JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF SPARTIAL PLANNING AND NATURAL RESOURCE MANAGENT

UNIVERSITY EXAMIMATION FOR THE DEGREE IN SCIENCE IN WATER RESOURCES MANAGEMENT

3RD YEAR 1ST SEMESTER 2022/2023 ACADEMIC YEAR

CENTRE: MAIN CAMPUS

COURSE CODE: PNB 1309

COURSE TITLE: SURFACE HYDROLOGY

EXAM VENUE: **STREAM: BSc. WRES MGT**

DURATION: 2 HOURS

Instructions

1. **Answer question 1 (Compulsory) and ANY other two questions**
2. **Candidates are advised not to write on question paper**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room.**

QUESTION ONE

a) With the aid of a neat sketch, describe the hydrologic cycle and state any one kind quality water changes in each phase of hydrologic cycle

(6 Marks)

b) Explain how the following human activities may influence the mechanism of hydrologic cycle.
   i. Afforestation
   ii. Urbanization

(6 Marks)

c) Four rain gauges located within a rectangular area with four corners at (0,0) ; (4,0) ; (4,4) and (0,4) have the coordinates and recorded rainfalls as shown in Table 1.

Table 1

Rain gauge location	Annual rainfall (cm)
(1,1)	50
(3,1)	60
(3,3)	40
(1,3)	50

All coordinates are expressed in km

Answer the following:

   i. Compute average areal rainfall by Thiessen polygon method
   ii. Compare results of Thiessen polygon and unweighted mean for this case.
   iii. State TWO disadvantages of Thiessen polygon method.

(8 Marks)

QUESTION TWO

a) Explain how the following meteorological factors affect evaporation
   i. Temperature of water and air.
   ii. Wind velocity
   iii. Solar radiation
   iv. Quality of water

(8 Marks)

b) State any **THREE** methods for reducing reservoir evaporation loss.

(6 Marks)

c) Estimate the monthly change in storage in **metres** of a reservoir in the month of April of certain year using the following data:
   - Surface area of the lake is 150ha
   - Inflow during the period of April is $1m^3/s$,

- Outflow during the period April is $0.80m^3/s$
- Total seepage loss is 2cm for April.
- The total monthly precipitation in the month of April is 3cm and
- The total evaporation loss in the month of April is 8cm.

(6 Marks)

QUESTION THREE

a) With the aid of neat sketches, distinguish between influent and effluent streams
(5 Marks)

b) Using data in Table 3b, compute river discharge by mid-section method. Assume that current meter equation is given by V=a+bN (a=0.1 and b=2.2, N-rev/sec). Also assume that velocities at 0.8D are half those recorded at 0.2D

Table 3b

Distance from bank(m)	Total depth (m)	Revolutions at 0.2D	Time (sec)
0.6	0	-	-
1.2	1.07	22	55
1.8	1.58	28	53
2.7	1.92	32	58
3.4	1.34	28	45
4.0	0.67	22	50
4.6	0.24	12	49
5.2	0	-	-

(10 Marks)

c) Estimate a river discharge using integration method on the basis of data given in Table 3c, if 20kg of tracer was initially dumped in the stream at 0800hrs. Assume the background concentration of tracer in the river before gauging exercise was zero.

Table 3c

Time(hrs)	0800	0830	0900	0930	1000	1030	1100	1130	1200	1230
Concentration at the Downstream stn mg/l	0	0	2.5	6.5	12.5	8.5	7.5	2.5	1.0	0

Time(hrs)	1300	1330	1400	1430
Concentration at the Downstream stn mg/l	0	0	0	0

(5 Marks)

QUESTION FOUR

a) State six idealized assumptions in analyzing steady radial flow to a well.

(6 Marks)

b) Arguing from Theis expression, derive Jacob's straight line drawdown–time expression for:
   i. Transmissivity
   ii. Storativity

(8 Marks)

c) A 300mm diameter well is pumped at a uniform rate of $0.04m^3/s$, while observations of drawdown are made in a well 30m away. Values of time (t) and drawdown (z) are given in Table 5. Evaluate aquifer transmissivity (T) and storativity (S) using Cooper-Jacob graphical approach.

Table 4

T (hrs)	1	2	3	4	5	6	8	10	12	18	24
Z(m)	0.6	1.4	2.4	2.9	3.3	4.0	5.2	6.2	7.5	9.1	10.5

(6 Marks)

QUESTION FIVE

a) State any SIX accepted measures for reducing floods.

(6 Marks)

b) "Sediment mitigation in reservoirs can be effectively be carried out if appropriate actions are taken at both basin and reservoir site level." Discuss this statement in reference to THREE actions of your choice.

(6 Marks)

c) A 4-hr UH is given in Table 5. Answer the following:
   i. Derive 8-hr UH
   ii. Estimate the change in peak discharge and base period between UH in Table 5 and UH derived in 5b(i)

Table 5: Ordinates of a 4-hr UH

Time (hr)	0	2	4	6	8	10	12	14	16	18	20
Inflow (m^3/s)	0	9	19	20	14	12	8	5	3	1	0

(8 Marks)