B.E. CIVIL ENGINEERING EXAMINATION, 2019
III RD YEAR, 1ST Semester Examination

SUBJECT: WATER SUPPLY ENGINEERING

Time: ~~Two hours~~/Three hours/~~Four hours/ Six hours~~

Full Marks 30/100

Use a separate Answer-Script for each part

No. of Questions	Part I (Marks:60)	Marks
	Answer All questions	
	Assume relevant data if not given	
Q1.	ANSWER ANY FOUR (4) QUESTIONS: - a) What are the harmful impurities in surface water sources? b) What do you mean by unit process? How they differ from unit operation? c) Do you agree that slow sand filter is more efficient than pressure filter? d) Justify the formation of hardness causing element during chemical sedimentation. e) Prechlorination is must in presettling tank if raw water is collected from lake. f) Aeration unit is located prior to filter unit in tubewell water treatment-justify. g) Zeta potential is responsible for stability of colloids – justify. h) pH is a criteria for generation of chlorine species during disinfection – Do you agree?	4x3=12
Q2, a)	Describe with necessary flow sheet, different types of unit operation for making water fit for potable purposes from river water. Explain the justification of providing of all such units.	12
	Or	
b)	Draw a neat flow diagram of treating ground water containing fluoride and iron with justification of installing all such units .	12
Q 3.		
a)	Derive an expression to determine settling velocity of a discrete particle in quiescent water	6
b)	Find the settling velocity of a discrete particle in water under conditions when Reynolds number is < 0.5. The diameter and specific gravity of the particle is 5x 10-3cm and 2.65 respectively. Water temperature is 20C (kinematics viscosity of water at 20o C is1.01X10-2.cm2/sec)	6
	Or	
c)	Distinguish discrete and flocculent settling. State and explain double layer ionic theory regarding colloid stability.	7
d)	Alum , Al2 (SO4)3, 18 H2O is to be used for coagulation purpose in a water treatment plant with a capacity of 1000000L per hour. The raw water has a natural alkalinity of 12mg/l,as CaCO3, how much lime shall be required daily for optimum coagulation? The alum dose is 40mg/l.	5

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No. of Questions	Part I (Marks:60)	Marks
Q 4.		
a)	What are the purposes of water filtration? Discuss the mechanism of granular bed filtration.	6
b)	With the help of a neat sketch explain the operation principle of rapid gravity sand filter. Show different valves for operation of the filter .	8
Q5	Answer any one(1) from the following:-	
(a)	An ideal horizontal flow settling basin is 4 m deep having surface area 1200m2. Water flows at 6000m3 /day with $\mu = 10^{-3}$ Kg/m-sec. Assuming Stokes Law to be valid , determine how much proportion of spherical sand particles 0.01 mm in diameter with specific gravity 2.65 that will be removed in the tank?	10
(b)	Laboratory tests show that 99.9% kill could be obtained in 10 min with a concentration of 14mg/l. What should be the contact time to obtain 99.99% kill with the same dose of the disinfectant? Derive necessary expression for solving the problem.	10
(c)	Laboratory test on a sample of water indicate that a chlorine dose of 1.8 mg/l is to be used in order to destroy 99.90% of pathogen in a contact time of 20 min. It is decided that hypochlorite with 28 % available chlorine shall be used to obtain 99.99 % kill of pathogens in a contact time of 30 mins. Estimate the amount of the hypochlorite (60%pure) required for treatment of 7500m^3/day of water. Assume n=1.2.	10

B.CIVIL ENGG. 3rd YEAR 1ST SEM. EXAMINATION 2019
WATER SUPPLY ENGINEERING

Full Marks 100
(40 marks for part II)

Time: Three hours

Use a separate Answer-Script for each part
Part-II
Answer all questions
Hazen-William's nomogram is allowed
(Assume any data, if required, reasonably)

1. Answer the following questions   (4+3+3+4+3+3) = 20

    I.   What are the different sources fresh water? What are the specific characteristics of water from each source?

    II.   What are the CPHEEO recommendations of the fire water demand?

    III.   What is fecal coliform? Why it is used as a pathogen indicator?

    IV.   Describe the Indian standards (IS 10500: 2012) for drinking water and health hazards of – (a) Arsenic; (b) Fluoride; and (c) Nitrate.

