



**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER I  
SESSION 2013/2014**

COURSE NAME : HYDROLOGY  
COURSE CODE : DAC 20902  
PROGRAMME : 1 DAA  
EXAMINATION DATE : DECEMBER 2013 /  
JANUARY 2014  
DURATION : 2 HOURS  
INSTRUCTION : ANSWER 4 (FOUR) QUESTIONS  
ONLY

THIS QUESTION PAPER CONSISTS OF SIX (6) PAGES

**Q1** (a) With the aid of sketches, explain the hydrologic cycle in nature indicating its various phases in **Figure Q1(a)**.

(6 marks)

(b) Explain briefly about water balance equation.

(4 marks)

(c) Refer **Table Q1(c)**, a swimming pool ( $4\text{m} \times 4\text{m} \times 1.5\text{m}$ ) has a small leak at the bottom. Measurements of rainfall, evaporation, and water level are taken daily for 5 days to determine what should be done for repair. Estimate the average daily leakage out of the swimming pool in  $\text{cm}^3/\text{day}$  where the pool is exactly 1.5 m deep at the end of day 1.

(5 marks)

(d) Determine the evaporation loss, in cm, over the lake for 10 days observation. The lake area is 121 ha, has  $0.43 \text{ m}^3/\text{s}$  of inflow,  $0.37 \text{ m}^3/\text{s}$  of outflow, total storage increase of 1.97 ha-m and infiltration loss is insignificant. A USGS gage next to the lake recorded a total of 3.3 cm precipitation for the lake for the month.

(10 marks)

**Q2** (a) Sketch and explain briefly about non recording precipitation gauge.

(10 marks)

(b) Refer **Table Q2(b)**, determine rainfall (cm) and rainfall intensity (cm/hour).

(15 marks)

- Q3** (a) Explain briefly about energy budget method. (6 marks)
- (b) List the compatible position to allocate the evaporation pan. (6 marks)
- (c) The drainage area of the Segamat River at Johore, is 12,900 km<sup>2</sup>. If the mean annual runoff is determined to be 155.5 m<sup>3</sup>/s and the average annual rainfall is 1.10 m, estimate the ET losses for the area. How does this compare with the lake evapotranspiration of 1 m/year measured at Pusu River, Selangor. (13 marks)
- Q4** (a) Sketch and label the paths of runoff. (10 marks)
- (b) Data of stream-gauging at a gauging site are given in **Table Q4(b)**. The rating equation of the current meter is  $v = 0.53 N_s + 0.07$  m/s. Calculate the discharge in the stream. (15 marks)
- Q5** (a) List **two (2)** factors that affecting hydrograph shape with example. (4 marks)
- (b) Sketch and explain briefly about straight line method. (6 marks)
- (c) Refer **Table Q5(c)**, the daily streamflow data for a particular catchment having an area of 6000 km<sup>2</sup>. Separate the baseflow using the intersection method ( $N = 0.8A^{0.2}$ ). Determine total of baseflow and direct flow. (15 marks)

**Q6** (a) Sketch and explain about flood routing process.

(9 marks)

(b) Route the inflow and outflow hydrograph tabulated in the **Table Q6(b)** where the inflow equals to outflow for the first day. Determine the coefficients  $K$  and  $x$  for use in the Muskingum routing equations for this reach.

(16 marks)

**Q7** (a) Sketch and label about groundwater sources.

(10 marks)

(b) The soil under the dam consists of four layers as shown in the **Figure Q7(b)**. Calculate the average conductivity (m/day) and transmissivity ( $m^2/day$ ) of the soil when water table is at the ground surface.

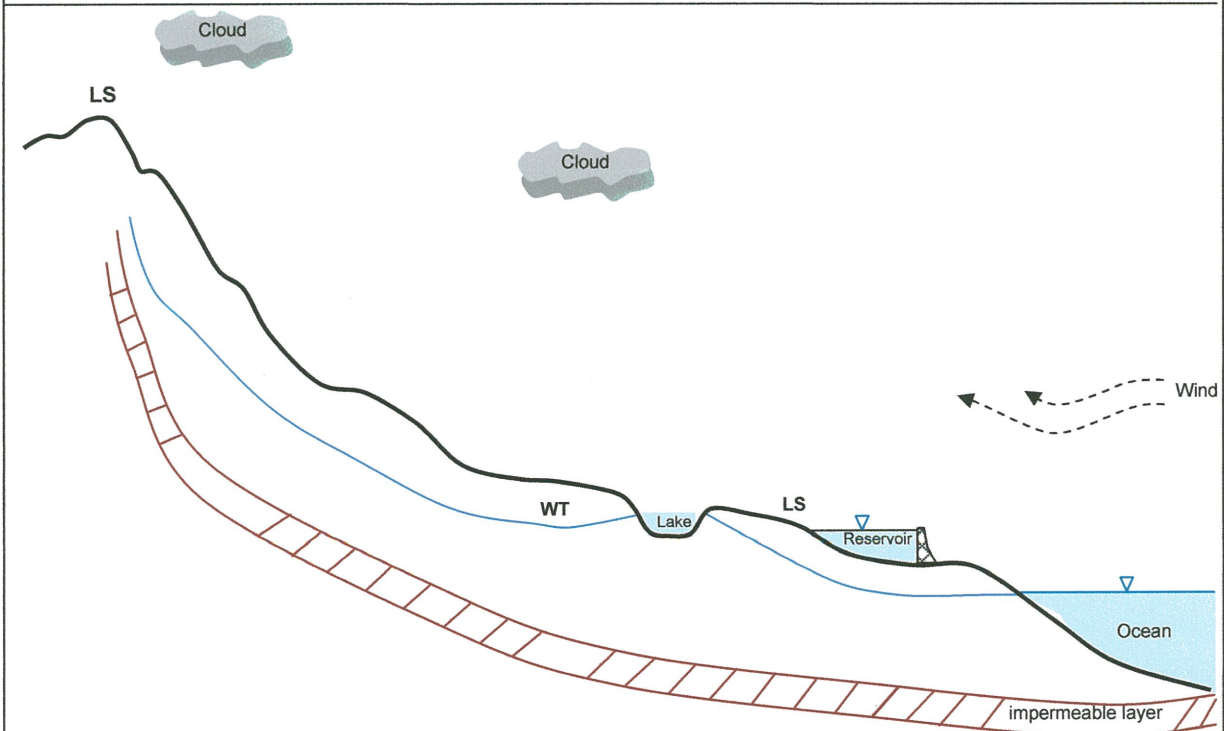
(15 marks)

