

**MAHARASHTRA JEEVAN PRADHIKARAN  
RESEARCH AND TRAINING CENTRE, NASHIKROAD**

**Professional Examination of Sub Divisional Officers / Engineers /  
Assistant Engineer Grade- I  
October 2011**

**Subject :- Water Supply Sanitation Engineering (Written)**

Date :- 19/10/2011

Time :- 10.00 to 13.00

Marks :- 75

- 
- Note :-
- (1) **Question No.1 is compulsory & write any Five questions** from the Remaining.
  - (2) Use of Calculator / Log table is allowed.
  - (3) Make suitable assumption If required. Assume suitable data. Wherever necessary and state then clearly.
  - (4) Marks are reserved in each questions for neat sketches.
  - (5) Figure in bracket on the right side indicate full marks.
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**Question No.1 :-**

- (I) Define service reservoirs. what are the functions of service reservoirs? (3)
- (II) Draw a "Flow Diagram" showing supply well, pumps, switch house, rising main, Break pressure tank, Gravity main, F.S.R & Stand post in the Distribution system. show location of valves & name them. Assume level wherever necessary. The total static head from Break pressure tank on Rising Main and on Gravity main should not be more than 85 mts and 60 mts respectively. (6)
- (III) Write short note on the sedimentation in the reservoir? What are various methods employed to reduce the silt in the reservoir? (6)

**No.2 :-**

**Write short notes on**

(12)

1. Consumer survey
2. Hydraulic modeling
3. Tube settlers
4. Solid waste management

**Question No.3 :-**

(A) What is oxidation pond ? Design an oxidation pond for treating sewage from a residential having population about 5000 persons. The contribution of colony sewage is at the rate of 120 lpcd and BOD<sub>5</sub> is 300 mg/lt. Draw neat sketch. (6)

(B) Differentiate between (6)

1 Aerobic and anaerobic treatment

2 Sewage and sullage

3 Nalni trap and Gully trap

**Question No.4 :- Draw neat and labeled sketch (12)**

(I) Drop manhole

(II) Dry latrines

(III) Single pipe plumbing

**Question No.5 :- Answer the following (12)**

1 State different types of test to be carried out during water analysis.

2 Describe in detail - a) Turbidity; b) MPN

3 Factors affecting selection of source of water supply scheme

4 Describe laying, jointing and testing of RCC NP-3 pipes for sewerage with neat sketch.

5 Describe need of segregations of solid waste collected from households. What do you mean by three 'R' in solid waste management?

6 Describe break point chlorination state its advantage.

**Question No.6 :- Answer the following (12)**

1 Describe various types of pumps used for pumping sewage

2 Explain the various types of flumes used for measuring the flow.

- 3 What is coagulation? How optimum dose of coagulant is determined? Determine the quantity of alum required in treating 13 million liters of water per day assuming 12 ppm dose.

**Question No.7 :- Answer the following**

(12)

- 1 Write a note on NRDW programme
- 2 Explain Sujal Nirmal Abhiyan Programme, its focus, aims. Also enumerate the criteria and financial pattern.
- 3 State merits and demerits of HDPE pipe using for water supply
- 4 What is excess fluoride in drinking water? State and explain methods of excess fluoride removal from water.

**Question No.8 :-**

- (A) What is water audit? Explain the terms UFW (4)
- (B) What is objective of leakage control? Explain major activates in the leak detection. Describe equipments used for leak detection. (8)

**Question No.9 :-**

- (A) Explain in brief how you prevent water supply source from pollution. (4)
- (B) B) Draw neat and labeled diagram (flow dia.) of 10 Mld sewage treatment plant for a town. (8)

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**Professional Examination of Sub Divisional Officers / Engineers /  
Assistant Engineer Grade- I      October 2011**

Candidate Seat No.

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**Subject :- Water Supply Sanitation Engineering (Oral)**

Date :- 19/10/2011

Time :- 14.00 to 14.30

Marks :- 75

- Note :-
- (1) All Questions are compulsory.
  - (2) Figure on R.H.S. indicates marks.
  - (3) Use of calculator is allowed.
  - (4) Use of personal computer, mobile etc. is not allowed.
  - (5) Write the answer in the space provided in the paper itself.

Question No	1	2	3	4	5	6	7	8	9	10	Total
Marks obtained											

Signature of Supervisor-----

Signature of Examiner-----

**Question No.1 :- A) Answer the following in one sentence** (10)

(1) Financial pattern for A class municipal council under MSNA Programme

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(2) Self cleansing velocity

---

(3) Purpose of settling tank

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(4) Functional scheme

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(5) % of available chlorine in fresh bleaching powder

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**B) Give formula for the following (Any Two)** (5)

(1) Daily demand

---

(2) Water hammer

---

(3) Efficiency of pump

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**Question No.2 :- A) Match the following** (10)

(A)	(B)
(a) 100 % metering	(I) Coagulant
(b) Aeration	(II) Remove colour
(c) Alum	(III) Priming
(d) Hazan William formula	(IV) Preliminary treatment
(e) HDPE pipe	(V) 24 X 7 water supply
(f) Centrifugal pumps	(VI) To add oxygen to water
(g) Sludge bulking	(VII) Take care of temperature changes in pipeline
(h) Activated carbon	(VIII) Pipe line design
(i) Expansion joint	(IX) Fusion jointing
(j) Screening	(X) Swelling of sludge

**B) Write long forms of following** (5)

- (1) NRDW P \_\_\_\_\_
- (2) PCCP \_\_\_\_\_
- (3) BEE \_\_\_\_\_
- (4) COD \_\_\_\_\_
- (5) NEERI \_\_\_\_\_

**Question No.3 :- A) Fill in the Blanks** (10)

- (1) Normal range of pH of drinking water is.....
- (2) Minimum residual chlorine in drinking water shall be .....
- (3) Filtration rate of rapid sand filter is ..... Lit/m<sup>2</sup>/hr

