Course Title: Environmental Engineering I
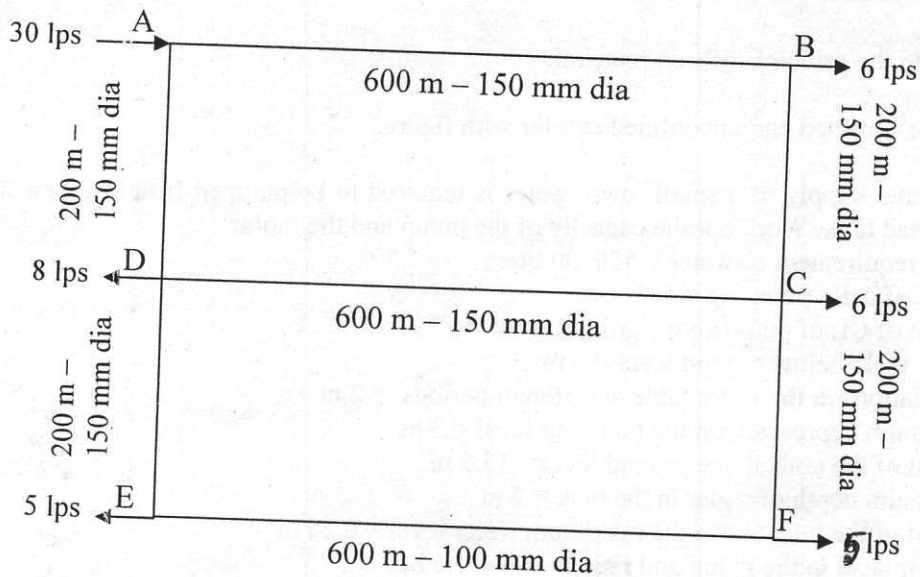
Time- 3 hour

Course Code: CE 331

Full marks: 100

(SEC- A)
Answer any five questions out of six. Assume any missing data.

1. (a) Define potable and palatable water. (3)

   (b) Explain the principle of iron removal. (6)

   (c) Define confined and unconfined aquifer with figure. (4)

   (d) For water supply of a small town, water is required to be pumped from a tubewell to an (7) overhead tank. Work out the capacity of the pump and the motor.
   Daily requirement of water = 550000 litres
   Hours of daily pumping = 6
   Height of CL of pump above ground level = 0.75 m
   Water table below ground level = 9 m
   Fluctuations in the water table at different periods = 2 m
   Maximum depression on the pumping level = 3 m
   Height of the tank above ground level = 13.5 m
   Maximum depth of water in the tank = 2 m
   Height of the inlet above the maximum water level = 0.25 m
   Loss of head in the pump and rising main = 1.5 m
   Efficiency of the pump= 65%
   Efficiency of the motor = 80%

2. (a) Differentiate between slow sand filter (SSF) and rapid sand filter (RSF). (6)

   (b) Classify pumps on the basis of different service. (2)

   (c) Write down the important considerations for selection of site for intake structures. (7)

   (d) Explain why continuous method water supply is better than intermittent method. (5)

3. (a) Water is supplied from an impounding reservoir 20 miles away to a service reservoir near (7) the town. A cast iron main is to be designed to supply 400 mgd. Loss of head due to friction in the pipe is estimated to be 200 ft. All the other head losses are neglected. Find the size of the cast iron pipe?

   (b) Classify distribution network with appropriate figure. (6)

   (c) Draw and explain the Break Point Chlorination curve. (4)

(d) What are the problems of groundwater development in Bangladesh?

(3)

4. (a) Briefly explain the theories of filtration.

(12)

(b) Determine peak design flow for 15000 people when the peak factor is 2.0, average water consumption is 135 litre/day with a wastage of 20%.

(3)

(c) Briefly explain iron removal plan with sketch.

(5)

5. (a) What are factors needed to be considered in determining the location of intake?

(4)

(b) Calculate the flow in each of the pipes in the following looped pipe network:

(16)

6. (a) Name different methods for removing hardness from water. Briefly explain two of them.

