KATHMANDU UNIVERSITY
End Semester Examination
March/April, 2017

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 2 9 2017

SECTION "A"
[20 Q × 0.5=10 marks]

Circle the best answer (s). Make reasonable assumptions for any missing data or information.

1. A beer factory needs 12 m^3 of per ton of beers manufactured. In terms of water consumption, this indicates that water demand essential to produce 1000 bottles of beers is roughly equivalent to a population of:
(a) 12 (b) 120 (c) 1.2 (d) None of the above

2. While planning and designing a water supply project, engineering decisions are made based on a few selected criteria. Which of the followings belong to such criteria (tick all possible answers).
(a) Administrative boundary of the service area
(b) Per capita water consumption
(c) Per capita cost of the project
(d) Water consumption in industry and commercial areas
(e) Water consumption in irrigation and re-creational facilities

3. Design period of a water supply project is normally:
(a) 0-5 years (b) 5 - 10 years (c) 15-25 years (d) 25- 35 years

4. Transmission main in a water supply system refers to:
(a) pipeline between treatment plant and service reservoir
(b) pipeline between intake and treatment plant
(c) pipeline between service reservoir and household connections
(d) pipeline between intake and the household connections

5. Which of the following pipes in a typical reservoir would have shortest length?
(a) Outlet (b) Wash-out (c) Overflow (d) Inlet

6. 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 (tick all possible answers):
(a) diameter of the pipe
(b) characteristics of the fluid
(c) velocity of the flow
(d) acceleration due to gravity
(e) roughness of the pipe surface

7. Which of the following equation is suitable for describing an Open Channel Flow ?
(a) Darcy-Weisbach Equation
(b) Hazen-William Equation
(c) Manning's Formula
(d) Hardy-Cross Formula

8. If the pipe size reduces suddenly, the velocity of water in the pipe..... :
(a) also reduces drastically (b) increases drastically
(c) remains the same (d) Either (a) or (b) can occur

9. Time for rainfall to flow from the hydraulically remotest point to the nearest manhole is termed as :
(a) Inlet time (b) Hydraulic Retention time
(c) Time of flow (d) Time of concentration

10. Time of concentration is sum of the Inlet time and .....
(a) Hydraulic Retention time
(b) Time of flow
(c) Rainfall duration
(d) Not applicable since both of the terms give the same meaning

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

12. Which of the following pipe can withstand highest head ?
(a) Steel (b) HDPE (c) GI (d) PVC

13. Which of the following map scale is most appropriate for the sewerage design profiles?
(a) 1 : 25,000 (b) 1: 2,500 (c) 1:250 (d) 1: 250,000

14. Residual head in tap stand posts should be in the range of:
(a) 0-5 m (b) 5- 15 m (c) 15 – 50 m (d) 50-100 m

15. Per capita construction cost of a water supply project in Nepal could be in the range of :
(a) NRs 5000-10,000 (b) NRs 200 – 300
(c) NRs 20,000 – 30,000 (d) NRs 2 lakh – 3 lakh

16. Most commonly used pipe for a sewerage system in Nepal is :
(a) RCC pipe (b) HDPE pipes (c) Cast Iron pipes (d) PVC pipes

17. Which of the following best represents drainage area of KU Central Campus in Dhulikhel.
(a) 0.02 km^2 (b) 0.2 km^2 (c) 2 km^2 (d) 20 km^2

18. What is the daily per capita water demand in the urban areas of Nepal?
(a) 20 L (b) 120 L (c) 1200 L (d) 1.2 L

19. Which of the following treatment units is not included in Kavre Valley Integrated Water Supply Project?
(a) Slow sand filter (b) Rapid sand filter
(c) Sedimentation Tank (d) Aeration Tank

20. The transmission line of Kavre Valley Integrated Water Supply Project consists of :
(a) GI pipe (b) CI pipe (c) HDPE pipe (d) RCC pipe

SECTION "B"
[10 × 0.5 = 5 marks]

Fill in the blanks with the most appropriate answer.

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

22. 17 crore liter per day = ... MLD and ..... m^3/s

23. With a growth rate of 3 % per year, the population of a community doubles in every ..... years.

24. For a given per capita demand and population of a city, the total quantity of water essential is given by the following relation.
Total Quantity = ... ×.....