    V.   What are the advantages of radial system compared to the other distribution systems of water supply?

    VI.   Discuss the assumptions of 'Equivalent Pipe Method' with elastration for the design of water distribution pipe network.

2.

a) Deduce the equation for 'incremental increase method' of population projection and discuss its applicability. The populations of a town as per the Census record are given below for the years 1961 to 2011. Assuming that the scheme of water supply will commence to function from 2020, it is required to estimate the population of 30 years and also the intermediate population of 15 years after 2020.

Year	1961	1971	1981	1991	2001	2011
Population	41,300	59,800	75,200	99,800	124,700	157,200

Project the population by 'incremental increase method'.

10

Or

2.

b1) Population of a city is 1.5 lakh, average water consumption rate is 270 lpcd, find out the (i) average daily demand; (ii) maximum daily demand; (iii) maximum hourly demand; (iv) fire demand considering fire flow $Q = [4637 \sqrt{P} \times (1- 0.01\sqrt{P})]$ l/min where P is the population in thousand; and (v) coincident draft.   5

2.

b2) A three-story wooden-frame building with a ground floor area of 680 m² is adjacent to a five-story building with a basement of ordinary construction with 900 m² per floor. Using Insurance Service Office (ISO) formula, determine the fire flow and duration required i) for each building and ii) the complex assuming the units are connected. Given, required fire flow for 4 h duration is 250 l/s to 310 l/s.   5

3.

a1) What are the functions of a distribution storage reservoir?   3

a2) For the water supply of a small town, having population of 1lakh with the daily water requirement of 200 lpcd, it is proposed to construct a distribution reservoir. The pattern of draw off is as under:

7.00 A.M. – 8.00 A.M. (25% of day's supply)

8.00 A.M. – 5.00 P.M. (40% of day's supply)

5.00 P.M. – 6.30 P.M. (30% of day's supply)

6.30 P.M. – 7.00 A.M. (5% of day's supply)

Pumping will be done: 7 A.M. to 11A.M. and 2 P.M. to 6 P.M. at a constant rate. Find out the size of the reservoir.   7

Or

3.

b) A tree system of pipe line feeds a colony from an overhead tank at 'A', the discharge level of which is 20 m above G.L. The minimum residual head requirement is 6 m of water column above G.L. Design the diameters of pipes in AB, BC and CD sections using *Hazen-William's constant* as 100. Available diameters of pipes start from 100 mm with 20 mm increment up to 600 mm. Ground in this area is leveled. Water is going out through B', C', D' and E'.
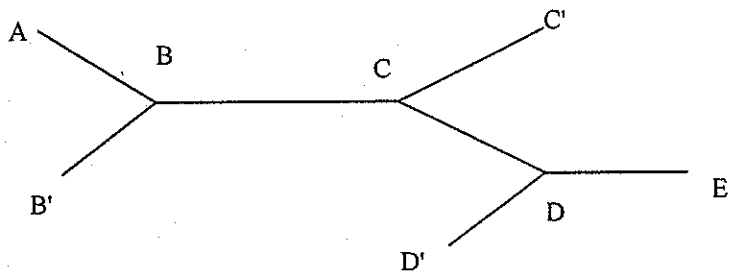
Lengths and requirements of water in different branches are as follows.

Pipe	Length (m)	Discharge (l/m)	Pipe	Length (m)	Discharge (l/m)
AB	400	?	BB'	200	2000
BC	300	?	CC'	250	2500
CD	280	?	DD'	200	3000
DE'	250	3500			

10