- (4) Permissible value of fluoride for drinking water is.....
- (5) Detention time of Flocculation tank ..... min
- (6) Allowable head loss in rapid sand filter ..... mts.
- (7) Distance between two manholes on sewer line for inspection ..... mts
- (8) Generally sewer are designed to flow under gravity with.....full
- (9) As per financial pattern share of local body of B class under MSNA is .....
- (10) Allowable NRW is ..... %

**B) Give the detention period for following units (5)**

- 1) Plain sedimentation tank \_\_\_\_\_
- 2) Flash mixer \_\_\_\_\_
- 3) Oxidation pond \_\_\_\_\_
- 4) Sludge drying beds \_\_\_\_\_
- 5) Sludge digester tank \_\_\_\_\_

**Question No.4 :- A) Give the standard values for the following (Any five) (10)**

- (1) The minimum head of water supply at consumer tap.....
- (2) The design value of Hazen William's coefficient for PVC pipes....
- (3) For design of sewerage the ratio of maximum hourly flow to average daily flow is.....
- (4) The capacity of wet well is provided..... of the peak flow.
- (5) The disposal of treated waste water can be made to river if the BOD of effluent is less than .....
- (6) The recommended acceptable limit of total hardness for drinking water is.....
- (7) Surface loading for design of plain sedimentation tank is ..... $M^3/M^2/d$
- (8) In Rapid sand filters the rate of filtrations is.....  $M^3/M^2/hr$ .

- (9) Losses allowable through pumping mains.....
- (10) The accuracy of ultrasonic flow meter is.....

**B) State true or false (Any Five) (5)**

- (1) Working pressure for CI "A" class pipe is 12 kg/cm<sup>2</sup> (T / F )
- (2) Scheme is said to be non functioning if water supply is provided with minimum 25 days in a month and at the rate of 40 lpcd.(T / F )  
(as per 96 column)
- (3) Tanker is provided when lpcd is less than 12 lit (T / F )
- (4) C value of D.I. pipe is less than PVC pipes. (T / F )
- (5) Oxidation pond is aerobic stabilization unit. (T / F )

**Question No.5 :- A) Mention the use the following (5)**

- (1) Thrust block \_\_\_\_\_  
\_\_\_\_\_
- (2) R.O. plant \_\_\_\_\_  
\_\_\_\_\_
- (3) Ultrasonic flow meter \_\_\_\_\_  
\_\_\_\_\_
- (4) Sounding rods \_\_\_\_\_  
\_\_\_\_\_
- (5) Total station \_\_\_\_\_  
\_\_\_\_\_

**B) Find odd one out (5)**

- (1) Jet pump, Hydraulic ram, Rotary pump reciprocating pump
- (2) Jar test, OT test, turbidity rod, pH-meter
- (3) Speedometer, Passometer, Flowmeter, odometer
- (4) Piezometer, Manometer, Barometer, Lactometer
- (5) Odour, colour, temperature, Dissolved oxygen



**C) Compute the following**

(5)

- (1) Weight of MS pipe Dia 323.9 mm and thickness 7.9 m

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- (2) 186.12 KW = \_\_\_\_\_ HP

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**Professional Examination of Sub Divisional Officers / Engineers /**  
**Assistant Engineer Grade- I**  
**October 2012**

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Question No.1 :- For a village water supply scheme, study the data given below carefully and answer question a,b,c.

- |       |   |              |
|-------|---|--------------|
| (i)   | Design population of village  | 10,200 souls |
| (ii)  | rate of water supply  | 40 LPCD      |
| (iii) | Hours of pumping  | 16 Hrs       |
| (iv)  | Considering losses in the system<br>(15% for Dist.system 2% for Rising main)  | 17 %         |
| (v)   | Length of Rising main   | 3200 m       |
| (vi)  | Ground level of supply well   | 100 m        |
|       | Suction level of pump   | 88 m         |
|       | Bottom level of supply well   | 86.5 M       |
|       | Top level of supply well staining   | 101.50 M     |
|       | Lowest level on Rising Main at 500 m chainage   | 97.0 M       |
| (a)   | Draw a 'Flow Diagram' showing supply well, pumps, switch room, Rising main with proper position of score valve, Reflux valve, air valve, ESR & stand post. (show the levels properly) | (5)          |

- (b) If the dia of Rising main is 150 mm DI K-9 pipe and frictional losses are 1.8 m/km. Calculate water hammer pressure using following formula. (5)

$$a = \frac{1425}{\sqrt{1 + \frac{kd}{Ec}}}$$

k = Bulk modulus of water  $2.07 \times 10^8 \text{ kg/m}^2$

d = dia of pipe in meter

c = Wall thickness of pipe in m.

(For DI K9 pipe, wall thickness = 6.3 mm)

E = Modulus of elasticity of D.I. pipe

=  $1.7 \times 10^{10} \text{ kg/m}^2$

Hmax = a.v.

v = velocity in m/s

- (c) Calculate the H.P. of pump (submersible pump) are to be provided. Also mention How many air valves will you provide in above Rising Main. (5)

**OR**

Question No.1 (A) For village water supply scheme having design population 1800 souls & source as a tubwell 5 km away from village calculate the following. (5)

(i) Capacity of ESR

(ii) Size & No. of air valves to be provided.

(iii) Draw schematic diagram (Flow diagram) showing source, pump house, rising main, ESR, standpost in Dist.system etc.

(B) If in above case, rate of frictional loss is 2.1 m /km and static head is 63 m calculate the H.P. of submersible pump. (5)

(C) What do you understand by per capita norms ? What are the recent norms fixed by GOM for different areas. (5)

Question No.2 :- Write short note on (Any three) (12)

- (i) Drop manhole.
- (ii) Sewage farming.
- (iii) By-pass arrangement in ESR.
- (iv) B.O.D.
- (v) Air valves.

