KATHMANDU UNIVERSITY
End-Semester Examination
February/March, 2018

Marks scored:

Level : B.Tech.
Year : III

Course : ENVE 309
Semester: I

Exam Roll No.: Time: 30 mins. F.M. : 20

Registration No.: Date MAR 05 2018

SECTION "A"
[10 Q.×1=10 marks]

Circle the best answer (s). Note that there could be more than one correct answers, in such cases, you need to circle all of them.

1. One MLD is equal to:
   (a) 11.57 L/s
   (b) 0.0116 m^3/s
   (c) 1000 m^3/day
   (d) 41.67 m^3/hr

2. Cryptosporodium measures about 5 μm in size and the dissolved particles can have a size of 1 nm, which of the following best represents the ratio of these two items.
   (a) 1000 (b) 5000 (c) 500 (d) 50,000

3. Minimizing losses and wastage and unaccounted for (UFW) water in transportation and distribution in a water supply system refers to:
   (a) Water demand management
   (b) Water supply management
   (c) Residual Handling Facility Management
   (d) Pipe network management

4. A beer factory needs 12 m^3 of per ton of beers manufactured. If a factory produces, 30,000 bottles in a day. In terms of water consumption, this indicates that the daily water demand of the factory is roughly equivalent to a population of:
   (a) 360 (b) 3600 (c) 36,000 (d) 360,000

5. Darcy-Wesibach Equation for estimating the headloss in a pipe is given below.

$$\Delta h = f \frac{L}{D} \frac{v^2}{2g}$$

   The friction factor (f) defined in the Equation depends upon:
   (a) diameter of the pipe
   (b) characteristics of the fluid
   (c) velocity of the flow
   (d) roughness of the pipe surface

6. The residual head in a particular section of a pipe is estimated by:
   (a) adding the head loss in the pipe with the available head at the beginning of the pipe section
   (b) subtracting the head loss in the pipe from available head at the beginning of the pipe section
   (c) subtracting the head loss in the pipe from velocity head at the beginning of the pipe section
   (d) subtracting the head loss in the pipe from total head at the beginning of the pipe section

7. A formula for estimating the incremental headloss is given below.

$$\Delta h = -\frac{\Sigma h_i}{n\Sigma\frac{h_i}{Q_i}}$$

The above formula is used to:

(a) estimate the headloss of pipes in a network
(b) estimate the flow rates in the pipes in a network
(c) estimate the size of the pipes in a network
(d) estimate the friction factors in the pipes in a network

8. In the following formula for estimating the storm water discharge (For Question No. 6 and Question No. 7):

$$Q = \frac{1}{360} C I A$$

The unit of A is :
(a) m^2 (b) ha (c) km^2 (d) $feet^2$

9. Which of the following pipe is not commonly used for gravity flow sewers?
(a) Asbestos cement
(b) Reinforce concrete
(c) HDPE
(d) Ductile iron

10. Answer the following question with a reference to Fig. 1, where ∠AOB = ϕ, d = water depth, r = radius of the pipe
Which of the followings correctly describes the relationship between d and r:
(a) $d = r\left(1 - \sin\frac{\emptyset}{2}\right)$
(b) $d = r\left(1 - \cos\frac{\emptyset}{2}\right)$
(c) $d = r\left(1 - \tan\frac{\emptyset}{2}\right)$
(d) $d = r - sin\frac{\emptyset}{2}$

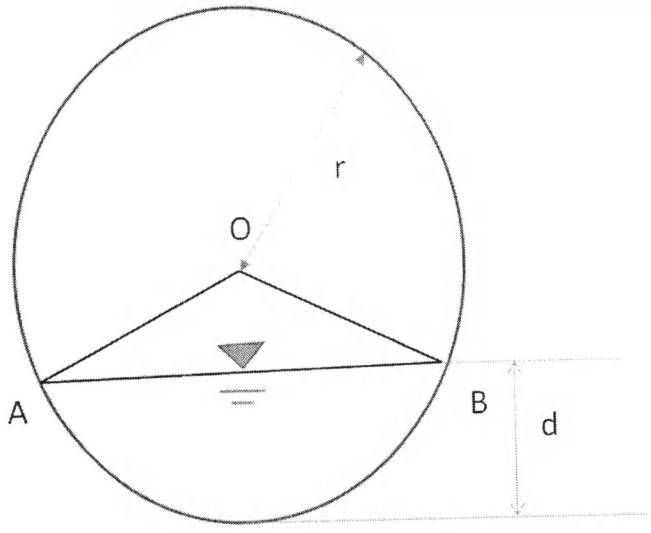

Fig. 1 : Schematic diagram of a cross-section of a sewer partially full

SECTION "B"

