

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Special Exam), Jan.-Feb. 2016

B. Tech in Civil Engineering, Semester V

Roll No.....

CE510 : Hydrology and Water Resource Engineering

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Q.1A Objective type multiple choice questions (10 questions @ 1 mark) 10

- i. A recording type rain gauge
 - A. produces a mass curve of rain fall
 - B. records the cumulative rain
 - C. is sometimes called integrating rain gauge or continuous rain gauge
 - D. all the above.
- ii. The surface Run-off is the quantity of water
 - A. absorbed by soil
 - B. intercepted by buildings and vegetative cover
 - C. required to fill surface depressions
 - D. that reaches the stream channels
- iii. Precipitation caused by lifting of an air mass due to the pressure difference, is called
 - A. cyclonic precipitation
 - B. convective precipitation
 - C. orographic precipitation
 - D. none of these.
- iv. Pick up the correct equation from the following :
 - A. Run off = Surface run off + Ground water flow
 - B. Run off = Surface run off - Ground water flow
 - C. Run off = Surface run off / Ground water flow
 - D. Run off = Surface run off x Ground water flow.
- v. Hydrology helps in.
 - (a) predicting maximum flows
 - (b) deciding the minimum reservoir capacity
 - (c) forecasting the availability of quantity of water at reservoir site
 - (d) All the above.

VI. The correct match of **Group-I** with **Group-II** is

Group-I	Group-II
P. Evapotranspiration	1. Penman method
Q. Infiltration	2. Snyder's method
R. Synthetic unit hydrograph	3. Muskingum method
S. Channel Routing	4. Horton's method

(A) P-1, Q-3, R-4, S-2

(B) P-1, Q-4, R-2, S-3

(C) P-3, Q-4, R-1, S-2

(D) P-4, Q-2, R-1, S-3

- vii. Two and half centimeters of rain per day over an area 200 Km^2 is equivalent to average rate of input of how many cubic meters per second of water to that area?
a) 57.87 b) 5.787 c) 0.57 d) 0.057
- viii. The ordinates of a 3-h unit hydrograph at 1 hour intervals starting from time $t = 0$, are 0, 3, 8, 6, 3, 2 and $0 \text{ m}^3/\text{s}$. Use trapezoidal rule for numerical integration, if required. What is the catchment area represented by the unit hydrograph?
(A) 1.00 Km^2 (B) 2.00 Km^2 (C) 7.92 Km^2 (D) 8.64 Km^2
- ix. A small catchment of area 150 ha received a rainfall of 10.5 cm in 90 min . due to a storm. At the outlet of the catchment. The stream draining the catchment was dry before the storm and experienced a runoff lasting for 10 hours within an average discharge of $1.5 \text{ m}^3/\text{s}$. The stream of again dry after the runoff event. The ratio of runoff to precipitation is?
(a) 0.29 (b) 0.30 (c) 3.43 (d) 0.343
- x.

Q.2 Short answer type questions (4 questions @ 2.5 marks)

10

- a. A precipitation station X was inoperative for some time during which a storm occurred. At three station A, B and C surrounding X the total Precipitation recorded during this storm are 75, 58 and 47 mm respectively. The normal annual precipitation amount at the station X, A, B and C are respectively 757, 826, 618 and 482 mm. estimate the storm precipitation for station X.
- b. The rainfall during three successive 2 hour periods are 0.5, 2.8 and 1.6 cm. the surface runoff resulting from this storm is 3.2 cm. find out the ϕ index value for this storm.
- c. Explain various types of perception.
- d. Hourly rainfalls of 25, 60 and 35 mm occur over a 20 ha area consisting 4 ha of $\phi = 50 \text{ mm/hr}$, 10 ha of $\phi = 30 \text{ mm/hr}$ and 6 ha of $\phi = 10 \text{ mm/hr}$. derive hourly values of rainfall excess (or net rain).

Q.3A How will you determine the areal mean rainfall over the a basin by (i) arithmetic mean method (ii) thiessen polygon method (iii) Isohyetal method .support your answer with illustrative sketches.

05

Q.3B With a neat sketch, describe various zones of storage in a reservoir and density current. Also suggest measures to control reservoir sedimentation and how do you estimate the probable life of reservoir.

05

Q.4A Enumerate the different type of rain gauge and describe with a neat sketch. The construction and function of the non-recording type of gauge being used in India.

05

Q.4B A 30 cm well completely penetrate an unconfined aquifer of depth 40 m. after a long period of pumping at a steady rate of 1500 lpm, the drawdown in two observation wells 25 m and 75 m from the pumping well were found to be 3.5 m and 2.0 m respectively. Determine the transmissibility of the aquifer .what is the drawdown at the pumping well?