Question No.3 :- Distinguish between (Any three) (12)

- (i) Aerobic bacteria & Anaerobic bacteria.
- (ii) Rapid sand filter & slow sand filter.
- (iii) Surface source & underground source.
- (iv) Sullage and sewage.
- (v) Borewell & Tubewells.

Question No.4 :- Draw neat & labeled sketches of following (Any three) (12)

- (i) Manhole.
- (ii) P- trap & gully trap.
- (iii) Two tap stand post.
- (iv) Borewell installed with handpump.
- (v) Septic tank for household.

Question No.5 :- Write in brief (Any three) (12)

- (i) Oxidation pond.
- (ii) Septic tank.
- (iii) M.B.R.
- (iv) Coagulation.
- (v) Hardness of water.

Question No.6 :- Answer the following (Any three) (12)

- (a) Write short note on NRDWP programme.
- (b) Explain Sujal Nirmal Abhiyan Programme, its functions, aims. Also enumerate the criteria & financial pattern.
- (c) (i) What are the criteria for scarcity in rural area.  
(ii) Explain different types of scarcity measures adopted by GOM.  
(iii) Who give the administrative approval to scarcity estimate at district level ? What are the financial limit.
- (d) Write short note on Nagrothan programme of GOM.

Question No.7 :- Answer the following (any three) (12)

- (a) Explain the hydraulic testing of pipe line particularly for rising main.
- (b) Explain water tightness test of ESR.
- (c) Write short note on
  - (i) PVT pipes
  - (ii) DI pipes
  - (iii) SW pipes
  - (iv) GI pipes
- (d) Explain different methods for forecasting design population in rural water supply scheme ? What do you understand by floating population.

Question No.8 :- Write Brief note (Any three) (12)

- (a) What are quality standard of potable water.
- (b) What are acceptable limits & cause of rejection in following.
  - (i) Fluoride
  - (ii) Total dissolved solids.
  - (iii) Chloride.
  - (iv) Nitrates.
- (c) Write short note on Break point chlorination.
- (d) Why co-agulation is necessary in surface water treatment. Explain in brief the material used for co-agulation.
- (e) What do you understand by O.T. test. Explain in brief for determine the residual chlorine.

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**Assistant Engineer Grade- I**

**October 2012**

Roll No. ....

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Date :- 10/10/2012

Time :- 14.00 to 14.30

Marks :- 75

- Note :-
- (1) All Questions are compulsory.
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Question No	1	2	3	4	5	6	7	Total
Marks obtained								

Signature of Supervisor .....

Signature of Examiner .....

Question No.1 :-	(A) Give formula for the following (Any two)	(3)
	(a) Daily demand .....	
	(b) Capacity of sump .....	
	(c) ESR capacity with 15% losses .....	
	(B) Give long forms of the following (Any two)	(3)
	(a) N.B.A. ....	
	(b) N.R.D.W.P. ....	
	(c) B.O.D. ....	
	(C) What is meant by the following (Any two)	(3)
	(a) D.O. ....	
	(b) P.P.P. ....	
	(c) Water Audit .....	

	(D) Mention the popular contribution for the following (Any two)	(3)
(a)	Maharashtra Sujal & Nirman, Abbiyan 2010-11 for 'C' class Municipal Council .....	
(b)	Maharashtra Survana Jayanti Nagri dalit wasti water supply & sanitation programme for 'B' class Municipal Council .....	
(c)	NRDWP for Rural water supply scheme for single village .....	
	(E) Choose the correct options (Any three)	(3)
(a)	Maximum permissible velocity for concrete drain ..... (1.4 M/s, 2 m/s, 2.5 m/s)	
(b)	Minimum dia of Sluice Valve for pipe of size 300 mm is ..... (150 mm, 250 mm, 300 mm)	
(c)	Capacity of wash water tank should be ..... of total capacity (1.5%, 2%, 2.5%)	
(d)	Maximum permitted depth of flow which will convey designed Quantity of sewage flow for dia upto 400 - 900 mm is ..... (0.5d, 0.67d, 0.75d)	
Question No.2	State True or False	(15)
(a)	HDPE pipes can be used for drainage .....	
(b)	Tanker is provided when lpcd is less than 20 lit. ....	
(c)	Scheme is said to be non functional if water supply is provided with less than 25 days in a month and at the rate of 40 lpcd .....	
(d)	Reinforcement is not provided in thrust block .....	
(e)	DI K-7 pipes can be used for rising mains .....	
(f)	A village or habitation is said to be partially covered if lpcd is between 10 to 40 .....	
(g)	Raft is provided if depth of excavation is more than 3M in murum . .....	
(h)	Sewer lines always run full. ....	
(i)	Nabard has sanctioned loan for liquid waste management for villages having population more than 10,000 population .....	
(j)	The yield of supply well should be more than rate of pumping .... .....	

Question No.3			(5)
		(a) Write down the norms adopted in Rural water supply scheme (Any two) (i) Residual Head at E.S.R. .... (ii) Per capita supply per day for peri urban area .... (iii) Designed stage .....	
		(b) State the following (Any two)  (i) Various types of valves in water supply scheme. ..... ..... (ii) Low cost sanitation promotes ..... ..... (iii) When the water is acidic the pH value of water must be less than ..... .....	(5)
		(c) Write down the permissible values (Any five)  (i) Total dissolved solids ..... (ii) BOD of effluent ..... (iii) pH of drinking water ..... (iv) Test pressure of DI K-7 pipes ..... (v) Drop in water level in ESR during hydraulic testing ..... ..... (vi) Minimum Residual head in distribution system ..... .....	(5)
Question No.4 :-		Fill in the blanks	(15)
	(a)	Allowable working pressure for PVC 10 kg/cm <sup>2</sup> is .....	
	(b)	Design period for Trunk sewers is .....	
	(c)	Rate of filtration of rapid sand filter is .....	
	(d)	Design period for pump is .....	
	(e)	Permissible value of Fluorides for drinking water is ..... ppm.	
	(f)	Minimum dia meter of C.I. pipes in the drainage system is .....	
	(g)	Flushing tanks in sewerage collection system are provided when ..... velocity is not achieved.	
	(h)	The minium residual chlorine at the end of distribtion sytem shall be ..... ppm.	
	(i)	Water meter are used to measure the ..... of water.	
	(j)	Power factor shall be more than .....	