[10 Q.×0.5=5 marks]

Fill in the blanks:

1. The two major factors affecting the per capita demand of waters are: .....

2. The overflow pipe is kept at the topmost portion of the chamber of a reservoir where as a washout pipe is kept at.....

3. 1 crore liter per day = ... MLD

4. With a growth rate of 4 % per year, the population of a community doubles in every ..... years.

5. Total head in a pipe flowing under pressure is comprised of ....., ..., and .....

6. Transmission main of a water supply system connects the ..... and .....

7. A HGL is always at a .....elevation than a Total Energy Line.

8. Hydraulic radius of channel with B as width and H as depth of flow is given as .....

9. Runoff Coefficient for paved driveways is ..... than the lawns and open areas where as the Runoff Coefficient for residential areas is ..... than downtown or business areas.

10. Most appropriate map scale for drawing sewerage design profiles is ..... : .....

SECTION "C"

[10 Q.×0.5=5 marks]

Define in a single sentence.

(1) Combined sewerage system

(2) UFW

(3) Peak factor

(4) Manhole

(5) Per capita water demand

(6) Grit chamber

(7) HGL in water supply system

(8) Wash-out pipe

(9) PVC

(10) Piezometric head

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SECTION "D"
[5 Q.×4=20 marks]

Long answer questions. Answer the following questions.

Make logical assumption for any missing data or information.

1. Draw a schematic diagram of a water supply system and indicate: intake, grit chamber, transmission line, reservoir and treatment system and distribution system.

2. Draw a labeled diagram of a profile of a pipeline showing the pipeline alignment, HGL line and the total energy line. Indicate the head loss and the residual head in the profile.

3. Recommended velocity limits for HDPE pipes are: 0.7 m/s and 3.0 m/s. Determine corresponding flows for a 50 mm pipe with an internal diameter of 42.2 mm.

4. A steel pipe has a diameter of 12.50 inch. Using the Darcy-Weisbach formula given below, calculate the head loss in a length of 500m if it is carrying a flow of 80 L/s. take a frictional factor of 0.04 for steel pipe.

$$\Delta h = f \frac{L}{D} \frac{v^2}{2g}$$

5. Rato Bhale Cold Store can slaughter and process 5000 chickens in a day. Water requirement for the processing is 25 L per chicken. Based on this information, answer the followings?
   a. How much water is required by the store in a day?
   b. Report the value in m^3/s ?
   c. Find the population equivalent of this water consumption assuming a per capita demand of 100 L/day.

SECTION "E"
[5 Q.×7=35 marks]

Answer *ALL* the questions.

Make logical assumption for any missing data or information.

6. A schematic diagram of an intake structure is given in Fig. 2.
   (a) Draw the Sectional Elevation at AA and indicate the inlet, overflow, outlet and wash-out pipes in the plan and as well as sectional elevation. Also indicate the flow of water in the intake.

   (b) Discuss the function of the these pipes. If an intake is to be designed for a flow of 5 L/s of spring discharge, provide approximate size and of these pipes required.

