Ref. No.: **Ex/CE/5/T /204/2024**

BACHELOR OF ENGINEERING (Civil Engg) 2024
SECOND YEAR 2ND SEMESTER EXAM 2024
SUBJECT :- HYDROLOGY

Time: 3 hours **Full Marks: 100.**

Answer any five (5) questions

Sl. No.	Question	CO	Marks
1	a) Explain briefly the need of study of Hydrology as a subject for civil engineering discipline. b) With the help of a neat sketch describe different components of hydrological cycle. c) The mean annual precipitation of a catchment is recorded as 950 mm.The area is 77000ha.If 22% loss is estimated due to afforestation for reduction of run-off what will be the volume of abstraction from all causes of same annual rainfall? Estimate the annual flow rate of the stream in m3/ d. Apply water budget equation.		[3+9+8]
2	(a)State and explain Darcy's Law for groundwater flow. How we can get the definition of hydraulic conductivity from the above law? (b) A 250mm gravel packed well is pumping at the rate of 1250 lit/min in a confined aquifer of thickness 60.0m The gravel pack is 150 mm thick with d_{10} = 0.35mm and d_{50} = 0.50mm. the region for which Darcy's law is valid given as Re= 2 Assume ν= 1.0×10^{-6} m^2/sec. Check also the application validity of Darcy's law C) A reservoir with a surface area of 400 Ha has the following climatological data for a given week i)Temperature 28^{o}C ii) Relative humidity 60% iii) Wind velocity at 1.2m above G.L. 8km/hr iv)Mean barometric reading 760mm of Hg, E_w 30.82 mm Hg Estimate the average daily evaporation from the lake and the the volume of water to be evaporated from the lake during the week in m3.. Use Meyers and Rohwers equation to solve the problem.		[2+3] [7] [8]
3	a) Derive an expression for steady state radial flow into a well under confined aquifer condition. b) A 200 mm dia well penetrates fully an unconfined aquifer of depth 40 m below the static water table. After 24 hrs of pumping @ 2000 Lts / min the drawdown in two observation wells located at 30m and 60m from pumping well are found to be 5.65 cm and 2.15m respectively..Estimate (i) Permeability (K) (ii) Transmissibility Coefficient (T) (iii) Drawdown in the pumping well.		[10] [10]

[Turn over

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a) In an watershed area there are five (5) non recording rain gauge stations . The average annual rainfall values at these stations are 100,120,185,90.130cm respectively. Determine the optimum number of such type of rain gauge stations for the water shed if 10 percent error is allowed in mean value of rainfall . [5]

b) Enumerate different forms of precipitation. [4]

c) Explain briefly Isohyetal method for measurement of mean precipitation data around a watershed. [4]

d) Find the average rainfall over a catchment with Thiesen polygon method using following data [7]

Station	Rainfall in cm	Area enclosed by polygon km2
1	10	o.22
2	20	4.02
3	30	1.35
4	40	1.60
5	50	1.95

5..

a)What is hydrograph ? Draw a typical flood hydrograph mentioning all component of the parts. How base flow is separated to obtain an unit hydrograph? [2+6]

b) Given below are observed from a storm of 6-h duration on a stream with a catchment area of 120 km 2.

Time in h,	0	6	12	18	24	30	36	42	48	54	60	66	72
Flow In m3 /sec	0	100	250	200	150	100	70	50	35	25	15	5	0

[9]

Assuming base flow is zero, derive the ordinates of 6-h unit hydrograph and draw also DRH , UH and FLOOD HYDROGRPH. [3]

c) Define catchment with sketch.

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a) What do you understand by Run-off for a catchment? What are natural flow and delayed underflow ? [2 +4]

b)The mean monthly rainfall and temperature of a catchment near Patna are shown below : Estimate the annual runoff volume and the corresponding run-off coefficient by Khoslas run off formula [6]

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Temp (^{0}C)	24	27	32	33	31	26	24	24	23	22	21	20
Rainfall (mm)	7	9	11	45	107	71	106	132	158	145	65	15

c) Observed rainfall and Runoff on annual basis are given in following Table. Develop the rainfall-runoff correlation equation for this catchment. Also estimate the correlation coefficient .If the the annual rainfall is 100 cm what will be the annual run off ?

[8]

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017
Annual Rainfall (cm)	90	111	38.7	130	145.5	99.6	145.8	61	120.2
Annual Run- off (cm)	32	50.7	6.6	65	76.5	43	67.8	8.4	49.8