UNIVERSITI SAINS MALAYSIA

Second Semester Examination
2012/2013 Academic Session

June 2013

RLD 512 – Hydrology and Watershed
(Hidrologi dan Kawasan Tadahan)

Duration: 2 hours
[*Masa: 2 jam*]

Please check that this examination paper consists of SIX pages of printed material before you begin the examination.

Students are allowed to answer all questions either in English OR Bahasa Malaysia only.

Answer **ALL** questions.

In the event of any discrepancies, the English version shall be used.

1. Burning the forest can increase both water yield and stormflow discharge. The amount of increase depends on the intensity, severity, and frequency of burning and the proportion of the wateryield that is burned. Discuss the potential role of fire on:

   (a) interception,
   (b) infiltration, overland flow, erosion, and sedimentation,
   (c) soil-water storage,
   (d) evapotranspiration,
   (e) quantity of streamflow, and
   (f) peak flows.

   (10 marks)

2. On the map, identify the surface water divide with a pen or pencil. Using the numbers 1,2,3, etc. indicate the order of each of the streams in the basin using both systems of delineating stream order.

   (5 marks)

3. Determine the scale of the map. For example, 24,000 means: one inch on the map equals 24,000 inches on the ground. …… scale.

   (5 marks)

4. Determine the area scale of the map as follows:

   1 sq. inch on the map = 24,000 sq. inch on the ground.

   Convert to acres:

   The area scale for your map is …… acres.
   From the map, the area of the basin is …16.75. sq. in.
   Therefore, the basin contains …… acres.

   (10 marks)

5. Determine the following parameters:

   Lc - the total length of the channel system in the basin: ……. miles.

   Lb - the overall maximum basin length measured from the mouth …… miles.

   H - relief from the top of the basin to the mouth ……. ft.

   D - drainage density (you must first determine basin area)..…… miles/ sq. miles.

   (5 marks)

6. If mean annual precipitation on this watershed is 60 inches and 45 inches are lost by evapotranspiration, ……. Inches go into streamflow runoff. Remember, storage on a year to year basis approaches 0 inches.

(5 marks)

7. If the watershed produces 15 inches of runoff each year, then the stream flow is equal to …… af. or …… cfsm or …….. cfs-basin.

(5 marks)

8. The basin, therefore, produces…….Gallons/second or …….. gallons of water/day.

(5 marks)

Notes:

We will now characterize some of the flow characteristics of the basin:

1 square miles	=	640 acres (ac)
1 acre	=	43,560 sq. feet
1 cu. Ft	=	7.5 gallons
1 cu. Ft of water	=	62.4 pounds (lbs)

Area inches are often referred to as inches, meaning the gain or loss to any area or drainage basin expressed as a uniform depth of water over that area of basin. We are quite used to thinking of rainfall in this manner -- now you must get used to thinking of stream flow and evaporation from land areas in the same units. An area inch is a linear measure; it takes on the meaning of volume only when the area is specified.

Acre foot (af) is a measure of volumes equivalent to one level acre, one foot deep, or 43560 cubic feet – a convenient unit in water management, particularly in irrigation practice, because the land is measured in acres.

Cubic feet per second (cfs) is a rate of flow which delivers one cubic foot of water each second.

Cubic foot per second per square mile (cfsm) is a rate of flow per unit of watershed area, a customary way to express streamflow so that direct comparisons of flow rates, independent of area can be made. In other words you don't have to know the area of your basin to determine cfsm.

Cubic feet per basin (cfs –basin) is a volume measure specific to the area of the basin you are working with. It is determined by multiplying cfsm x sq. miles in the basin.

9. Calculate the time duration needed to operate a sprinkler system for a day when there are three days available in a week for the system to operate.

