King Mongkutís University of Technology Thonburi
Midterm Examination: Semester 1/2018

CVE 385 Hydrology

Friday 5th October 2018

Groups 33

Time 09.00 - 12.00 am.

Instructions

1. There are 9 questions (40 points) in this examination.
2. Answer in this exam paper.
3. This is a closed book examination. Dictionaries in book format are permitted.
4. Programmable calculator is not allowed.
5. Students are not allowed to take examination scripts, answer booklets or any materials out of the examination room. Violation of the rule shall result in a penalty of student receiving a zero in that examination.
6. Students who are caught cheating in the examination shall be penalized by receiving Fail grade (F) in that subject and is forced to withdraw (W) from all remaining subjects in that semester. The maximum penalty may include expulsion.

Professor Dr. Chaiyuth Chinnarasri
Examiner

When you have finished your work, please raise your hand to ask for permission to leave the examination room.

This examination paper has been approved by the Department of Civil Engineering.

Associate Professor Dr.Sutat Leelataviwat
Department Head

Name _____ ID number _____

1) Select a major water resources project in your cities. What specific hydrologic problems do the project involve? Explain the purposes of the project; describe its main features.
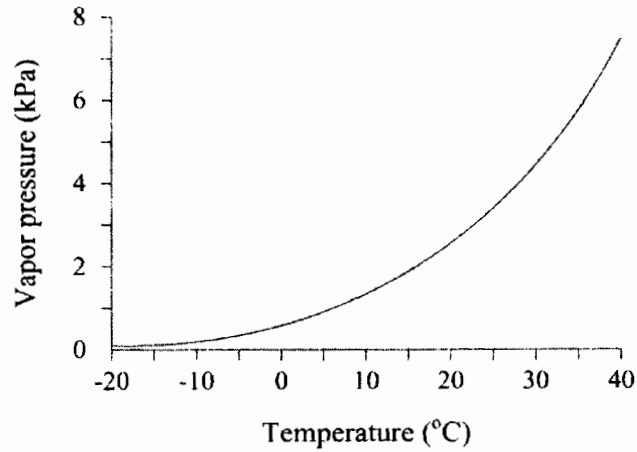
<div align="right">(3 points)</div>

2) A reservoir has the following inflows and outflows (in cubic meters) for three months. If the storage at the end of December is $100m^3$, determine the storage at the end of Mar.

<div align="right">(3 points)</div>

Month	Jan	Feb	Mar
Inflow	9	7	5
Outflow	14	13	12

3) At a climate station, air pressure is measured as 100 kPa, air temperature as 22°C, and the wet-bulb (dew point) temperature as 14°C. The saturation vapor pressure is related to the air temperature as shown in figure. An approximation equation is

$$e_s = 611 \exp\left[\frac{17.27\,T}{237.3+T}\right]$$

where e_s is in Pascal and T is in degree Celsius. Calculate the corresponding vapor pressure, relative humidity, specific humidity and air density. (4 points)

4) From a radiosonde (balloon) ascent, the pairs of measurements of pressure and specific humidity shown in Table were obtained. Estimate the precipitable water in a column of air up to the 250 mb level. (4 points)

Pressure (mb)	1005	850	750	700	630	580	500	400	250
Specific humidity (g/kg)	14.2	12.1	9.4	7.1	6.3	5.7	3.9	1.6	0.3

5) Prove that the actual average fluid velocity in the porous medium is $V = {}^q/_\eta$ where q is the flow rate per unit area of soil and η is the porosity. (3 points)

6) Four rain gages located within a drainage area while two rain gages located outside as shown. Recorded rainfall are shown in Table. (6 points)

Station	Rainfall (mm)
P_1	16
P_2	21
P_3	32
P_4	40
P_5	48
P_6	Out of order

Compute the average rainfall over the drainage area using
      (a) the arithmetic-mean method, and
   (b) the Thiessen method

