CE 412: Water Supply & Wastewater Disposal Systems

Quiz 1 – 2019-20 II

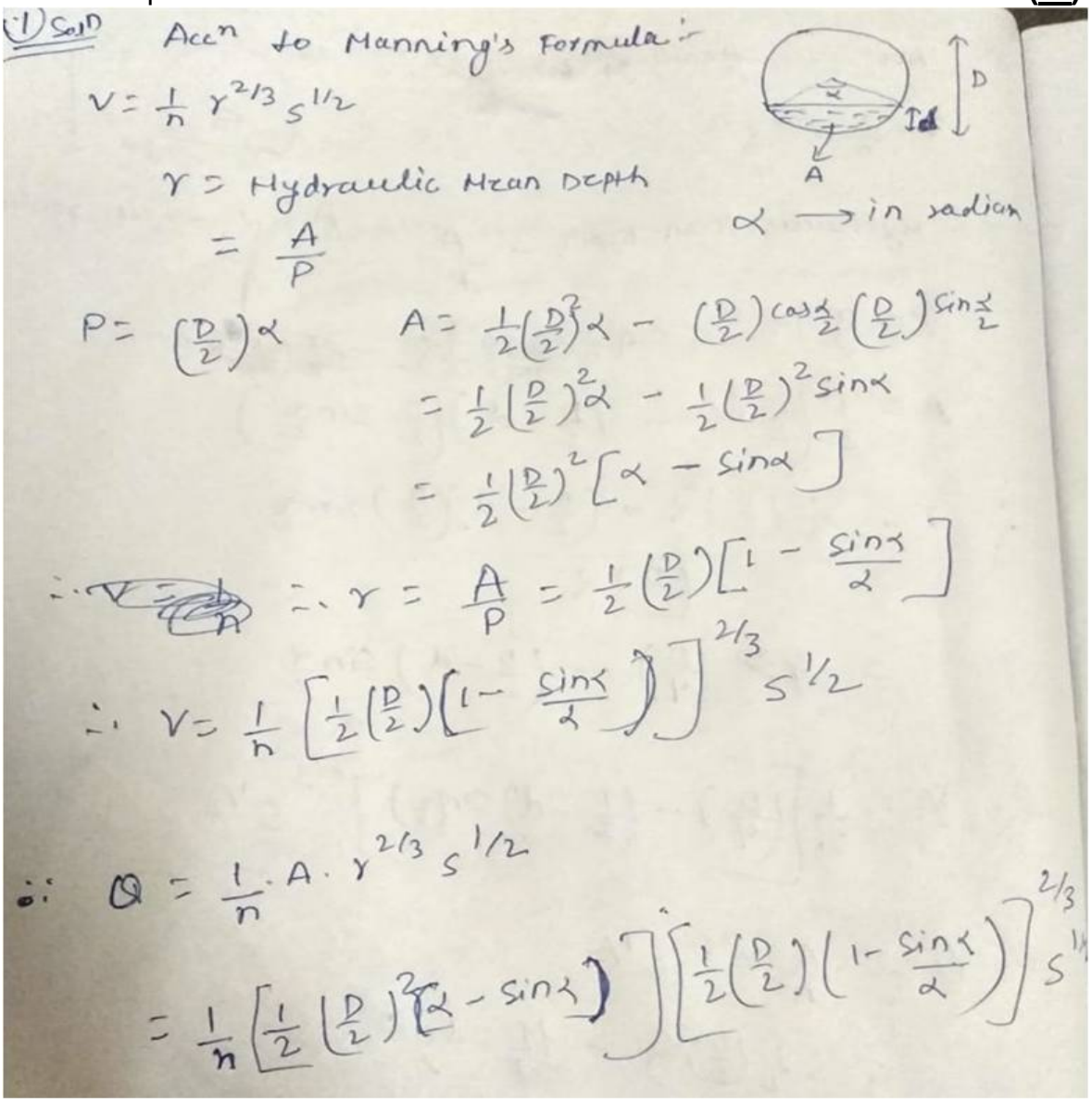
Maximum Time: 50 Minutes **Maximum Weightage: 25**

Instructions

- Answers must appear in the space provided.
- Numbers in the parenthesis at the end of each question indicate weightage assigned to a question. You are advised to spend time in minutes **not** more than two times the weightage assigned to a question.
- Use of notes/reference material or any electronic device other than scientific calculator is NOT permitted.
- Make suitable assumptions wherever necessary.
- Write your name and roll number in the space below before proceeding further.