(10 marks)

Information data:

Soil - need 85mm of precipitation per week

Sprinklers - 50% sprinkler head spacing,
- Radius of throw 7 meter
- Operating pressure 1.9 bar
- Discharge : Full circle = 0.9 m^3/h

10. Calculate the water flow rate the pump need to deliver and its pressure required?

(15 marks)

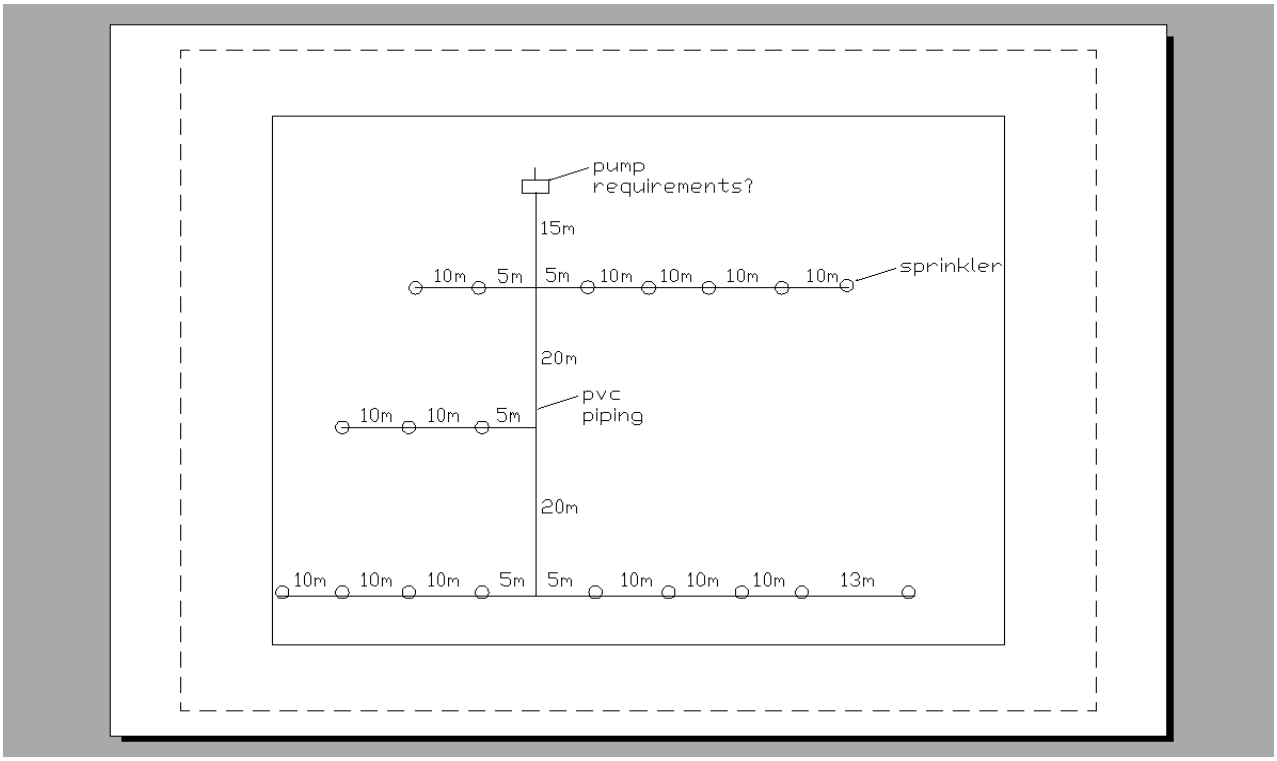
Design spesifications :

The pump is pumping up water from a well with the water level 8 meter below the pump.

19 nos. rotor pop-up sprinkler which require 0.28 l/s water flow, and 1.6 bar pressure each to operate.

All piping used Class 200 PVC, distance is in meter.

Assume pressure loss through all fittings are 10% of the piping pressure loss.



11. (a) Describe the fundamental principle of sustainable drainage systems currently being practiced in Malaysia. Comment on the importance of “control at source.”

(10marks)

(b) Describe similar drainage practices in other countries.

(5 marks)

12. (a) Flow area, wetted perimeter and hydraulic radius are the most common and basic terms used in hydraulic analysis and design. Define each of the terms.

(5 marks)

(b) What is “orifice” and describe its applications in drainage infrastructures and landscape architecture.

(5 marks)