Question No.5 :-	(A) Mention use of following	(5)
(a)	Thrust block .....	
(b)	Total station .....	
(c)	Jar test Apparatus .....	
(d)	Water hammer control devices .....	
(e)	Energy Audit .....	
	(B) Select proper figures / words & complete the sentence (Any five)	(10)
(a)	The per capita cost of scheme when lift is more than 30M is ..... .....(1750, 1900, 1790)	
(b)	The distribution system is designed for .....volume flow (3,4,5)	
(c)	The floor level of pump house on Jackwell shall be ..... m above H.F.L. (1.5 m, 2.5 m, 3 m)	
(d)	H.P. of motor = $\frac{.... \times H}{75 \times 0.60}$ (V.Q.C.)	
(e)	Oxidation pond works on the principle of ..... Action (Anaerobic, Aerobic, Chemical)	

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# MAHARASHTRA JEEVAN PRADHIKARAN

Examination conducted by

Maharashtra Environmental Engineering Training & Research Academy (MEETRA), Nashik.

Professional Examination of Asstt. E.E. /A.E.-I/SDE/SDO (Civil)

October 2013

**Subject** :- Water Supply & Sanitation Engineering (Written)  
**Date** :- 23/10/2013 **Time** :- 10.00 to 13.00  
**Marks** :- 75

Note :- (1) Question No. 1 is compulsory & write any five Questions from the remaining.  
(2) Use of Calculator, Log table are allowed.  
(3) Figure in bracket on right hand side indicate total marks.  
(4) Mobile, Laptop, Tablets are not allowed.  
(5) Make suitable assumption if required. Assume suitable data wherever necessary & state them clearly.

- Que. No.1. (A) What is coagulation? How optimum dose of coagulant is determined?  
Determine quantity of alum required in treating 10 million liters of water per day assuming 20 ppm dose. (8)  
(B) Write the name of methods for forecasting population for any scheme. Explain in detail any one of them. (4)  
(C) State the various types of surface intake works. (3)
- Que. No.2. Write short notes on any four of the following. (12)  
a) Hardness of water  
b) Water hammer control  
c) Break point chlorination  
d) Drop manhole  
e) Orthotolidine test
- Que. No. 3. (A) Design a raw water pumping machinery for the population of 10,000 Souls, Rate of water supply is 100 LPCD, Hours of supply is 12 hours. Static head is 30m frictional losses is 5m. Assume necessary data. (8)  
(B) Write down the financial pattern for different class of Municipal Council & Corporation under Maharashtra Sujal Nirmal Abhiyan Programme. (4)
- Que. No. 4. (A) Design a septic tank for small colony having population 200 souls. (7)  
Rate of Water supply - 135 liter /capita/day  
Desludging period - 2 Years  
Rate of sludge deposit - 30 Lit/Capita/Year

Quantity of sewage produce - 80 % of water supply

Detention period of sewage - 24 hours

Work out size of septic tank (Assure L:B=2:1)

Work out size of soak-pit if percolation through it is 1000 lit/m<sup>2</sup>/day

- (B) Write notes (Any One. *one*) (5)
- (i) Total solids and suspended solids.
  - (ii) Biochemical oxygen demand.

Que. No. 5. (A) Draw a neat sketch of 5 MLD capacity unconventional W.T.P. & State the uses of each unit. (6)

- (B) Distinguish between (Any Three) (6)
- i) Aerobic and anaerobic bacteria.
  - ii) Sullage and Sewage
  - iii) Self cleaning velocity and Non scouring velocity.
  - iv) Rapid sand filter & slow sand filter

Que. No. 6. (A) Draw neat flow diagram of 10 MLD sewage treatment plant for a town & state the uses of each unit. (8)

- (B) Describe need of segregation of solid waste collected from house holds. What do you mean by three 'R' in Solid Waste Management? (4)

Que. No. 7. Answer the following. (Any Three) (12)

- a) What is water audit? Explain the term NRW.
- b) What is Energy audit? Explain the term power factor.
- c) What do you mean by hydraulic modeling?
- d) State merits and demerits of HDPE pipes used in water supply scheme.

Que. No. 8. Answer the following (Any Three) (12)

- a) What is criteria for selection of any area for periurban water supply scheme fixed by GoM?
- b) Explain different types of valves required to be used in water supply scheme with their function.
- c) State the service level benchmark fixed GoI for water supply scheme of a city. Give the name of ~~all~~ nine parameter and their benchmark values.
- d) Explain the hydraulic testing of pipe line.

# MAHARASHTRA JEEVAN PRADHIKARAN

Examination conducted by

Maharashtra Environmental Engineering Training & Research Academy  
(MEETRA), Nashik.

Professional Examination of Asstt. E.E. /A.E.-I/SDE/SDO (Civil)

October 2013

Roll No.

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Que. No. 1:- (A) Give formula for the following with appropriate unit.(Any Two). (5)

- Hydraulic mean depth.
- Velocity as per Manning's Formula.
- Scour depth.

