

**FEDERAL UNIVERSITY OF TECHNOLOGY, OWERRI**  
**SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY**  
**CIVIL ENGINEERING DEPARTMENT**  
**HARMATTAN SEMESTER EXAMINATION, 2019/2020 SESSION**  
**CIE 421 (APPLIED CIVIL ENGINEERING HYDROLOGY) TIME: 2 HOURS**  
**INSTRUCTION: ANSWER TWO QUESTIONS FROM EACH SECTION**

**SECTION A**

- 1(a) Sketch a typical natural hydrograph and discuss the various components. (6 marks)
- (b) State the Manning's formula for discharge capacity and explain the terms in the formula. (6mks)
- (c) What is the effect of a high value of n in the Manning's formula? (3 marks)
- 2 (a) What is a Unit Hydrograph. (3 marks)
- (b) List the various components that contribute to stream flow. (4 marks)
- (c) From the study of a storm, the ordinates of a 2hr unit hydrograph are obtained as given in Table Q2. From this Table, obtain a 6hr unit hydrograph. (8 marks)

**Table Q2**

Time(hrs)	0	2	4	6	8	10	12	14	16	18	20	22	24
Flow(m <sup>3</sup> /s)	0	7	20	40	29	17	11.5	7	5.5	3.5	3	2	0

- 3(a) A storm occurred on a drainage area of 350km<sup>2</sup> and discharges observed at 6hr intervals are shown in Table Q3. Assuming a constant base flow of 10m<sup>3</sup>/s, obtain the ordinates of the unit hydrograph. Also determine the effective rainfall depth. (9 marks)

**Table Q3**

Time(hrs)	0	6	12	18	24	30	36	42	48	54	60	66	72
Flow(m <sup>3</sup> /s)	18	135	285	210	175	125	95	80	65	50	35	25	18

- (b) Explain the following terms; (i) Influent Streams, (ii) Intermittent Streams, (iii) Perennial Streams (6 marks)

3)  $A = 350 \text{ km}^2$   
 $T = 6 \text{ hr}$   
 Base flow =  $10 \text{ m}^3/\text{s}$   
 Unit hydrograph

**Section B**

5. (a) Explain the following terms:

(I) Specific yield (II) Transmissibility (III) Storage coefficient (IV) Specific storage

(b) Differentiate between water table and piezometric surface

(c) A 0.30m diameter well penetrates 25m below the static water table. After one day of pumping at 5400litres/min, the water level in a test well at 90m is lowered by 530mm, and in a well 30m away the drawdown is 1110mm.

(i) What is the transmissibility of the aquifer?

(ii) Also determine the drawdown in the main well.

6. (a) Write short note on the following:

Aquifer  
 Aquiclude  
 Aquifuge  
 Aquitard

(I) Aquifer (II) Aquiclude (III) Aquifuge (IV) Aquitard

(b) Derive Dupuit-Thiem's equation for the yield of a well penetrating an unconfined aquifer. What are the basic assumptions of the theory? Diagram is essential.

(c) A 40cm diameter gravity well whose bottom is 8000cm below the undisturbed ground water table, was pumped at a steady rate of  $1.50\text{m}^3/\text{min}$ . The drawdown observed in two observation wells at radial distances of 5m and 15m are, respectively, 4m and 2m. Determine the drawdown in the well.

6. (a) What considerations would you have while selecting the site for a stream gauging station?

(b) Discuss the area-velocity method for measurement of discharge of a river.

(c) The following data were collected at a gauging station on a stream. Compute the discharge by the mean - section method.

Distance from bank (m)	0	3	6	9	12	15	18	21	24	27
Water depth (m)	0	1.5	3.2	5.0	9.0	5.5	4.0	1.6	1.4	0
Mean velocity (m/s)	0	0.12	0.24	0.25	0.26	0.24	0.23	0.16	0.14	0