(5)

(b) Determine settling velocity for a design flow of 450000 ft^3/day, $\rho_s = 155$ lb/ft^3, $\rho_w = 62.4$ lb/ft^3, diameter is 0.008 inch, viscosity 0.000672 lb/ft.s.

(3)

(c) Explain any four of the following:

(4X3)

   i.   Coagulation and flocculation
   ii.   Disinfection
   iii. Sanitary significance of fluoride
   iv.   Sanitary significance of nitrate
   v.   Greywater

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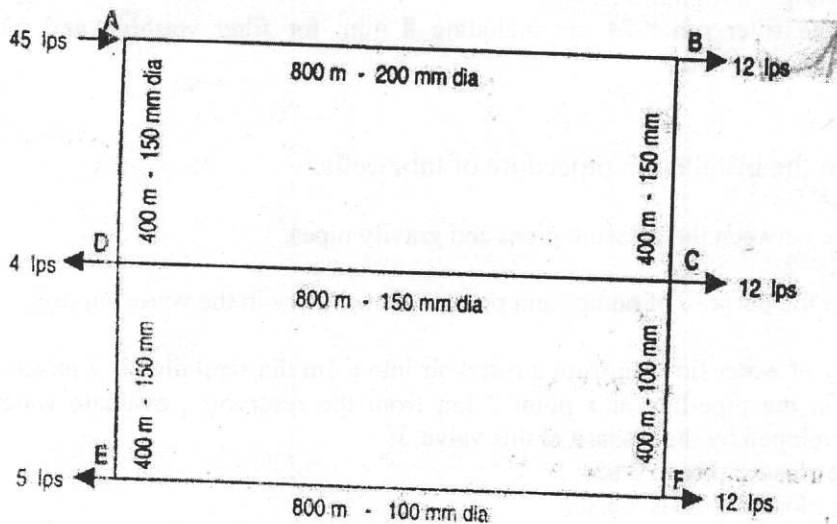
Course Title: Environmental Engineering I   Course Code: CE 331
Time- 3 hour   Full marks: 100

Question No. 1 is compulsory. Answer FOUR from the rest.
(Note: Assume any missing data)

1.   (a)   Design a tube well of a suitable aquifer for extracting drinking water at a depth from 280 ft   (24)
to 340 ft.
(Summary of grain size test report, gradation chart & all relevant data are given below).

2.   (a)   Write explanatory notes on the following: (any three)   (9)
i. Porosity & permeability of soil   ii. Fire demand   iii. Water use and re-use   iv. Artificial
groundwater recharges   v. plain sedimentation

    (b)   Write down the considerations for planning and design of a low - cost water supply scheme   (6)
in developing countries.

    (c)   A rapid sand filter is to be designed for a capacity of 27,000 m^3/day. What should be the   (4)
number and size of the units ? Calculate the percentage of filtered water required to wash
the filter bed and the capacity of the wash water tank.

     [Assume : Rate of filtration : 5 m^3/hr/m^2
Rate of washing : 35m^3/hr/m^2
Length of the filter run : 24 hrs including 8 min. for filter washing and 12 min. for
resettlement of sand bed.]

3.   (a)   Write down the installation procedure of tubewells.   (7)

    (b)   Differentiate between the pressure pipes and gravity pipes.   (3)

    (c)   Write down the purpose of pumps and pumping machinery in the water supply.   (4)

    (d)   The velocity of water flowing from a reservoir into a 1m dia steel pipe is 2 m/sec. If a valve   (5)
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
    I.   The closure time is 3 sec
   II.   The closure time is 5.5 sec

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

4. (a) Define intake structures. (2)

(b) Write down the important considerations for selection of site for intake structures. (6)

(c) What are the main types of water distribution networks ? What are their relative advantages and disadvantages ? (7)

(d) A 100 mm diameter tubewell is sunk to withdraw water from a 10 m thick confined aquifer having coefficient of permeability equal to 0.75 lps/m^2 . The depth of water below the peizometric level is 30m and it falls 2m in the tube well while pumping. Calculate the discharge of the tube well when the radius of the circle of influence is 30m. (4)

5. (a) Draw and explain the break point chlorination. (4)