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

26. Hazen William Equation states a relationship between .....;
.....and .....

27. Sewerage works requires knowledge of various fields. Three of them are :
.....; .....; and
.....

28. 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.

29. When the depth of the sewage in a circular pipe is half of the diameter, the hydraulic radius is given as
.....

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

SECTION "C"
[10 × 0.5 = 5 marks]

Define each of the following in a single sentence.

31. Fire demand:

32. Safe yield of a source:

33. Hydraulic Characteristic Curve:

34. The parameter "r" in the formula given below:

$$P_n = P_0(1 + r)^n$$

35. Peak factor :

36. Overflow pipe:

37. Slow sand filter:

38. Combined sewerage system:

39. Manhole:

40. Hydraulic radius:

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SECTION "D"
(Long answer questions)
[3Q × 7 = 21 marks]

Attempt *ANY THREE* questions. Make logical assumption for any missing data or information.

1. (a) The following components were found in the Kavre Valley Water Supply (KVWS) Treatment Plant Site. Rapid sand filter, slow sand filter, A storage reservoir for storing backwash water, A supply reservoir of 300 m^3, A supply reservoir of 450 m^3, chlorination chamber, sedimentation tank, transmission line and distribution line. Draw a schematic flow diagram to showing these components.
   (b) Draw a labeled diagram of a combined sewerage system and separate system and show the locations of a treatment plant and overflow chamber. [4+3=7]

2. (a) 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 tap stands are to be built. Following the schedule below design a ferrocement tank 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

   (b) If the life quality of the population enhances and the per capita water demand increases from 45 to 80 lpcd, what strategy would you recommended to the authority to meet the water demand ? [3+2+2=7]

3. The formula given below is used to estimate the flow of stromwater generated in a community.

$$Q = \frac{CIA}{360}$$

   (a) Describe the parameters given in the equation and write down the appropriate units of the parameters.
   (b) Estimate the storm water generated in a football field. Intensity of rainfall being 10 cm/hr. Make reasonable assumptions for other parameters. [4+3=7]

4. (a) You are asked to design and develop a community water supply project, make a list of the activities you would like to carry out and also indicate the priority.
   (b) If you need to construct a sewer line for a community, discuss what are the various information you would like to collect to plan and design the sewer? [4+3=7]

SECTION "E"

(34 Marks)

Attempt *ALL* questions. Make logical assumption for any missing data or information.

5. (a) Water is transported from A at elevation 300 m to B at elevation of 40m. The length of the pipe is 1 km and pipe is HDPE 110 mm: 4kg/cm^2 (internal dia = 99.2 mm). The pipe is carrying a flow of 1.5 MLD. Using the Darcy Weisbach Equation, find the head loss in the pipe. Estimate also the residual head at point B.

$$\Delta h = f\left(\frac{L}{D}\right)\left(\frac{v^2}{2g}\right)$$

Where, f is the friction factor and can be taken as 0.023 for HDPE pipes
L is the length of the pipe
D is the internal diameter of the pipe
v is the velocity of the pipe
g is the acceleration due to gravity
Δh is the head loss in the pipe and should be reported in m. [4]

(b) A HGL profile is to be drawn for a community water supply project. The length of the pipeline is approx 5 km and the elevation profile is 500 m. Decide the vertical and horizontal scales of the plot with reasons. [3]

6. Calculate the head losses and primary corrected flows in the various pipes of a distribution network as shown in Fig. 1. The diameters and the lengths of the pipes used are given against each pipe. Compute corrected flows after two corrections as given in the Table 2. [15]

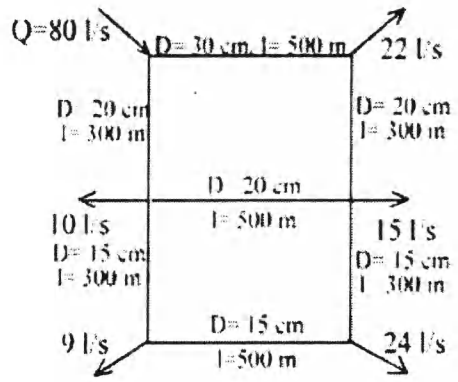

Fig. 1 : Schematic network diagram for Problem 2.

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.

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

7. 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.