(B) Give long forms of the following : (7)

- MDPE pipe:- \_\_\_\_\_
- C.O.D. :- \_\_\_\_\_
- Cumec :- \_\_\_\_\_
- J.T.U. :- \_\_\_\_\_
- ppm :- \_\_\_\_\_
- NHPC :- \_\_\_\_\_
- CPH EEO :- \_\_\_\_\_

(C) Choose the correct option (According to CPH EEO Manual) (3)

- (a) Design period of storage dam :-.....  
( 100 Years, 50 Years, 30 Years)
- (b) Design period of Electric Motor & pump :-.....  
(30 Years, 12 Years, 15 Years)
- (c) Design period of distribution system in Cities :- .....  
(30 Years, 12 Years, 15 Years)

Que. No. 2. State true or False: (15)

- (a) Connecting pipe of water intake designed for 3 volume flow. ....
- (b) Pre-Chlorination is done to prevent algaegrowth in raw water. ....
- (c) Detention period in flocculation zone is considered as 15-30 minutes. ....
- (d) 1.8 to 2.0 m head loss is allowed for rapid sand filter. ....
- (e) As per CPHEEO manual minimum residual pressure for peak demand for three storey building having height is 12m. ....
- (f) Self cleansing velocity for design peak flow of sewer is 0.8m per second.....
- (g) Maximum permissible limit for drinking water for fluoride is 1.5 ppm.....
- (h) Back washing is required for pressure filter.....
- (i) C Value of CI pipe is more than DI pipe.....
- (j) I.S. 10500 is the standard for drinking water.....
- (k) In septic tank digestion of settled sludge is carried out by anaerobic decomposition process. ....
- (l) Oxidation pond is aerobic stabilization unit.....
- (m) The settled sludge containing micro organisms call activated sludge.....
- (n) Capacity of ESR can be determined by mass curve.....
- (o) HDPE pipe is used for drainage.....

Que. No. 3. (a) Write down the permissible values (3)

(i) Nitrates ( $\text{NO}_3$ ) for drinking water .....mg/ltr

(ii) pH of drinking water .....

(iii) Turbidity .....

(b) State the following (Any Two) (5)

1) Various type of meters used in water supply scheme.

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2) Low cost sewage treatment options.

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3) Purpose of flash mixer unit in water treatment plant.

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(c) Define the following: (Any Two) (4)

i) Peak factors for design of water supply distribution system.

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ii) Residual chlorine.

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iii) Working pressure of pipes.

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(d) State purpose of following units (3)

(a) Aeration in WTP

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(b) Air valve

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(c) Scour valve

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Que. No. 4. Fill in the blanks. (15)

- a) Design period of Water treatment plant is ..... Year.
- b) Recommended maximum water supply for town with pipe water supply without sewerage system is ..... LPCD.
- c) Design period of Rising main in sewerage system is .....
- d) Bulk modulus of water is .....
- e) Detention time in septic tank is.....hrs.
- f) Loading rate of plain sedimentation tank is .....m<sup>3</sup>/day/m<sup>2</sup>
- g) Filtration rate of rapid sand filter ..... liter/ m<sup>2</sup>/hr.
- h) The disposal of treated waste water can be made to river if the BOD of effluent is less than .....
- i) The accuracy of ultrasonic flow meter is ..... %
- j) Minimum residual head in distribution system .....m.

Que. No. 5. (A)Mention use of the following (5)

i) Consumer survey

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ii) Bulk meter

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iii) Water Audit

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iv) Pressure release valve

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v) Jar test

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(B) Write in one to two sentence about the following:

(10)

1) Oxidation pond

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2) Drop Manholes

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3) Manholes

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4) Self cleaning velocity

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5) Grit chamber

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**MAHARASHTRA JEEVAN PRADHIKARAN**  
**Examination conducted by**  
**Maharashtra Environmental Engineering Training & Research Academy (MEETRA),**  
**Nashik**  
**Professional Examination of Asstt. EE/A.E.-I/SDE/SDO(Civil)**  
**November 2014**

**Subject** :- Water Supply & Sanitary Engineering (Written)  
**Date** :- 12/11/2014 **Time** :- 10.00 to 13.00  
**Marks** :- 75

**Note :-** (1) Question No. 1 is compulsory & write any five Questions from the remaining.  
(2) Use of Calculator, Log table are allowed.  
(3) Figure in bracket on right hand side indicate total marks.  
(4) Mobile, Laptop, Tablets are not allowed.  
(5) Make suitable assumption if required. Assume suitable data wherever necessary & state them clearly.

**Que.No.1.** A Water supply schemes of two towns with following details is to be proposed by following options.

- 1) Separate pumping machinery provided on sump feeding ESR of each town (without MBR).
- 2) Pumping machinery installed to fill MBR to feed the ESRs of both the towns by gravity through MBR.

The WTP, sump and MBR is located at one location at midway between source & ESRs of the town.

Details	Town 1	Town 2	MBR
LSL of sum	97.00 m	97.00 m	97.00 m
FSL of ESR/MBR	135.00 m	140.00 m	151.00 m
Driving head	4.00 m	4.00 m	4.00 m
Total frictional losses in pure water R/M and G/M	5.00 m	7.00 m	-
Efficiency of pump	70%	70%	70%
Total water requirement/day	10 lakhs liters	20 lakhs liters	-
Discharge of pump	100m <sup>3</sup> /hr	150m <sup>3</sup> /hr	150m <sup>3</sup> /hr
Rate of electricity per unit	Rs. 4/-	Rs.4/-	Rs. 4/-
Hours of pumping	10 hrs	13.33 hrs	20 rs.

- a) Calculate HP of pumps and total electricity charges.
  - i) When a separate pumps are provided on sump feeding ESR of each town (without MBR) (6)
  - ii) When pumps installed is feed MBR through which ESRs of both the towns are filled by gravity. (6)
- b) Compare and comment on the electricity charges in both the cases and feasibility if MBR is proposed. (3)

**Que.No.2.** Write short notes on any four of the following. (12)

- a) Break point chlorination.
- b) Aeration of water
- c) Orthotolidine test
- d) Dechlorination
- e) Superchlorination

**Que.No.3.** Answer the following. (Any Two) (12)

- 1) The water works of a town of population 25000 has to meet its water demand at the rate of 135 lit/capita/day. If the disinfection is to be done by the bleaching powder having 33% available chlorine, determine the qty of the bleaching powder required per year. The required dose of chlorine at the water works is 0.5 ppm for disinfection.
- 2) State and describe the two methods of supplying water to consumers based on duration of supply hours. Which method exist in practice currently?
- 3) List out the different systems of distribution network depending upon their layout and direction of supply described any two of them.