(b) Write down the technologies for removal of hardness of water and discuss briefly all of them. (10)

(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 75% removal in basin. (d) What is over flow rate ? (5)

6. (a) At present rainwater harvesting is potential alternate source of water supply in Bangladesh. Discuss. (7)

(b) Calculate the flow in each of the pipes in the following looped pipe network: (12)

The necessary equations are given below:

1. $U_P = \sqrt{(E_W/\rho)} \cdot \dfrac{1}{\sqrt{(1 + E_W/E_P \cdot d/t)}}$

2. $P_{h} = P_{h}(max)\,(T_C/T)$

3. $T_C = 2S/U_P$

4. $\Delta = -\dfrac{\sum H}{(x \sum H/Q_a)}$

Where, Δ = flow correction; Q_a = assumed flow; H = Head loss and x = component equal to 1.85 for

Hazen William's equation and 2 for Manning equation.

5.

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 sieve No.

Seive 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

University of Asia Pacific
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Final Examination Spring 2012
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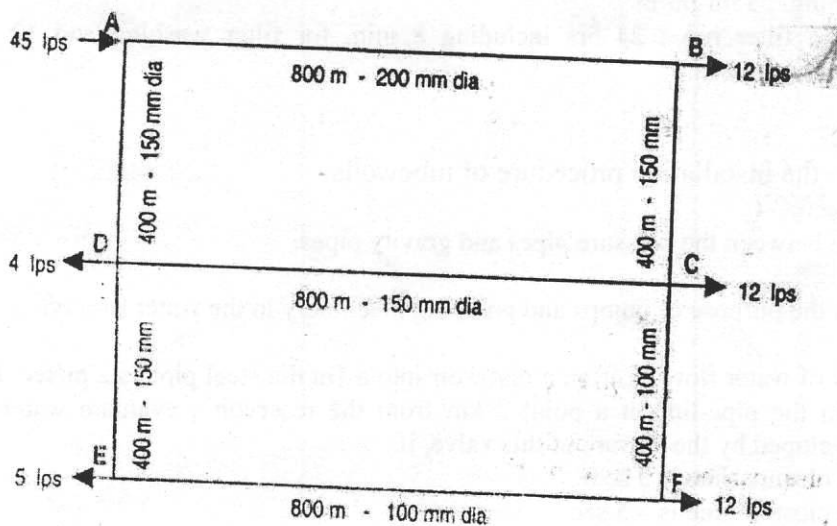
(SEC – B)
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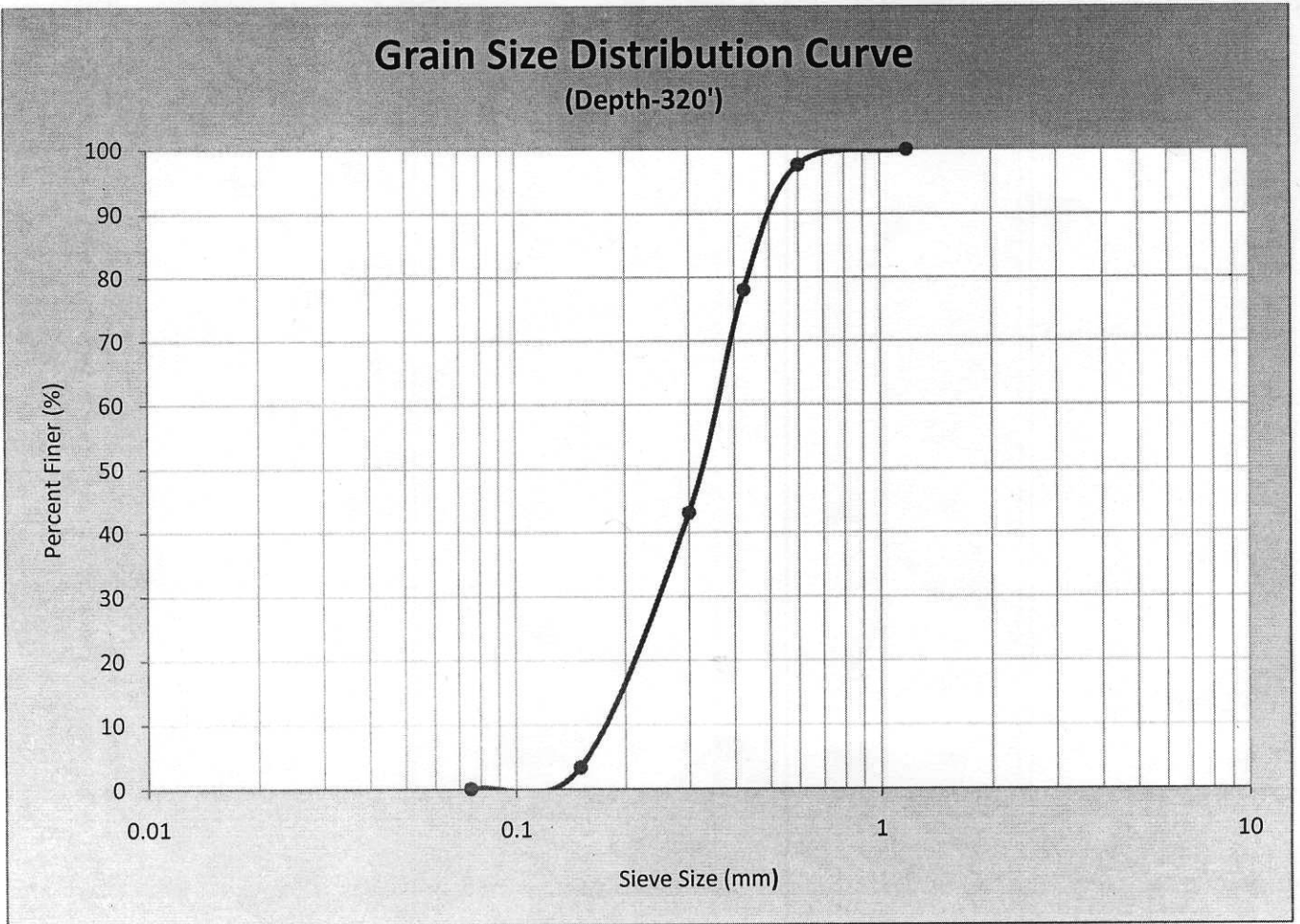
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Note: Complete and attach the gradation chart with the exam paper.

