THE TECHNICAL UNIVERSITY OF KENYA

FACULTY OF ENGINEERING & THE BUILT ENVIRONMENT

SCHOOL OF INFRASTRUCTURE & RESOURCE ENGINEERING

DEPARTMENT OF CIVIL & CONSTRUCTION ENGINEERING

DEGREE OF BACHELOR OF ENGINEERING, CIVIL ENGINEERING

END OF SEMESTER 2 YEAR 4 EXAMINATIONS APRIL 2015

EECQ 4242 ENGINEERING HYDROLOGY 1B

TIME 2 HOURS

INSTRUCTIONS

1. This question paper consists of **FIVE (5)** questions.
2. Answer Question One and any other two questions.
3. All answer to a new question should start on a new page.
4. All the calculation and assumptions must be clearly shown and stated.

QUESTION 1

1) Describe the principles of a unit hydrograph. How do these principles limit the applicability of unit hydrographs?(5marks)
2) Differentiate between hydrological and hydraulic routing?(2marks)
3) Differentiate between Prism storage and wedge storage in Muskingum theory.(2marks)
4) Write down the two main equations in hydraulic routing and describe each term. (2marks)
5). The highest annual floods for a river for 60 years were statistically analyzed. The sixth largest flood was 30,000 m^3/s. Determine:

a. The period in which the flood of 30,000 m^3/s may reoccur once (2marks)

b. The percentage chance that this flood may occur once or more in the next 20 years (2marks)

c. The percentage chance that a 50-yr flood may occur one or more times in 50 years (2marks)

6) How do you evaluate the risk in the design of a project which is designed for T year flood and whose life period is N years? (2 marks)

7) Define Environmental flows Ecohydrology and (4marks)

QUESTION 2

1) Could a 100 year flood occur in the next year after a 100 year flood has taken place? (2marks)

2) Why is Maximum probable flood not used for design? And what are the uses of Maximum probable flood? (2marks).

3) The maximum annual floods for the River Kiu were statistically analyzed for a period of 93 years (1876-1968). The mean annual flood and the standard deviation are 14210 m^3/s and 9700 m^3/s, respectively. Determine:

a. The recurrence interval of the highest flood 42500 m^3/s (in 1968) by Weibull's method and what its percentage chance of occurring in any year, and in 10 years? (6marks)

b. What is the recurrence interval of the design flood (49500 m^3/s) and the highest flood (42500 m^3/s) by Gumbel's method? (4 marks)

4) A barrier reservoir amortizes within 50 years. The accepted calculable risk of having a flood discharge in the next 50 years is 10%. Which return period must be used during the design of the reservoir? (4marks).

5) The annual floods for a large period were statistically analyzed by Gumbel's methods, which yielded average Q = 19000 m^3/s and a standard deviation of 3200 m^3/s. Determine (3marks)

a. The probability of a flood magnitude of 30000 m^3/s occurring in the next year.

b. The flood magnitude of 5-yr return period.

QUESTION 3

1) Why would a hydrograph have a very short lag time? Go into detail about the different factors. (4 marks)

2) Explain the differences in discharge between the urban and a wooded rural hydrographs following a rain storm. (5 marks)

3) What do you understand by 'a 6-hour unit hydrograph'? A steady 6-hour rainfall with intensity of 4 cm/hr produces a peak discharge of 560 m^3/s. The average storm loss can be assumed as 1 cm/hr and base flow 20 m^3/s. What is the peak discharge of the unit hydrograph and its duration? On the same basin, determine the peak discharge from a 6-hour rainfall at intensity of 3.5 cm/hr assuming an average loss rate of 1.5 cm/hr and base flow of 15 m^3/s. (6 marks)

4) The ordinates of a hydrograph at a section of a steam having a drainage area of 200 km^2 are tabulated as shown below. Derive the unit hydrograph. (5marks)

Time (hours)	0	10	20	30	40	50	60	70	80	90	100
Flow (m^3/s)	2	2.5	17	33	27	20	12	7	3.5	1.5	1

QUESTION 4

1) What is flood routing and what are the uses of flood routing? (5marks)

2) Route the flood hydrograph given below through a channel reach and derive the outflow hydrograph and determine the attenuation and the travel time. Also show the water leaving the storage and the water entering the storage. The various values of K and x for the reach may be taken as 36 hrs and 0.15 respectively and C_0= 0.02, C_1=0.31, C_2=0.67.(15marks)

Time (hours)	0	12	24	36	48	60	72	84	96	108	120	132	144	156	168
Flow (m^3/s)	42	45	88	272	342	288	240	198	162	133	110	90	79	68	61
Time (hours)	180	192	204	216	228	240									
Flow(m^3/s)	56	54	51	48	45	42									

QUESTION 5

1) Explain the principles of Ecohydrology. (6 marks)

2) Explain the environmental flow assessment methodologies and show their advantages and disadvantages. (8 marks)

1) What are the challenges of implementing successful environmental flows? (6 marks)