BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
SECOND SEMESTER 2021-2022
COMPREHENSIVE EXAMINATION-ENGINEERING HYDROLOGY (CLOSE BOOK + OPEN BOOK)

Course No: CE F321 **Date: 21-05-2022 (Sat)**
Duration: 180 min (8:00 – 11:00 AM) **Max. Marks: 90**

Instructions:
1. There are two parts. Part-A is close book (**40 marks, 60 min duration**) and Part-B is open book (**50 marks, 120 min duration**)
2. You will be given Part-B only after completing Part-A
3. In Part-B, show all calculations/steps in detail.

PART-A

(Maximum Marks: 40, Duration: 60 min)

First 20 questions carry 1 mark each and last 10 questions carry 2 marks each.

1. Rows of trees or shrubs planted to protect agricultural area from the wind and soil erosion is known as _____.
2. Ministry in India responsible for development and management of water is_____ _____.
3. In case of channel routing, the peak of the outflow hydrograph is obtained at the point of intersection with inflow hydrograph (True/False):_____.
4. The development activity that has contributed maximum soil erosion in Kerala is _____.
5. In which type of aquifer would you find rock lenses in unconfined zones:_____.
6. Groundwater levels in Pilani are below 800 ft (True/False):_____.
7. In Muskingum's equation, what does 'K' represent?_____.
8. What does RUSLE calculate?_____.
9. The purpose of sluice gate in dams is_____.
10. _____is the vertical distance of a dam crest above the maximum reservoir water level.
11. Limiting case of unit hydrograph with time tending to zero is known as_____.
12. _____hydrograph is derived from theory and experience and basin lag is calculated based on certain formula.
13. _____ portion of the hydrograph represents the time where basin contributes maximum to the outlet discharge.
14. Continuity and momentum equations for unsteady open channel flow are called as _____.
15. In groundwater, actual velocity of flow and discharge velocity are same (True/False): _____.

16. Flow mass curve is an integral curve of hyetograph (True/False):_____.
17. Geological formation that can neither transmit water nor store water is known as _____.
18. Ratio of sediment yield at the outlet to the gross erosion is known as_____.
19. _____is the most prominent contaminant in the groundwater of Pilani.
20. _____ project estimates soil erosion and water runoff occurring on hill slopes in Iowa and surrounding states in USA.
21. _____and _____ are the two most important properties of an aquifer.
22. Degradation, _____ , and _____ are the three processes occurring during soil erosion.
23. When a forest land is converted to urban region, peak of the hydrograph _____and the lag time_____.
24. Two prominent mechanical ways to control gulley erosion are _____ and _____.
25. _____and _____ are two types of storages in channel routing.
26. _____ is part of a river or channel where there is a sharp change in channel slope, such as a waterfall or lake.
27. _____ and_____ are two methods used for separating base flow in a hydrograph
28. Effective rainfall includes _____ and_____.
29. _____ and _____ are two primary assumptions of a unit hydrograph.
30. In a S-curve, the formula for finding equilibrium discharge in m^3/s is _____.

Please submit Part-A in first 60 minutes. All the best!

PART-B

(Maximum Marks: 50, Duration: 120 min)

Each question carries 10 marks.

Q1. Muzaffarnagar city in Uttar Pradesh has both River Ganga (A) and River Yamuna (B) flowing across its landscape. At a particular region in Muzaffarnagar, Ganga and Yamuna are separated by an aquifer formation of 5.3 km. The water levels are 22 m in River Ganga and 13 m in river Yamuna.

a. Compute the seepage flow per unit length (**in m^3/day**) of the river if K is 18 m/day

b. What would be the seepage flow per unit length (**in m^3/day**) of the river when a horizontal layer of 1 m thick is located at a height of 7 m from the bottom impervious layer. Take K in the upper unconfined region and lower confined region as the same i.e., 18 m/day.

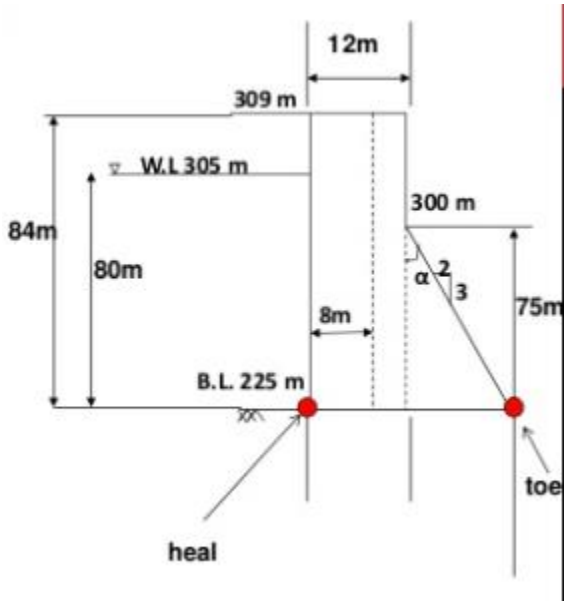
c. What would be the seepage flow per unit length (**in m^3/day**) of the river if a clay layer 1 m thick is sloping from 10 m level at one end of the aquifer to 6 m level at the other end.

Q2. Design the gravity dam and check its stability against tension, overturning, sliding. Assume that forces acting are water pressure, uplift pressure and self-weight. Show values of forces and moments in a table.

Density of concrete = 2400 Kg/m^3

Take unit weight of water as 10KN/m^3

The dotted lines in the diagram represents a drainage gallery. Take uplift pressure at heel = 100%, Toe = 0% and drainage gallery = 50%



Q3. A 2-hour Unit Hydrograph coordinates are given below.

Time (hr)	0	2	4	6	8	10	12	14	16	18	20	22
2-h UH (m^3/s)	0	20	60	150	120	90	70	50	32	20	10	0

(i) Find the coordinates of 3-hr UH from the catchment. Interpolate all the middle values. Show all calculations in the form a Table.

(ii) If the area of catchment is 400 Km^2, find the equilibrium discharge

(iii) Draw a neat graph (without using graph paper), showing S-curve related to 2-h UH, 3-h UH and also the final 3-h UH. Provide approximate coordinates

Q4. The inflow and outflow hydrographs for a reach of a river are given below. Determine the value of the Muskingum coefficients K and x for the reach. Use graph paper and be very accurate in your calculations. Show all steps and describe the entire procedure clearly. (Hint: x could be any value between 0.20-0.50)

Time (hr)	0	24	48	72	96	120	144	168	192	216
Inflow (cumec)	35	125	575	740	456	245	144	95	67	50
Outflow (cumec)	39	52	287	624	638	394	235	142	93	60

Q5. The monthly inflow and contemplated demand of a small village located near Ganges River is given below. Determine the minimum storage required to meet the demand.

Month	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec
Monthly inflow (Mm^3)	50	40	30	25	20	30	200	225	150	90	70	60
Monthly demand (Mm^3)	70	75	80	85	130	120	25	25	40	45	50	60

Now, the mean monthly evaporation and rainfall are given below. Assuming the reservoir area to be 30 km^2, estimate the change in the storage requirement necessitated by the data given below. Also, assume the runoff coefficient of the area flooded by the reservoir as equal to 0.4.

Month	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec
Evaporation (cm)	6	8	13	17	22	22	14	11	13	12	7	5
Rainfall (cm)	1	0	0	0	0	19	43	39	22	6	2	1

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