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Total Number of Pages: 03

B.Tech.  
PCI51103

**5<sup>th</sup> Semester Regular Examination 2017-18**  
**Water Supply and Sanitary Engineering**

**BRANCH: CIVIL**

**Time: 3 Hours**

**Max Marks: 100**

**Q.CODE: B262**

**Answer Question No.1 and 2 which are compulsory and any four from the rest.**  
**The figures in the right hand margin indicate marks.**

**Q1 Answer the following questions: *multiple type or dash fill up type* (2 x 10)**

- a) The discharge per unit plan area of a sedimentation tank, is generally called \_\_\_\_\_
- b) The process of passing water through beds of granular materials, is called \_\_\_\_\_
- c) Mathemoglobinemia or blue baby disease is caused due to \_\_\_\_\_
- d) The pH value of sewage is determined with the help of \_\_\_\_\_
- e) In areas where light rains are uniformly distributed throughout the year, the type of sewerage system to be adopted is \_\_\_\_\_
- f) Specific capacity or yield of wells, is generally expressed, as \_\_\_\_\_
- g) 5 days-biochemical oxygen demand (BOD5) is taken at a temperature of \_\_\_\_\_
- h) When the reduced level of the water source is higher than the reduced level of the consumer's place, water is generally supplied by  
(A) pumping system (B) gravitational system (C) Both (a) and (b)  
(D) All the above
- i) Gravity conduits are generally in the form of  
(A) Canals (B) Flumes (C) Aqueduct (D) All the above
- j) If the chosen diameter of a pipe, is less than the economical diameter,  
(A) Cost of pipe will be less (B) Head loss will be high  
(C) Cost of pumping will be more than saving (D) All the above

**Q2 Answer the following questions: *Short answer type* (2 x 10)**

- a) Draw the typical sketch of pump showing Suction Head and Delivery Head
- b) Enlist various processes involved in water treatment.
- c) State the chemicals used for coagulation. What is optimum dose of coagulant?
- d) What is Schmutzdecke layer?
- e) State difference between water supply pipe and sewer pipe w.r.t. design ?
- f) Name the different layouts of distribution networks.
- g) Define sullage and industrial waste.
- h) What is sewage sickness?
- i) List characteristics of sewage.
- j) What do you mean by self-cleansing velocity? Write its expression.

**Q3 a) Two tube wells each of 20 cm diameter are spaced at 100 m distance. Both the wells penetrate fully a confined aquifer of 12 m thickness. Calculate the discharge if only one well is discharging under a depression head of 3 m. What will be the percentage decrease in discharge of the well if both the wells are discharging under the depression head of 3 m? Take radius of influence for each well equal to 250 m and coefficient of permeability of aquifer as 60 m/day. (10)**

- b) Differentiate between Dry Intake Tower and Wet Intake Tower. (5)

**Q4 a)** Derive the expression for settling velocity of a spherical particle in a liquid under condition when Reynold's number is less than 0.5. (10)

Find the diameter of the particle with specific gravity of 1.2 removed in a tank having a surface area of 250 m<sup>2</sup> and treating 8MLD. Assume temp= 26°C,  $V_o = V_s$

**b)** Chlorine usage in the treatment of 20,000 cubic meter per day is 8kg/day. The residue after 10min contact is 0.20mg/l. Calculate the dosage in milligram per litre and chlorine demand of the water. (5)

**Q5 a)** A rapid sand filter is to be provided in a water treatment plant, to process the water for a town with a population of 2,75,000. The water demand is 200litres/capita/day. (10)

The rate of filtration is 15m<sup>3</sup>/m<sup>2</sup>/hour. Allow 5% of filtered water for storage to meet the backwash requirements. Each backwashing period is of 30 min. Determine the number of filters required allowing one as a stand by unit. The available surface area configuration of filter unit is 10m x 4m. Also compute the up-flow velocity and headloss to expand the bed to 0.66m from its original undistributed depth of 0.6m. The porosity of the bed is 0.50. The specific gravity is 2.5. The average particle size is 0.6mm. The drag coefficient is 5.02. The flow is assumed to be transition flow