**Que.No.4.** a) Describe Aerobic and Anarobic stabilization ponds designed to treat sewage and biodegradable industrial waste. (4)

- a) Explain the importance of the velocity at minimum flow through sewer. (4)
- b) Write down manning's formula, Hazen William formula & Darcy Weisbach formula for design a pipeline of Water Supply Scheme. (4)

**Que.No.5.** Draw neat and labeled sketch of the following (Any Three) (12)

- a) Septic tank for household.
- b) Water supply connection to household from 90mm dia PVC distribution pipe.
- c) Details of perforated pipe under drain below the filter sand bed.
- d) Sketch of aqua privy.
- e) Surface water intake arrangement with channeling in a riverbed during scarcity in summer season.

- Que.No.6.** Write Short notes on any four of the following. (12)
- Details of filter sand & filter gravel.
  - Air cushion valve.
  - Zero velocity valve.
  - Kinetic air valve
  - Precautions in handling and storage of PVC pipes.
  - Expansion joints in pipelines.

- Que. No.7.** Answer the following (Any Three) (12)
- State the factors affecting consumptions of water.
  - Advantage and disadvantage of domestic consumer meters.
  - Write in brief about precautions while sampling from taps during water sampling for bacteriological analysis.
  - List out the functions/duties necessary for good management of a water supply system.

- Que.No.8** A) Irrigation department has granted a permission of water reservation for water supply scheme under the condition that the local body should store water for 90 days. Water requirement of the town

A town has a existing lake adjoining to the alignment of raw water rising main. It is proposed to divert the raw water through Raw Water Rising Main to lake daily for certain hours. Daily pumped water to be diverted is for 225 days out of 365 days in a year. The salient features of WSS is as under. (10)

- Rate of water supply = 135 lpcd.
- Population = 1,00,000
- Water losses in R/M, WTP & Dist System = 20%
- H.P. of pumps = 2 Nos X 250 HP + 1 No X 250 H.P.(Standby)
- Discharge of pump (250HP pumps) = 8,10,000 lit/hr.
- Evaporation & infiltration losses in a lake = 30%

- Calculate daily hours of raw water pumping to be diverted to lakes for 225 days so as to fulfill the water requirement for scarcity period of 90 days.
- Also calculate electricity charges @Rs.5/- per unit, for additional R/W pumping for 225 days to be diverted to lake.

- B) What is the importance of "Ferrule" in domestic connection of water Supply? (2)

**MAHARASHTRA JEEVAN PRADHIKARAN**  
**Examination conducted by**  
**Maharashtra Environmental Engineering Training & Research Academy (MEETRA),**  
**Nashik**

**Professional Examination of Asstt. EE/A.E.-I/SDE/SDO(Civil)**  
**November 2014**

Roll No.	
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**Subject** :- Water Supply & Sanitary Engineering (Oral)

**Date** :- 12/11/2014

**Time** :- 14.00 to 14.30

**Marks** :- 75

**Note :-** (1) Solve all questions.

(2) Use of Calculator, Log table are allowed.

(3) Figure in bracket on right hand side indicate total marks.

(4) Mobile, Laptop, Tablets are not allowed.

(5) Make suitable assumption if required. Assume suitable data wherever necessary & state them clearly.

Question No	1	2	3	4	5	6	7	Total
Marks obtained								

Signature of Supervisor .....

Signature of Examiner.....

**Que.No.1.** A) Write long form of the following abbreviation. (7)

- a) MPN :- \_\_\_\_\_
- b) COD :- \_\_\_\_\_
- c) CPHEEO :- \_\_\_\_\_
- d) TDS :- \_\_\_\_\_
- e) HGL :- \_\_\_\_\_
- f) PVC :- \_\_\_\_\_
- g) STP :- \_\_\_\_\_

B) Give detention period of the following units. (3)

- i) Flocculator :- \_\_\_\_\_
- ii) Settling tank :- \_\_\_\_\_
- c) Grit chamber :- \_\_\_\_\_

C) Mention the use of the following (5)

1) Thrust Block :- \_\_\_\_\_  
\_\_\_\_\_

2) Ultrasonic flow meter. :- \_\_\_\_\_  
\_\_\_\_\_

3) Ferrule :- \_\_\_\_\_  
\_\_\_\_\_

4) Total Station :- \_\_\_\_\_  
\_\_\_\_\_

5) Union in plumbing work :- \_\_\_\_\_  
\_\_\_\_\_

Que.No.2. A) Give the standard values for the following (12)

- i) The connecting main in head work is designed for..... volume flow.
- ii) The value of Hazen-William's coefficient for design purpose in case of PVC pipes is taken as .....
- iii) Standard BOD is measured at .....<sup>0</sup>c & .....days.
- d) The water supply rate for periurban village is specified as .....lpcd.
- e) The standard rate of filtration through a rapid sand filter is usually ..... to ..... lpm/sqm.
- f) Depth of sand in rapid sand filter is ..... m to .....m.

Que.No.3. Fill in the blanks. (12)

- a) For perforated pipe underdrain system, gravel shall be of .....mm minimum size, .....mm maximum size.
- b) Uniformity coefficient of filter sand shall not be more than ..... and not be less than .....
- c) Gaseous chlorine is approximately ..... times heavier than air.
- d) Free chlorine when added to water reacts as under  
$$\text{Cl}_2 + \text{H}_2\text{O} \rightleftharpoons \dots\dots\dots + \text{HCL}$$
- e) In advance water treatment, RO and ED is the abbreviation of ..... And .....

- f) In ..... System of water supply, the consumer gets supply only for certain fixed hours (A few hours in the morning and/or a few hours in the evening)

**Que.No.4.** Answer the following.

- i) In design of distribution system for continuous system if the source is likely to yield less in summer, then which option will you adopt? (3)

- a) Design as a continuous system and run as intermittent system.
- b) Design as intermittent system and run as continuous system or intermittent system.

