

National Exams May 2012

04-For-A5, Forestry Hydrology

3 hours duration.

NOTES:

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.
2. This is a CLOSED BOOK EXAM.
A Casio or Sharp approved calculator is permitted.
3. Credit points were labeled for each question. There are total 100 points.
4. Most questions require an answer in essay format. Clarity and organization of the answer are important.

04-For-A5 Forest Hydrology

1. Describe and explain the following term related to precipitation:
 - a. Frontal storm
 - b. Convective storm
 - c. Orographic rain
 - d. Rain shadow(2 points)

2. Explain the principles on how does solar radiation, wind speed and relative humidity affect water evaporation from a large lake? (2 points)

3. Compare the following terms and explain their differences and their relations
- a. Evaporation – Evapo-transpiration
 - b. Potential Evapo-transpiration - Actual Evapo-transpiration
 - c. Potential Evapo-transpiration – Water Surface Evaporation
 - d. Net precipitation – Gross precipitation
 - e. Return flow – Stream-flow
- (5 points)

4. Suppose you were required to estimate the average evapo-transpiration of a small watershed that has a full weather station installed within the watershed and a stream flow gauge installed at the outlet of the watershed. However, there are data gaps in both weather records and stream flow records. How would you solve the problem? (4 points)

5. Explain the difference between snow interception and rain interception. Consider the differences between conifer – deciduous forests. (3 points)

6. What is albedo? How does albedo affects snow melt? (2 points)

7. Calculate amount of snow that could be melt for a snowpack:
Snow depth 100cm; snow density = 0.1 g/cm^3 ; snow temperature = -20°C ; specific heat of snow = $0.5 \text{ cal/cm}^3/^\circ\text{C}$; heat of fusion = 80 cal/g ; total energy input to the snowpack = 250 cal/cm^2 . Assume that heat conductivity of snowpack is high and energy input is relatively slow. How much snow could be melted? (5 points)

8. Graph illustration of different components of a typical hydrograph, label and briefly explain. (4 points)

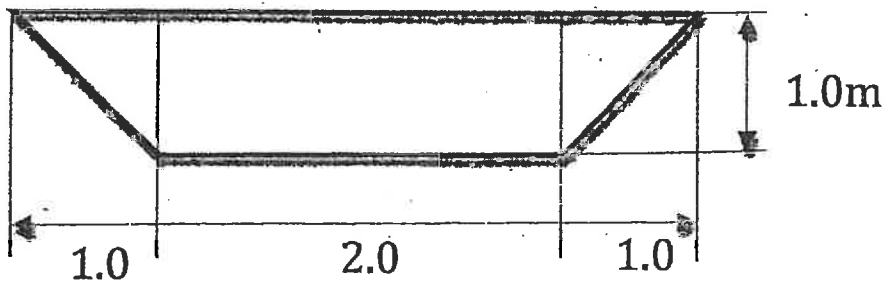
9. Describe a commonly used method to measure stream flow in small watershed? Could we use the same technology to estimate stream flow of large watersheds? Explain why. (4 points)

10. There is a commonly used empirical method to estimate streamflow in the following form:

$$V = \frac{R_h^{2/3} s^{1/2}}{n}$$

Please explain the term and units, suppose you are using SI system. (5 points)

11. Estimate flow rate of a stream with cross section illustrated below. Assume $n = 0.035$ and the water surface height difference is 0.10m at two points on the stream 20m apart. (5 points)



12. What is return period? Suppose you designed a culvert according to standard of 50 year events. However, your culvert had been washed out every year in the past two years and how would you explain to your manager? (5 points)

13. To select the size of culvert, what do you need to consider from hydrological point of view? What information do you need in order to have a proper choice? (5 points)

14. What is riparian zone? What is buffer zone, are they the same? Why? (4 points)

15. What are the main ecological and hydrological functions of riparian buffer zones? (5 points)

16. What are the current government regulations applicable to riparian buffer zone related to forest operations? (3 points)

17. From the environmental protection point of view, what are the impacts of forest clear cut on steep slopes? What is the most dangerous time that could have environmental hazard after clear cut on steep slopes? For example, 1 day after cut, 1 month after cut, 1 years after cut; 20 years after cut, and explain why. (5 points)

18. In regions like Maritime Canada with annual precipitation of 1000mm, will stream discharge increase or decrease after clear cut? Why? (4 points)

19. Compare a mature forest, a recent burned site, and recently clear cut, after a long-period of dry weather, which area will generate more surface run-off after a short and intensive rainfall? (2 points)

20. What are the major impacts of forest operation on aquatic habitat in a watershed with salmon and trout? (5 points)

21. What is the proper method for install a culvert in a fish-bearing stream? (4 points)

22. Soil compaction is considered to be a negative impact of forest operation on forest ecosystem. What is the impact of soil compaction from hydrological point of view? Please explain the impacts from hydrological processes. (4 points)

23. Use a graph to illustrate the hydrography differences in a watershed with forests, recent clear cut, and a land being converted into urban or agriculture use. (4 points)

24. What are impacts of clear cut on hydrograph related to snow melt? (4 points)

25. In order to protect water and aquatic habitat, government has special regulations regarding alteration of watercourse or wetland. List five things that could be considered as "alteration". (5 points)

