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**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY SCHOOL OF SPATIAL PLANNING**

**UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN WATER RESOURCE AND ENVIRONMENTAL MANAGEMENT**

**SEMESTER 2016/2017 ACADEMIC YEAR**

**CENTRE: MAIN CAMPUS**

**COURSE CODE: PWE 3313**

**COURSE TITLE: SURFACE HYDROLOGY**

**EXAM VENUE: STREAM: SPATIAL PLANNING**

**DATE: EXAM SESSION:**

**TIME: 2 HOURS**

**Instructions:**

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

**QUESTION ONE [30 marks]**

1. Using a suitable sketch explain the importance of the various phases of the hydrologic cycle in the assessment of the water resources potential of a catchment.

**[7 Marks]**

1. Discuss man’s influence on hydrologic cycle in respect to:
2. Water quality
3. Water quantity
4. Water ecology

**[7 marks]**

1. Describe the various forms of precipitation

**[5 marks]**

1. With the aid of a sketch describe permanent stream gauging station as a method of measuring stream flow.

**[4 marks]**

1. Describe the principle of working of a tipping bucket type recording rain gauge with a neat sketch. What are its advantages and disadvantages?

**[7 marks]**

**QUESTION TWO [20 marks]**

1. Describe a procedure for depth area duration analysis of storm

**[7 marks]**

1. Describe an empirical equation for depth area duration curve.

**[3 marks]**

1. A storm of 24 hours duration occurring in a catchment produces the following isohyets:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Isohyets [in cm] | 7.5 | 7 | 6.5 | 6 | 5.5 | 5 | 4.5 | 4 | 3.5 |
| Enclosed area [in km2] | 11 | 39 | 49 | 55.5 | 75 | 97.5 | 125 | 150 | 177.5 |

Compute the depth area duration (DAD) curve of this 24 hours storm.

**[10 marks]**

**QUESTION THREE [20 marks]**

1. The current meter observations taken during the gauging of a stream are given in the following table. The current meter rating may be taken a v=0.05+0.3N. Compute the discharge in the stream.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distance from bank ,m | Depth of flow  m | Meter depth | No. of revolutions | Time in seconds |
| 1.0 | 0.5 | 0.3 | 12 | 48 |
| 1.8 | 1.0 | 0.8 | 23 | 52 |
| - | - | 0.2 | 36 | 51 |
| 2.6 | 1.6 | 1.28 | 27 | 54 |
| - | - | 0.32 | 41 | 60 |
| 3.2 | 2.0 | 1.60 | 33 | 58 |
| - | - | 0.40 | 45 | 62 |
| 3.8 | 2.0 | 1.60 | 32 | 58 |
| - | - | 0.44 | 44 | 60 |
| 4.4 | 1.8 | 1.44 | 28 | 53 |
| - | - | 0.36 | 42 | 58 |
| 5.2 | 1.2 | 0.96 | 24 | 50 |
| - | - | 0.24 | 35 | 50 |
| 6.0 | 0.6 | 0.36 | 14 | 45 |
| 6.8 | 0.0 | - | - | - |

**[12 marks]**

1. Draw the rating from the stage – discharge relationship from the table below. Assume the value of zero discharge to be 20.50 m3/sec. Determine the stage of the river corresponding to a discharge of 2600 m3/s.

|  |  |  |  |
| --- | --- | --- | --- |
| Stage [m] | Q [m3/s] | Stage [m] | Q [m3/s] |
| 21.95 | 100 | 24.05 | 780 |
| 22.45 | 220 | 24.55 | 1010 |
| 22.80 | 290 | 24.85 | 1220 |
| 23.00 | 400 | 25.40 | 1300 |
| 23.40 | 490 | 25.15 | 1420 |
| 23.75 | 500 | 25.55 | 1550 |
| 23.65 | 640 | 25.90 | 1760 |

**[8 marks]**

**QUESTION THREE [20 marks]**

1. Describe the isohyetal method of computing average rainfall including their advantages and limitations.

**[6 marks]**

1. Thiessen polygons constructed for a network of rain gauge stations in a basin yielded Thiessen weights of 0.10, 0.16, 0.12, 0.11, 0.13, 0.15, 0.14, 0.18, 0.08 and 0.07. If the rain gauges recorded rainfalls of 152, 135, 185, 160, 226, 178, 154, 180, 188 and 160mm during a storm,
2. Determine the average depth of rainfall over the basin by the Thiessen polygon method
3. Potential volume of surface runoff at the basin outfall if losses account for 45% of runoff

Take area of basin as 7500 km2

**[7 marks]**

1. Describe the following factors affecting runoff:
2. Physical factors
3. Climatic factors

**[7marks]**

**QUESTION FOUR [20 marks]**

1. Describe factors considered when selecting a stream gauge station.

**[5 marks]**

1. The following are rates of rainfall for successive 20 minutes period of 140 minutes storm 5.0, 5.0, 20.0, 15.0, 2.50, 10.0 cm/hr. taking the value of Ø-index as 6.4 cm/h, find out the net runoff in cm.

**[4 marks]**

1. Describe Horton’s equation for defining the rate curve of infiltration capacity.

**[2 marks]**

1. Describe the components of a hydrograph of isolated storm

**[4 marks]**

1. Describe physical methods of mitigating storm water

**[5 marks]**

**QUESTION FIVE [20 marks]**

1. Discuss the role of river basin planning

**[5 marks]**

1. Discuss a river basin management planning process

**[5 marks]**

1. Discuss methods of sediments control in a reservoir

**[5 marks]**

1. Describe trap efficiency and factors on which this trap efficiency depend

**[5 marks]**