- ii) Distribution system should be designed for the following minimum residual pressures at ferrule points; (3)

- a) Single storey building.....
- b) Two storey building .....
- c) Three storey building .....

- iii) In case of design of PVC pipes, the working pressure is standardized at 27<sup>0</sup> c. At higher temperature upto 45<sup>0</sup>c the strength of the pipe reduces and the working pressure shall be modified as per IS 4985:2000 calculate the modified working pressure for following if working pressure coefficient is 0.65 for temperature at 45<sup>0</sup> c. (3)

Class of pipe	Working pressure at 27 <sup>0</sup> c	Modified working pressure at 45 <sup>0</sup> c
Class-2	4Kg/cm <sup>2</sup>	.....
Class-3	6Kg/cm <sup>2</sup>	.....
Class-4	8Kg/cm <sup>2</sup>	.....

- iv) The acceptable limit for water quality parameters for (3)

Parameters	Acceptable limit
TDS	.....
Fluoride	.....
Iron	.....

**Que.No.5.** Answer the following

- i) State the design period in years as per CPHEEO manual for water supply scheme (4)

Project components	Design Period
a) Pumping machinery	.....
b) Water treatment units	.....
c) Raw water conveying mains	.....
d) Distribution system	.....

ii) List out the five methods of population projection. (5)

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iii) State per capita water requirement in addition to the recommended per capita water supply to the towns.(Any Three) (3)

- a) Hostels :- ..... liters/head/day
- b) Air Ports & Sea ports :- ..... liters/head/day
- c) Day schools and colleges :- ..... liters/head/day
- d) Offices :- ..... liters/head/day

Que.No.6. Answer the following. (Any Four)

i)List out steps involved in the sewerage system layout. (3)

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ii)State the principle of measurement (in general) utilized for measurement of flows in waste water treatment. (3)

<b>Point Concerned</b>	<b>Principal of measurement</b>
a) Raw waste water	.....
b) Air flows	.....
c) Gas flows produced	.....

iii) State (3)

- a) Manning's formula
  
  
- b) Hazen William's formula
  
  
- c) Darcy weisbach's formula

iv) State the purpose of the following in house connection of water supply. (3)

a) Ferrule :- \_\_\_\_\_

b) Union :- \_\_\_\_\_

c) Ferrule setting :- \_\_\_\_\_

v) While making house connection for water supply, the ferrule is generally fixed to water main below ground level. State the advantages and disadvantages, if the ferrule is fixed on service pipe above ground level toward building instead of ferrule fixed on distribution line tapping point as currently practiced? (3)

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**MAHARASHTRA JEEVAN PRADHIKARAN**  
EXAMINATION CONDUCTED BY  
MAHARASHTRA ENVIRONMENTAL ENGINEERING TRAINING & REASERCH  
ACADEMY ( MEETRA ) NASHIK  
**PROFESSIONAL EXAMINATAION OF A.E.E./A.E.-I/ S.D.E./S.D.O.(CIVIL)**  
**OCTOBER 2015**

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**SUBJECT:- SPECIAL SUBJECT ( WATER SUPPLY & SANITATION ENGINEERING(CIVIL))**  
**WRITTEN**

**DATE: 28/10/2015**

**TIME : 10.00 to 13.00 pm**  
**MARKS : 75**

- =====
- NOTE:-** 1) Question No.1 is compulsory and write any five question from the remaining  
2) Use of Calculator , Log Table are allowed  
3) Figure in bracket on right hand side indicate total marks  
4) Mobile , Laptop , Tablets are not allowed  
5) Make suitable assumption if required. Assume suitable data wherever necessary and state them clearly.
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**Question No.1(A):-** **(8)**

What do you understood by disinfection? What are the three main methods of disinfecting water? explain any one most commonly used method in brief.

**Question No.1(B) :-** **(4)**

Calculate the quantity of bleaching powder required per day for disinfection of 4 million lit/day. The dose of chlorine to be 0.5ppm and bleaching powder contains 30% of available.

**Question No.1(C) :-** **(3)**

What is dechlorination? Why it is necessity ?

**Question No.2:-**

**Write short Note on any three of the following** **(12)**

- i) Fire demand.
- ii) pH of drinking water.
- iii) Source of water.
- iv) Self cleaning velocity.

**Question No.2:-**

**Write short Note on ( Any three )** (12)

- i) Effect of water content in cement concrete
- ii) Compaction of concrete
- iii) Energy Audit
- iv) Curing of Concrete
- v) Ready mix concrete

**Question No.3:-**

**Differentiate between following ( Any four )** (12)

- i) PERT & CPM Network analysis
- ii) Sullage & Sewage
- iii) Working Stress & Limit State design
- iv) Schedule 'A' & Schedule 'B' tender
- v) One way & two way slab
- vi) Pressure reducing & flow central valve

**Question 4:-**

**Explain in brief** (12)

- i) Water hammer pressure
- ii) Well Foundation
- iii) Necessity of curing of concrete
- iv) Purpose of guniting of MS pipe

**Question No.5:-**

**Write detail specification , mode of measurement and payment proposed ( Any two )** (12)

- i) Construction of Cofferdam
- ii) Construction of B.B. Masonry chamber
- iii) Lowering, laying & Jointing of HDPE pipe
- iv) Excavation of soft and hard soil for pipe trenches

**Question No.6:-**

**Give analysis for following ( Any two ) ( 12)**

- a) 12mm cement plaster of mix ( 1:4)
- b) PCC ( 1:3:6) in foundation
- c) Random Rubble stone masonry in CM ( 1:6) in superstructure
- d) Excavation in hard rock by blasting

**Question No.7:-**

**A) Attempt any two (6)**

- i) Type of cement and its suitability
- ii) What is workability of concrete? State any two methods to measure it
- iii) What is meant by water cement ratio? State its importance