[4+3]

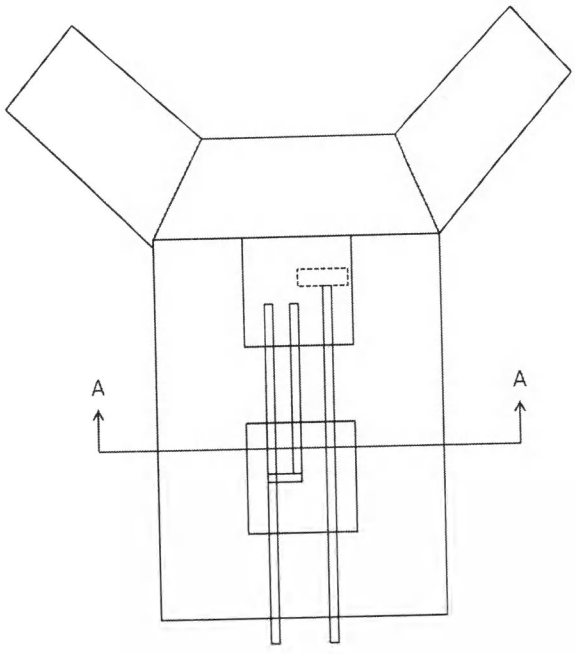


Fig. 2: A spring intake (Not to scale)

7. Determine the total water requirement of a city with a base year population (P) of 80,000 and the following information.

(a) The per capita water demand at the design year should be considered as 200 L/day.

(b) Population growth rate is 4% per anum and the design period is 20 years.

(c) There are two schools in the city, each with a population of 1000, and the student water demand is 10 L per day per student.

(d) There are 10 institutions in the city whose water demand is 1000 L /day per institution.

(e) Fire demand has to be estimated using the following formula.
Fire Demand (Kilo liters/day) = $100\sqrt{P}$

(f) There is a beer industry in the city which manufactures 5000 beer bottles in a day. The water requirements for the industry is 15 m^3/ton of the products.

[7]

8. A water supply project is envisioned for a population of 400 and water demand is only 45 lpcd. The source is 0.45 lps and five tapstands are to be built. Following the schedule below design a circular reservoir. Find the diameter of it considering the depth to be 2 m.

Schedule	
5:00 AM – 7:00 PM	10 % of total daily water need
7:00 AM – 11:00 AM	25% of total daily water need
11:00 AM – 1:00 PM	35% of total daily water need
1:00 PM - 5:00 PM	20% of total daily water need
5:00 PM – 7:00 PM	10% of total daily water need
7:00 PM – 5:00 AM	Negligible water demand

[5+2]

9. Calculate the head losses and primary corrected flows in the various pipes of a distribution network as shown in Fig. 3. The diameters and the lengths of the pipes used are given against each pipe. Compute corrected flows after one corrections (for one loop only) as given in the Table 2. [7]

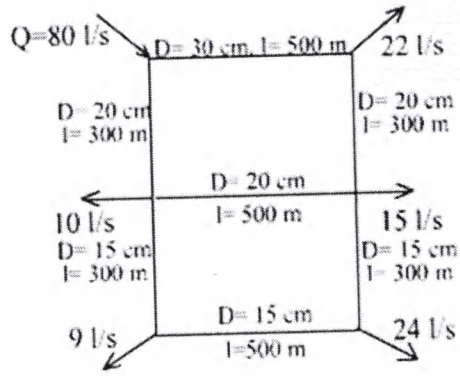


Fig. 3 : Schematic network diagram for Problem 2.