- 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.
- 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
- 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. [5]

8. Kathmandu University Administration would like to use a combined sewer to cater the storm water generated in 3(b) above and the domestic wastewater. They would like to use a 400 mm RCC pipe and discharge the combined sewage to Punyamata River at Shrikhandapur. Estimate the combined flow that this pipe would carry and decide if it would be a full flow or partial flow (Take n = 0.014). [4+3=7]

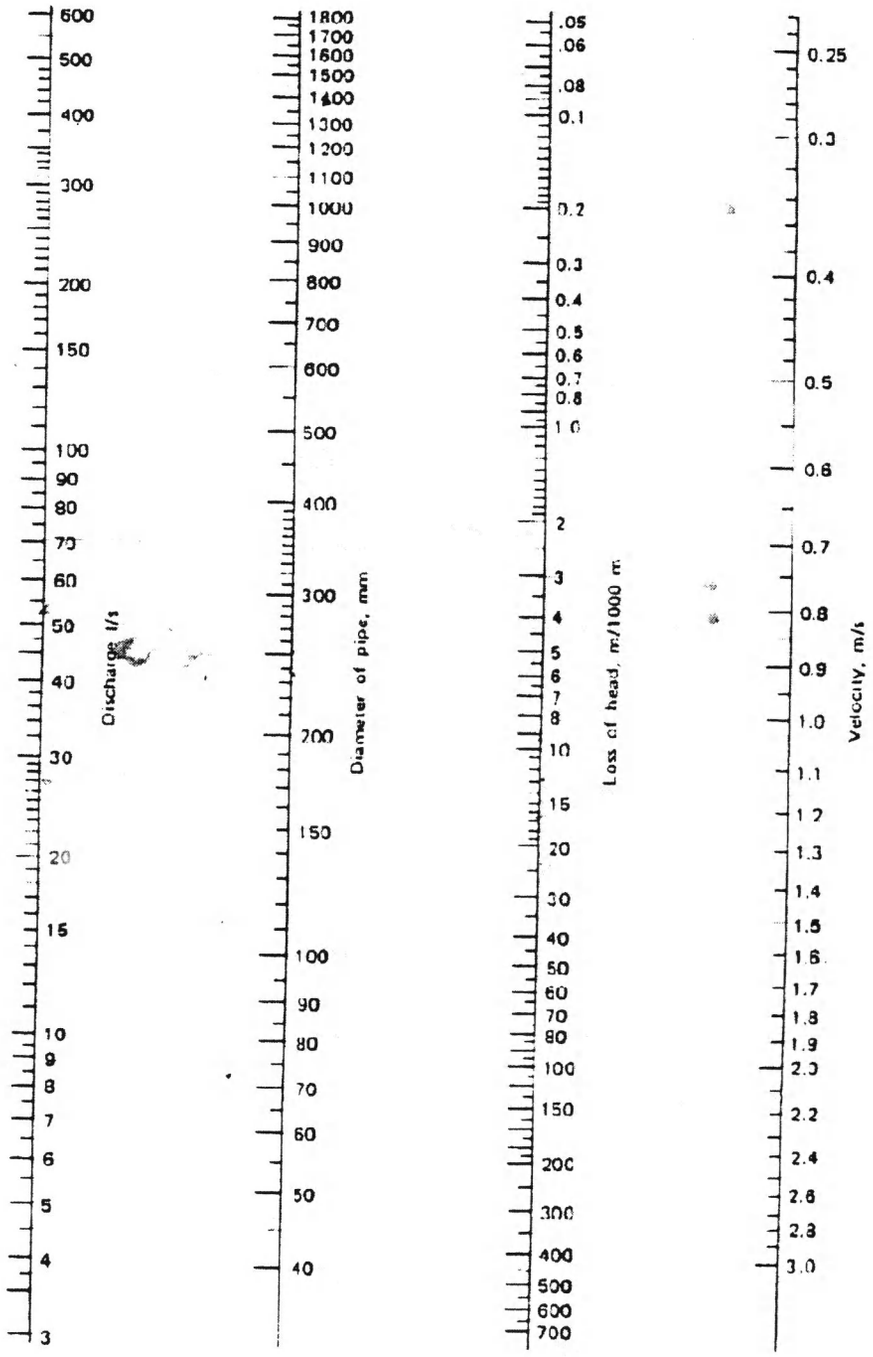

Fig. 3 : Nomograph of Hazen-Willian Equation