Course Title: Environmental Engineering I   **Course Code: CE 331**
Time: 3 hour   **Full marks: 100**

Answer all the questions below:
(Note: Assume any missing data)

1. (a) Discuss briefly any chemical disinfection process in water treatment. (10)

   (b) Discuss the chlorine doses in water treatment for disinfection with a typical chlorination curve. (6)

   (c) It is required to supply water to a population of 35,000 at a per capita demand of 150 liters per day. The disinfectant used for chlorination is bleaching powder which contains 30 % of available chlorine. Determine how much of bleaching powder is required monthly at the waterworks, if 0.3 ppm of chlorine dose is required for disinfection. (4)

2. (a) Discuss the coagulation process in conventional water treatment. (6)

   (b) Write explanatory notes on the following: (any three) (9)
   (i) Life of a tube well and its failure (ii) Water use and re-use (iii) Artificial recharge of groundwater (iv) Rainfall harvesting in Bangladesh (v) Well maintenance

   (c) The discharge of water flowing from a reservoir into a 1m dia steel pipe is 1.6 m^3/sec. If a valve is situated in the pipe-line at a point 2 km from the reservoir , evaluate water hammer pressure developed by the closure of this valve, if (5)
   I.   The closure time is 2.8 sec
   II. The closure time is 5.5 sec

   The thickness of the pipe –shell may be taken to be 2.5 cm.

3. (a) Differentiate between : (any three) (9)
   (i)   Naturally developed well & gravel-packed well
   (ii)   Reverse –circulation rotary method & direct rotary method for drilling well
   (iii)   Pressure pipes and gravity pipes.
   (iv)   Dry intake tower and wet intake tower

   (b) Why a well should be completed to the bottom of the aquifer ? (3)

   (c) Why well development is important ? (3)

   (d) Write down the shortcomings of Tara pumps. (5)

4. (a) Define intake structures. Write down the important considerations for selection of site for intake structures. (7)

(b) Discuss briefly the technologies of removal of hardness or arsenic from water. (7)

(c) One million gallons of water per day (1 mgd) passes through a sedimentation tank which is 20 ft. wide, 50 ft. long and 10 ft deep. (a) Find the detention time for this basin. (b) what is average velocity of flow through the basin ? (c) If the suspended solids content of the water average 40 ppm, what weight of dry solids will be deposited every 24 hrs assuming 80% removal in basin. (d) What is over flow rate ? (6)

5. (a) Design a tube well of a suitable aquifer for extracting drinking water at a depth from 280 ft to 340 ft. In the following graph the co-ordinates should be identified. (Summary of grain size test report, gradation chart & all relevant data are given below). (20)

The necessary equations are given below:

1. $U_P = \sqrt{(E_W/\rho)} . \dfrac{1}{\sqrt{(1+ E_W/E_P . d/t)}}$ 2. $P_h = P_h(max) (T_C/T)$ 3. $T_C = 2S/U_P$

Summary of Grain Size Test Results:

Sample depth	D_{10}	D_{30}	$U = D_{60}/D_{10}$	% of Coarse Sand	% of Medium Sand	% of Fine Sand	FM
(ft)	mm	mm		%	%	%	
240	0.17	0.25	1.4	0.5	89.5	20	1.5
260	0.18	0.24	1.46	0.5	89.5	20	1.49
280	0.2	0.3	1.3	4	86	10	1.68
300	0.15	0.24	1.58	12	68	20	1.60
320	0.18	0.25	1.52	2	82	16	1.56
340	0.18	0.27	1.11	10	75	15	1.67
360	0.15	0.22	1.55	1	76	23	1.38
380	0.16	0.21	1.38	0.5	75	24	1.30

The relevant size of sieves

Sieve No.	Size (mm)
4	4.75
8	2.36
16	1.18
30	0.6
40	0.425
50	0.3
100	0.15
200	0.075

Grain Size Distribution Curve
(Depth-320')