**b)** Discuss about the construction and working operation and cleaning of a rapid gravity filter with a neat sketch. (5)

**Q6 a)** Calculate the requirement of lime and soda for cold softening of 2,00,000 liters of raw water with the following chemical composition: (10)

| Sl. No. | Constituents                  | Concentration (mg/l) | Eq. wt. (g) |
|---------|-------------------------------|----------------------|-------------|
| 1       | CO <sub>2</sub>               | 39.6                 | 22          |
| 2       | Ca <sup>++</sup>              | 44                   | 20          |
| 3       | Mg <sup>++</sup>              | 18                   | 12          |
| 4       | HCO <sub>3</sub> <sup>-</sup> | 122                  | 61          |

**b)** Enlist various methods of chlorination of water and explain break point chlorination. (5)

**Q7 a)** Using Rational method, rainfall intensity duration, inlet time, length of lines and drainage area for different location given below. (10)

| Area | Area (km <sup>2</sup> ) | Inlet time, min | Sewers                | Length of sewer, m |
|------|-------------------------|-----------------|-----------------------|--------------------|
| 1    | 0.016                   | 5               | Manhole 1-2           | 120                |
| 2    | 0.032                   | 5               | Manhole 2-3           | 180                |
| 3    | 0.024                   | 8               | Manhole 3 – Discharge |                    |

Compute the diameter for outfall sewer. Assume:

Runoff coefficient for entire area = 0.30

Velocity of flow in sewer flowing full = 0.75 m/sec

5 year average rainfall intensity at different time given below:

| Duration of rainfall, min   | 5     | 8   | 9   | 11.7 | 15  | 20 | 30 |
|-----------------------------|-------|-----|-----|------|-----|----|----|
| Rainfall Intensity, mm/hour | 137.5 | 127 | 123 | 115  | 101 | 90 | 75 |

Table below gives the hydraulic elements for circular pipes flowing:

| Quantity of flow, l/m | Diameter of Pipe, mm | Slope of pipe m/m | Velocity m/sec |
|-----------------------|----------------------|-------------------|----------------|
| 400                   | 450                  | 0.025             | 2.7            |
| 600                   | 525                  | 0.020             | 2.8            |
| 690                   | 1050                 | 0.00055           | 0.75           |
| 1500                  | 1350                 | 0.001             | 1.55           |

**b)** Calculate the ratio of discharge of a sewer when flowing at full depth to that of when flowing at  $\frac{3}{4}$ th depth. (5)

**Q8 a)** An average operating data for conventional activated sludge treatment plant is as follows: **(10)**

wastewater flow = 35000 m<sup>3</sup>/d, ii) Volume of aeration tank = 10900 m<sup>3</sup>,

iii) Influent BOD= 250 mg/l, iv) Effluent BOD = 20 mg/l,

v) Mixed liquor suspended solids (MLSS) = 2500 mg/l,

vi) Effluent suspended solids = 30 mg/l,

vii) Waste sludge suspended solids = 9700 mg/l,

viii) Quantity of waste sludge = 220 m<sup>3</sup>/day

Based on the information above, determine

a) Aeration period (hrs)      b) F/M ratio (kg BOD per day/kg MLSS)

c) Percentage efficiency of BOD removal      d) Sludge age (days)

**b)** Differentiate between Conservancy system and Water Carriage system of Sanitation. Write their Advantages and Disadvantages. **(5)**

**Q9 a)** Explain the various stages of sludge digestion process. List the factors affecting sludge digestion process. **(10)**

**b)** The sewage of a town is to be discharged into a river stream. The quantity of sewage produced per day is 8million litres, and its BOD is 250mg/l. If the discharge into the river is 200l/s and its BOD is 6mg/l, find out the BOD of dilute water. **(5)**