**B) Write about documents required for land acquisition proposal of private land and describe the land acquisition process (6)**

**Question No.8:-**

**(12)**

Describe the procedure of preparation of tender document of any water supply scheme as per the latest available circular ( From invitation of tender to issuing work order )

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**MAHARASHTRA JEEVAN PRADHIKARAN**  
 EXAMINATION CONDUCTED BY  
 MAHARASHTRA ENVIRONMENTAL ENGINEERING TRAINING & REASERCH  
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**PROFESSIONAL EXAMINATAION OF A.E.E./A.E.-I/ S.D.E./S.D.O.(CIVIL)**  
**OCTOBER 2015**

<b>Roll No</b>	
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**SUBJECT:- SPECIAL SUBJECT ( WATER SUPPLY & SANITATION ENGINEERING(CIVIL))**  
**ORAL**

**DATE: 28/10/2015**

**TIME : 14.00 to 14.30 pm**

**MARKS : 75**

=====

- NOTE:-** 1) Solve all Questions  
 2) Use of Calculator , Log Table are allowed  
 3) Figure in bracket on right hand side indicate total marks  
 4) Mobile , Laptop , Tablets are not allowed  
 5) Make suitable assumption if required. Assume suitable data wherever necessary and state them clearly.

Question No	1	2	3	4	5	Total
Marks obtained						

Signature of Supervisor ----- Signature of Examiner-----

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**Question No.1:-**

**A) Write long form of the following abbreviation. (7)**

- i) AMRUT -----
- ii) WHO -----
- iii) GRP -----
- iv) NPSHa -----
- v) DWF -----
- vi) MSW -----
- vii) BOD -----

**B) Mention the use of following. (5)**

- i) Non Return Valve ( NRV) -----
- ii) Expansion Joint. -----
- iii) Drop manhole. -----
- iv) Screening. -----
- v) Septic tank. -----

**C) Write the value of each as per CPHEEO manual. (3)**

- i) The minimum recommended diameter of sewer pipe is -----cm.
- ii) Maximum allowed Nitrates ( as  $\text{NO}_3$ ) in drinking water is -----mg/l.
- iii) Distribution system should be designed for minimum residual pressure at ferrule point in case of two storey building is -----m.

**Question No.2:- Fill in the blanks. (15)**

- 1) The amount of oxygen consumed by sewage from potassium dichromate is termed as -----
- 2) The leakage of sewage from sewers into the surrounding is known as -----
- 3) Design period of distribution system as per CPHEEO norms is ----- years
- 4) Recommended maximum water supply rate for metropolition and mega cities provided with piped water supply where sewerage system is existing is -----LPCD.
- 5) Recommended water supply rate for offices is ----- LPCD
- 6) The water requirement for fire demand is usually derived by various. Formulae in which it is evident that the water requirement for fire demand depends on -----

- 7) Sounding rod is used for detecting ----- of water from underground mains.
- 8) ----- use in service pipe to prevent damage if there is any unequal settlement.
- 9) Sodium Hexameta Phosphate is used in water for -----
- 10) ----- is used to remove silt in a pipe line.
- 11) The entry of foul gases into the house coming from sewers can be prevented by using-----
- 12) C Value for DI pipe is -----
- 13) In case of gravity pipes, maximum working pressure shall be ----- work test pressure.
- 14) RCC pipe P3 test pressure is ----- kg/cm<sup>2</sup>
- 15) One can use capacitor to improve -----

**Question No.3:- A) Answer the following in one sentences. (10)**

1) Financial pattern of AMRUT programme for water supply scheme below 100000 population city.

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2) For combined sewage system egg-shaped sewers are preferred because.

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3) Corrosion of concrete sewer occur due to.

-----  
 -----

4) The cleaning of slow sand filter is done by.

-----  
-----

5) Write any two methods of disinfection.

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**B) Give formula for following. ( Any two)**

**( 5)**

1) Mannings formula (v)

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2) Specific speed (  $\eta q$  )

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3) Hydraulic mean depth for circular pipe (r)

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**Question 4:- A) Match the following**

**(5)**

Treatment Method	Design parameter
1) Plain sedimentation	a) Bacteria count
2) Ion-exchange	b) Hydraulic loading rate
3) Flocculator	c) Exhaust of bed
4) Rapid sand filter	d) Settling velocity
5) Chlorination	e) Velocity gradient

**B) Write down the function of following units/ equipments in sewage & water Supply Scheme (10)**

- 1) Primary Settling Tank -----
- 2) Trickling filter -----
- 3) Secondary settling tank -----
- 4) Waste stabilization tank -----
- 5) Floor Traps -----
- 6) Gully Traps -----
- 7) Shuice valve -----
- 8) Surge Tank -----
- 9) Jar Test -----
- 10) R.O. ( Reserve Osmosis) -----

**Question No.5:- A) State True or False (10)**

- 1) Super chlorination means apply of extra chlorine for highly polluted water -----
- 2) Depth of tank is necessary for design of a sedimentation tank -----
- 3) Water free from impurities can be obtained from springs -----
- 4) The best method of disposal of refuse to ensure compete destruction of pathogenic bacteria is by incineration -----
- 5) Vacuum filters are used for filtration of sewage -----
- 6) The growth of algae is useful in oxidation pond -----
- 7) The cavitations and pitting can prevented by reducing the velocity head -----
- 8) Piezometric head is the sum of velocity head and pressure head -----



9) Pitot tube is used for measuring velocity of water accurately -----

10) Biochemical oxygen demand of safe drinking water is zero -----

**B) Write down IS code number for any five of the following**

1) Drinking Water -----

2) DI pipe -----

3) Plain and reinforced concrete-----

4) HDPE pipe for potable water -----

5) Basic requirement for water supply, drainage and sanitation  
-----

6) Guidelines for registration of plumbers -----

7) PVC pipes for drinking water -----

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