05

- Q.5A Given below are the monthly rainfall & corresponding runoff value for a period of 10 months. Develop a correlation Between Runoff & rainfall (R & P). 05

Month	I	II	III	IV	V	VI	VII	VIII	IX	X
P	04	22	28	15	12	8	4	15	10	5
R	0.2	7.1	10.9	4	3	1.3	0.4	4.1	2.0	0.3

- Q.5B The normal annual rainfall depth recorded of five rain gauge station A,B,C,D and E are 910,1070,1410,810 and 590 mm respectively. Determine the optimum number of rain gauge stations to be established in the drainage basin if it is desired to limit the error in the mean value of rainfall to 10% .what is the percentage accuracy of the exciting network in the estimation of the average depth of the rainfall over the basin? 05

- Q.6A What is unit hydrograph? What are the basic proposition of the unit hydrograph theory? What are the limitations of the unit hydrograph theory? 05

- Q.6B For a river the estimated flood peaks for two return period by the use of Gumbel's method are given below 05

Retune period	Peak flood (m ³ /s)
100	485
50	445

What flood discharge in this river will have a return period of 1000 years?

OR

- Q.6B Estimated the average depth of precipitation, from depth-area curve ,that may expected over an area of 2400 sq. km, due to the storm of 27 September 2015,lasting for 24 hours, assuming the storm center to be located at the center of the areas enclosed between different isohyets as follows : 05

Isohyet in mm	21	20	19	18	17	16	15	14	13	12
Enclosed area in sq. km	543	1345	2030	2545	2955	3280	3535	3710	3880	3915

Hence determine the depth of rainfall due to the storm that may be expected to be recorded by rain gauge placed at the storm center.

- Q.7A An Avg. rainfall of 16 cm occurs over a catchment during a period of 12 hours. Unit hydrograph of 6 hour duration rises linearly from 0 to 30 cumec in 6 hour and then falls from 30 to 0 in the next 12 hours. ϕ index of catchment is 0.5 cm/hr and base flow in the river is 5 cumecs. Find out the peak discharge of direct runoff hydrograph and area of the catchment. 05

- Q.7B Explain clearly, 'design flood' and 'time of concentration'. 05

On the basis of isopluvial maps, the 50 years 24 hr maximum rainfall at JAIPUR is found to be 16 cm. determine the probability of 24 hr rainfall of magnitude equal to or greater than 16 cm occurring at JAIPUR.

(a) atleast once in 10 successive year

(b) two times in 10 successive years

OR

- Q.7B What is the hydrological cycle? Give a brief description of different Components of a hydrologic cycle with neat sketch. 05

Q.8A In a catchment, there are four rain - gauge stations, P, Q, R, and S. Normal annual precipitation values at these stations are 780 mm, 850 mm, 920 mm, and 980 mm, respectively. In the year 2013, stations Q, R, and S, were operative but P was not. Using the normal ratio method, the precipitation at station P for the year 2013 has been estimated as 860 mm. If the observed precipitation at stations Q and R for the year 2013 were 930 mm and 1010 mm, respectively, what was the observed precipitation (in mm) at station S for that year? 10

Q.9A What are "Tile drains "and how do they help in preventing water logging? 7+3
In a tile drainage system, the drains are laid with their center 1.5 m below the ground level. the impervious layer is 9.0 m below the ground level and the average annual rainfall in the area is 80 cm. if 1% of the annual rainfall is to be drained in 24 hours to keep the highest position of the water table to 1 meter below ground level, determine the spacing of the drain pipes .coefficient of permeability may be taken as 0.001 cm/sec.

Q.9B A 30 minute unit hydrograph for a catchment is given in table below3.1 .the ϕ index is 4 mm/hour .the storm details are given in table 3.2 .obtain the runoff hydrograph for the storm. 10

Table 3.1

Time (min)	0	30	60	90	120	150	180	210	240	270	300	330	360	390
Runoff(m3s-1)	0	1.2	2.8	1.7	1.4	1.2	1.1	0.91	0.74	0.61	0.5	0.28	0.17	0

Table 3.2

TIME (min)	0-30	30-60	60-90
Rainfall(cm)	3.3	2.7	1.9

OR

Q.9B Write short note on any four : 2.5*4
(a) Meandering and its causes.
(b) Waterlogging and its ill-effects.
(c) non- recording rain gauge
(d) Reservoir sedimentation
(e) Thiessen Polygon method