Grain Size Distribution Curve
(Depth-320')

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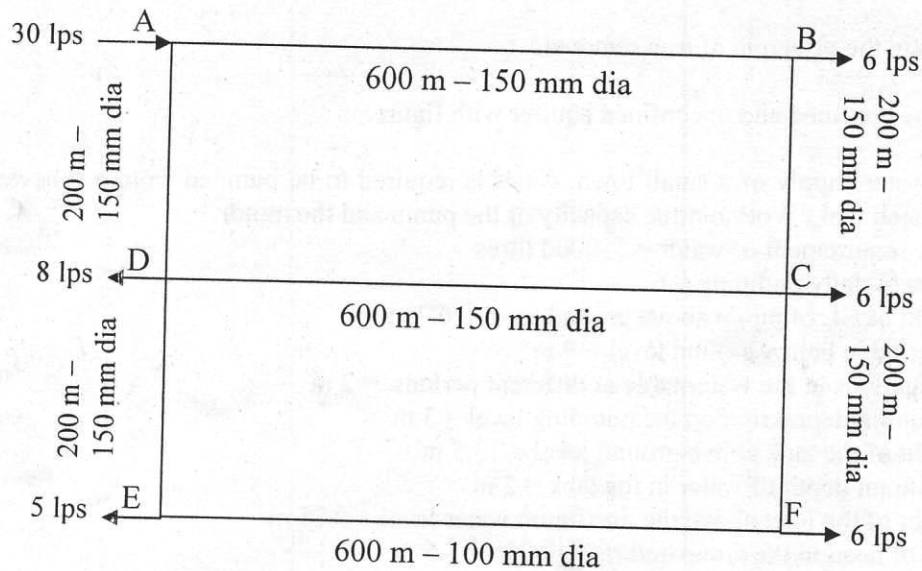|	
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