Name: _____ **Roll No:** _____

1. Using Manning's Equation derive the expression for estimating the velocity and discharge in a pipe of diameter "D" with Manning's Coefficient "n" laid on a slope "S" and depth of flow "d". **(10)**



2. The average flow in the incoming sewer is 180 lps and the minimum and maximum flows are 0.4 and 2.5 times respectively. Length of pipes in the siphon is 120 m and difference in invert levels at the inlet and outlet structures is 1 m. The head loss due to pipe bents is not more than 6 cm. What should be the heights of weirs in the inlet structure so that the flows above "minimum" and "average flow" are diverted to the appropriate pipes. Show all necessary computations to arrive at the answer. **(10)**

the appropriate pipes. Show all necessary computations to arrive at the answer. **(10)**

pipe 1: $q_1 = q_{min} = 0.4 \times 180$ lps $= 72$ lps $= 0.072\ m^3/sec$

Assume, $v = 1\ m/sec$ $\quad Q = AV$

Step 1 $\Rightarrow 0.072 = \frac{\pi D^2}{4} \times 1 \Rightarrow \boxed{D_{req} = 0.302\ m}$

Step 2 provide $D = 0.3\ m \Rightarrow V_{actual} = \frac{0.072}{\pi \times 0.3^2/4} = 1.018\ m/sec > 0.9\ m/sec$

Step 3 $v = \frac{1}{n} R^{2/3} S^{1/2} \Rightarrow 1.018 = \frac{1}{0.013} \times \left(\frac{0.3}{4}\right)^{2/3} \times S^{1/2}$

$\Rightarrow \boxed{S = 5.537 \times 10^{-3}}$

$\frac{h_L}{L} = S \Rightarrow h_L = 5.537 \times 10^{-3} \times 120 = 0.66\ m$

Minor loss $= 6\ cm$, total loss $= 0.66 + 0.06 = 0.72\ m < 1\ m.$

pipe 2 $q_2 = q_{avg} - q_{min} = 0.18 - 0.072 = 0.108\ m^3/sec$

~~provide same dia = 300 mm (for ease of calculation)~~

~~$Q = AV \Rightarrow V = \frac{0.108}{\pi \times (0.3)^2/4}$~~

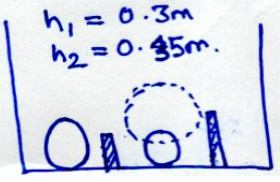
Assume, $V = 1\ m/sec$, $D_{req} = \sqrt{\frac{0.108 \times 4}{\pi}} = 0.37\ m$

provide, $D = 0.4\ m$. $\quad V_{ac} = \frac{0.108 \times 4}{\pi \times (0.4)^2} = 0.859\ m/sec < 0.9\ m/sec$

provide, $D = 0.35\ m$. $\quad V_{ac} = 1.12\ m/sec > 0.9\ m/sec$.

$v = \frac{1}{n} R^{2/3} S^{1/2} \rightarrow S = 5.457 \times 10^{-3}\ m.$

$h_L = 5 \times 120 + 0.06 = 0.71\ m < 1\ m.$



3. Given the following population data, suggest giving justification the appropriate method for predicting population. **(02)**

Year	1971	1981	1991	2001
Population in lacs	25	30.4	35.4	40.7

Ans: Arithematic method is appropriate as difference between consecutive years is approximately equal.

4. Why sewage discharged through a sewer at the bottom of the ocean rises to the surface. **(03)**

Ans: Specific gravity of sewage is almost equal to freshwater but less than ocean. This difference is density causes sewage discharge to rise in oceans.