Bulk modulus of elasticity of water = 2.1 GN/m^2. (8)

CT-02

Time-20 minutes

CE 3221

Q.01 Define Aquifer, Aquiclude, Aquifuge, Aquitard and Artesian Aquifer 05

Q.02 Write short notes on- 06

i) Perched Aquifer

ii) Cone of Depression

Q.03 In a confined aquifer of 800 cm thick, a 10 cm diameter well is pumped at a constant rate of 144.288 m^3/day. The steady state drawdown observed in two wells located at 10 m and 50 m distances from the centre of the well are 3 m and 0.05 m respectively, compute T and K, where symbols carry the usual meaning. 09

Class Test-2
CE 3221

Marks: 20
Time: 25 min

Q.1.What do you understand by data curve, type curve and matching?

Q.2.A pumping test was carried out on a new irrigation well penetrating fully into a confined aquifer at a rate of 25 lit/sec. The drawdown measured in an observation well located at 47 m from the pumping well during the test is as given below. Determine T and S of the aquifer, Using Cooper-Jacob method.

Time (hrs)	0.55	1.85	2.75	5.45	9.05	12.05	18.05	30.05
Drawdown(m)	0.095	0.299	0.387	0.60	0.701	0.790	0.916	1.11

CT-03

Time-20 minutes

Q.01. Write the specification for designing a water well [10.0]

Q.02 From analysis of a boring data for constructing a deep tube well in RUET, it was found that the coarse sand layer lies between 118 ft to 148 ft from the ground level. If the desired discharge is 900 lpm, assume diameter of well, then find the length of screen and check the entrance velocity [10.0]

a)when artesian aquifer

b)when water table aquifer