**- END OF QUESTION -**

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**FIGURE Q1(a)**

**TABLE Q1(c) : Data of evaporation and rainfall**

| Day | Evaporation (mm) | Rainfall (mm) | Measured Level (mm) |
|-----|------------------|---------------|---------------------|
| 1   | 14               | -             | 1,530               |
| 2   | 0                | 26            | -                   |
| 3   | 13               | -             | -                   |
| 4   | 0                | 52            | -                   |
| 5   | 12               | -             | 1330                |

**TABLE Q2(b) : Rainfall data**

|                          |   |    |    |    |    |    |    |    |    |
|--------------------------|---|----|----|----|----|----|----|----|----|
| Time                     | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 |
| Cumulative Rainfall (mm) | 0 | 9  | 16 | 22 | 35 | 48 | 56 | 62 | 66 |

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**TABLE Q4(b) : Data of stream-gauging**

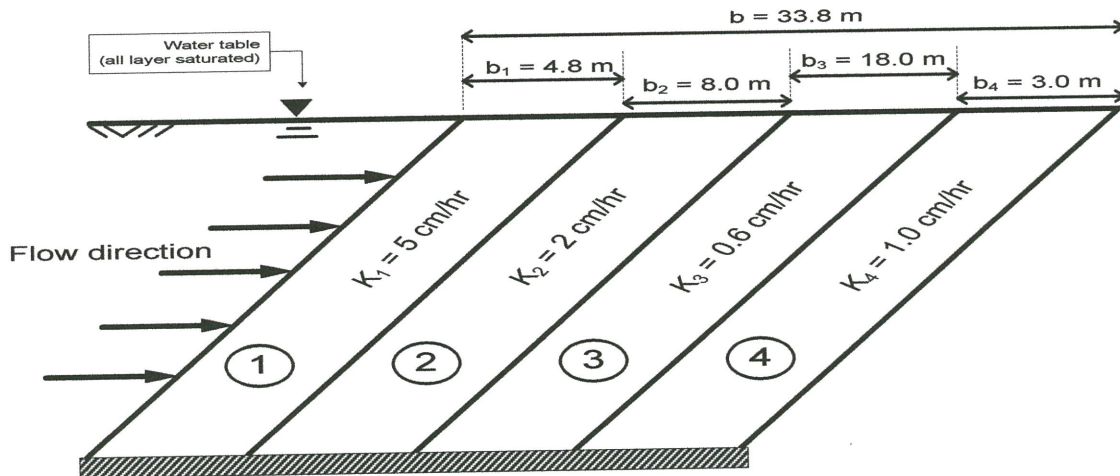
|                                |    |     |     |     |     |     |     |    |
|--------------------------------|----|-----|-----|-----|-----|-----|-----|----|
| Distance from left of bank (m) | 0  | 3   | 6   | 9   | 12  | 15  | 18  | 21 |
| Depth (m)                      | 0  | 1.5 | 3.0 | 6.5 | 6.3 | 3.0 | 1.3 | 0  |
| Revolutions at 0.6d            | 0  | 45  | 65  | 125 | 120 | 64  | 42  | 0  |
| Duration of observation (s)    | 90 | 90  | 90  | 90  | 90  | 90  | 90  | 90 |

**TABLE Q5(c) : Daily streamflow data**

|                                |     |     |     |      |      |      |     |     |     |     |
|--------------------------------|-----|-----|-----|------|------|------|-----|-----|-----|-----|
| Time (days)                    | 1   | 2   | 3   | 4    | 5    | 6    | 7   | 8   | 9   | 10  |
| Total Flow (m <sup>3</sup> /s) | 600 | 750 | 900 | 1200 | 1300 | 1000 | 900 | 700 | 650 | 550 |

**TABLE Q6(b) : Inflow and outflow hydrograph**

|                              |    |     |     |     |     |     |       |       |     |    |
|------------------------------|----|-----|-----|-----|-----|-----|-------|-------|-----|----|
| Time (hour)                  | 3  | 6   | 9   | 12  | 15  | 18  | 21    | 24    | 27  | 30 |
| Inflow (ft <sup>3</sup> /s)  | 50 | 150 | 340 | 250 | 200 | 155 | 115   | 90    | 50  | 25 |
| Outflow (ft <sup>3</sup> /s) | 50 | 59  | 126 | 235 | 239 | 214 | 178.5 | 141.5 | 110 | 75 |



**FIGURE Q7(b)**