Table 2: Computations for the Hardy Cross Analysis of the Pipe Network

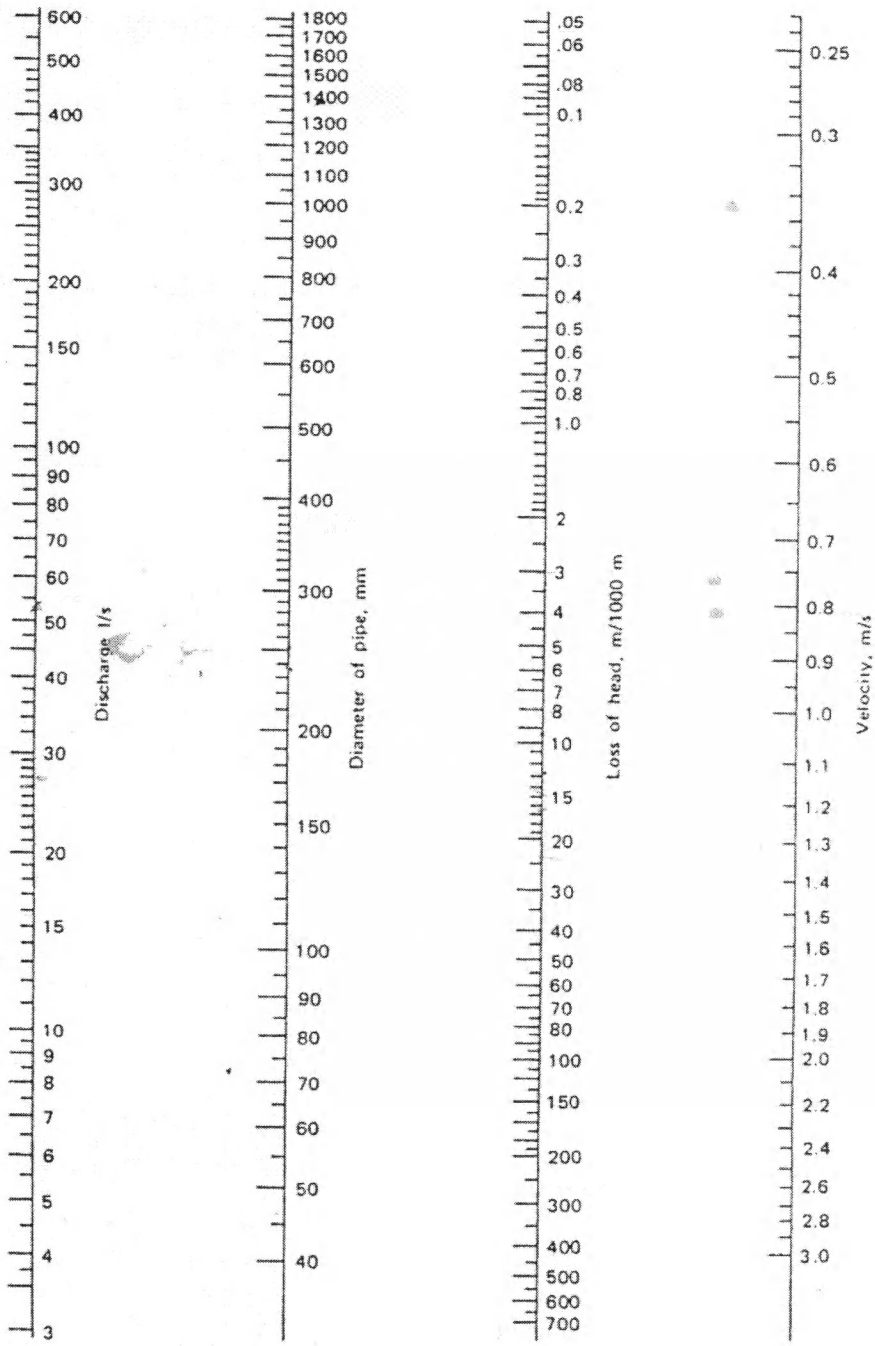
Line	Diameter (mm)	Length	Flow (L/s)	Head Loss (m/1000m)	Total h_L	H_L/Q	ΔQ	Corrected flow
AB								

You may use the following formula and the Headloss calculation Chart attached.

$$\Delta Q = -\frac{\sum h_L}{1.85 \sum \frac{h_L}{Q}}$$

10. Kathmandu University Dhulikhel campus has a total land area of 17.5 hectare and total built up area till date is 30, 000 sq.m. About 4000 sq. m is under construction. Estimate the storm water flow generated from the campus assuming the followings.
   (a) There are three collection points in the campus: one at the KU gate, another at constructed wetland near AEC and third one is at the Boys Hostel. The flow is roughly divided in three catchment areas.
   (b) Runoff coefficients are given as: water tight roofs – 0.90, paved driveways and walks – 0.80, lawns and forests – 0.15 and playgrounds – 0.25
   (c) Intensity of rainfall is to be calculated with the following formula
   I (mm/hr) = 5000 / (t+40)

   Where t is the time of concentration in minutes and it can be considered as 5 minutes. [7]



I value

h_L = I value x length of pipe.

Fig 5.9 Nomograph of Hazen-Williams eq ($C = 100$)

Fig. 3 : Nomograph of Hazen-Willian Equation