1 km²
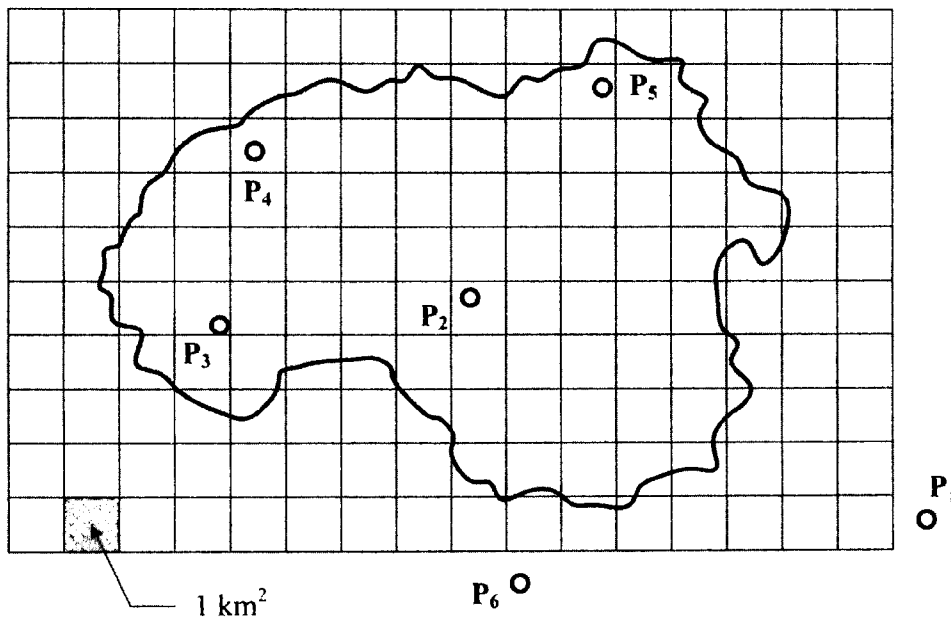
7) Latent heat transfers are the dominant cause of internal energy change for water. The latent heat of vaporization varies slightly with temperature according to

$$l_v = 2.501 \text{x} 10^6 - 2370\,T$$

where T is the temperature (°C) and l_v is the latent heat of vaporization (J/kg)

Calculate the evaporation rate from an open water surface, if the net radiation is 210 W/m². The air temperature is 25°C and water density is 997 kg/m³. No data of sensible heat and ground heat flux. (4 points)

8) Parameters in Phillipís equation for a clay soil are $S = 45$ cm·h$^{-1/2}$ and $K = 10$ cm/h. Determine the cumulative infiltration and the infiltration rate at 0.5 h increments for a 3 h period. Plot both as functions of time. Assume continuously ponded conditions.

(5 points)
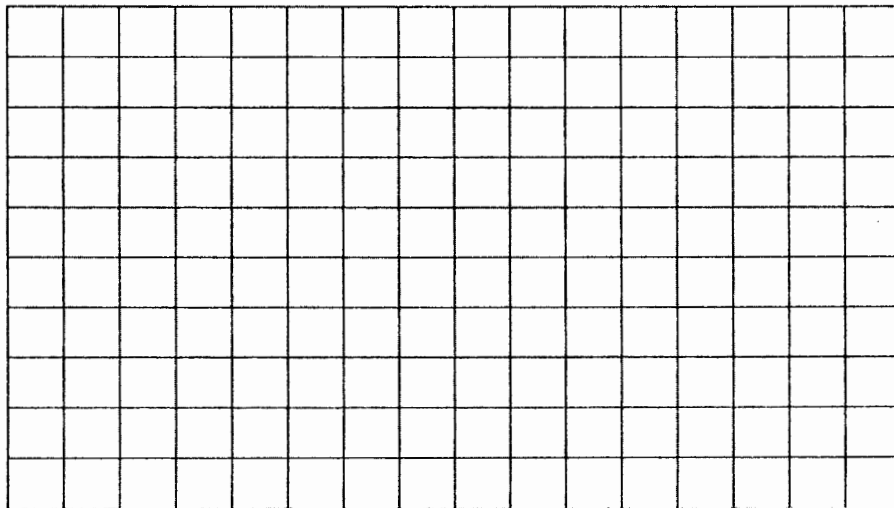
9) Select only one word or term that matches the statements below.   (8 points)

Convective lifting, Lysimeter, Infiltration rate, Tipping bucket, Solar radiation, Phillipís equation, Monsoons, Residence time, Atmosphere, Relative humidity, Lapse rate, Saturation, Specific humidity, Precipitable water, Frontal lifting, Hortonís equation, Absorption, Watershed, Isohyetal method, Condensation, Darcyís law, Orographic uplift, Thiessen polygon, Bergeron process, Class A pan, Rainfall hyetograph, Saturation deficit, Vapour pressure, Green-Ampt method.

a		The relative measure of the amount of moisture in the air to the amount needed to saturate the air at the same temperature.
b		A high area of land where rain collects, some of it flowing down to rivers, lakes at lower levels.
c		The formation of precipitation requires lifting of air mass so that it cools and condenses. In this case warm air is lifted over cooler air by frontal passage.
d		The dry cold winter winds blowing outward are replaced in summer by warm or hot winds carrying moist air from oceans being drawn into a low pressure area.
e		A measuring device, which can be used to measure the amount of actual evapotranspiration.
f		Infiltration begins at some rate and exponentially decreases until it reaches a constant rate.
g		The plot of rainfall depth as a function of time. (Intensity)
h		Air is saturated with respect to water but supersaturated with respect to ice. Hence water vapour is deposited on the ice particles to form ice crystals.