

Govt. Engineering college, Ajmer

Department of civil engineering

Test paper

Subject: Environmental Engineering – II

Semester: VI, test-II (2017-2018)

Q 1. A 350 mm diameter sewer is to flow at 0.35m depth on a grade ensuring a degree of self-cleansing equivalent to that obtained at full depth at a velocity of 0.8 m/sec, find : 1. The required slope 2. Associated velocity 3. The rate of discharge at this depth, given:

1.) Manning's rugosity coefficient = 0.014 2.) Proportionate area = 0.315 3.) Proportionate wetted perimeter = 0.472. 4.) Proportionate HMD (r/R) = 0.7705 (3)

Q 2. Write notes on any two a) Racks and screens b) Parshall flume c) Testing of sewer line (3)

Q 3. Write short notes on any two: a) Aerated grit chamber b) Plumbing system c) Materials for sewer d) Sanitary fitting accessories (4)

SOLUTION

Ans 1: At full depth, $V = 0.8\text{m/sec}$, $D = 350\text{ m}$, $N=0.014$.

At 0.35 depth, $d/D = 0.35$, $a/A = 0.315$, $p/P = 0.472$, $r/R = 0.7705$

At full depth

$$V = \frac{1}{N} \cdot R^{2/3} \cdot \sqrt{S}$$

$$\text{Or } 0.8 = \frac{1}{0.014} \cdot \left(\frac{0.35}{4}\right)^{2/3} \cdot \sqrt{S}$$

$$\text{Or } \sqrt{S} = 0.0568 \quad \text{or } S = 3.234 \times 10^{-3}$$

(i) Now, for a sewer to be the same self cleansing at 0.35 depth as it will be at full depth, we have the gradient (S_s) required.

$$\text{We know } S_s = \left(\frac{R}{r}\right) S$$

$$= \frac{1}{0.7705} \times 3.234 \times 10^{-3}$$

$$= 4.2 \times 10^{-3} = 4.2 \% \quad , \text{ hence required grade is } \mathbf{4.2 \%}$$

(ii) The velocity generated at this gradient at 0.35 depth, is given by

$$V_s = \frac{N}{n} \cdot \left(\frac{r}{R}\right)^{1/6} \cdot V = 1 \times (0.7705)^{1/6} \cdot 0.8$$

$$= \mathbf{0.765 \text{ m/sec}}$$

(iii) The discharge q_s is then given by:

$$q_s = a \cdot v_s = 0.315 \cdot \frac{\pi}{4} \times (0.35)^2 \times 0.765$$

$$= \mathbf{0.023 \text{ Cumecs}}$$

Ans 2: a) Racks and screens: 1. Definition

2. Function

3. Types and description

b) Parshall flume: 1. Description

2. Function

3. Diagram

4. Formulae

c) Testing of sewer line: 1. Aim 2. Types of test viz.: 1) Test for straightness and obstruction, 2) Water test, Smoke test 3) Air test

Ans 3: a) Aerated grit chamber: 1. Aim & Description 2. Function 3. Dimensions

b) Plumbing system: Description with neat sketch of 1) Two pipe system 2) One pipe system 3) Single stack system 4. Partially ventilated system.

c) Materials for sewer: Types of pipes and their description with relative merits and demerits.

d) Sanitary fitting accessories: Description with neat sketch of 1) Wash basins 2) Sinks 3) Bath tubs 4) Water closets 5) Urinals 6) Flushing cisterns