TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Chaitra

Exam.		Regular	
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Water Supply Engineering *(CE 605)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. Draw a schematic diagram of typhical urban water system and briefly describe the function of each components. [4]

2. Differenciate deep and shallow well. Briefly describe the water characteristics of those wells. [4]

3. Calculate the design discharge for design year 2040 for Rural Municipality in Ilam District. the data collected in survey year 2020 is as below:

   Survey year population = 1600; Population growth rate = 2.3% per year; number of buffalos = 350; Number of cows = 500; Number of goats = 900; Number of chickens = 2500; Number of boarder students = 100; Number of day scholar students = 550; Number of offices = 5; Health post = 2 nos. [8]

4. a) Why examination of water is necessary? What are E-coli and coliform? How their presence are tested in water? [2+1+1]

   b) A water sample of 700 ml with pH 6 is mixed to another water sample of 500 ml with pH 8. What will be the pH of the mixture? [4]

5. What are the components of intake? Describe with the help of neat sketches a reservoir intake for an earth dam. [1+7]

6. a) Design a settling tank for a town having design year population of 41,600 numbers with a water supply rate of 120 lpcd. The detention period is expected as 4 hours, length width ratio as 4 and effective depth as 3.5 m. Also check for SOR and velocity. Sketch neat diagram with dimensions as designed. [8]

   b) Determine the size of slow sand filter for a present population of 15000 nos, design period = 20 yrs, annual population growth rate = 2.5%, water consumption = 45 lpcd, and also draw the section of slow sand filter. [5+3]

   c) Why high content of iron and manganese is objectionable in drinking water? List the methods of removal of iron and manganese from water. Describe briefly various methods commonly used for aeration of water. [1+2+5]

7. a) Differentiate between continuous and intermittent supply system. Explain layout of distribution system which is adopted in town or cities which have developed haphazardly without proper planning? [2+6]

   b) Design pipelines AB and BC for the following pipe network. A minimum pressure of 1 kg/cm^2 is required at the tap. Take Hazen William constant as 100 which pipe class have to be designed. Is there any option to reduce high level pipe class and how? [8]
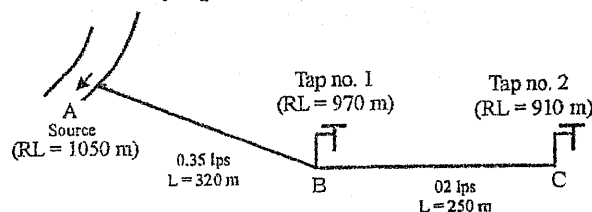
8. Describe briefly the process of pipe lying in a water supply system. [4]

9. How do you define protection and maintenance of a water supply system? Discuss different types of maintenance work with examples. [1+3]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Chaitra

Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

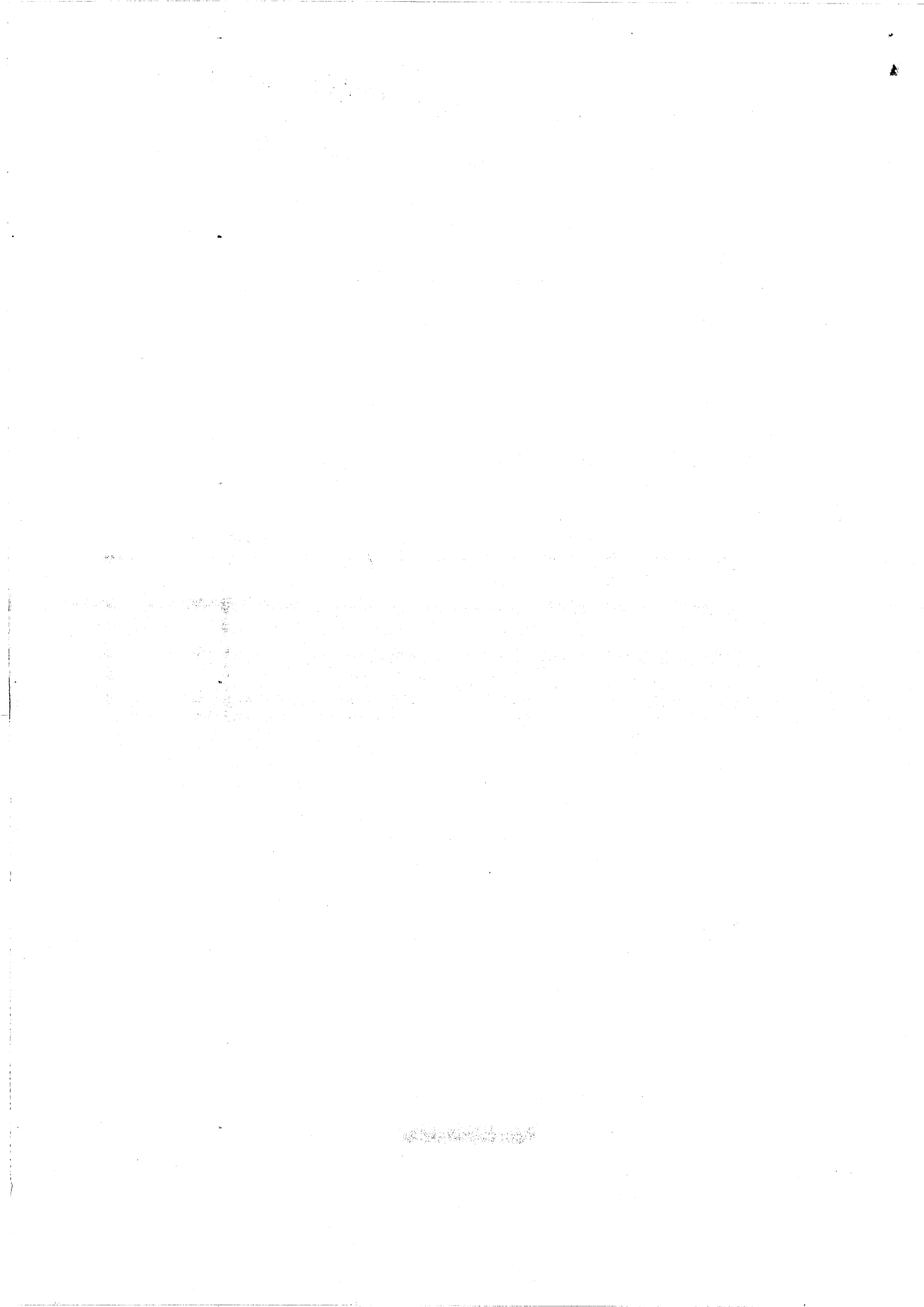## *Subject:* - Water Supply Engineering *(CE 605)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Discuss with sketch the main components to be provided in the public water supply scheme for a hilly area of Nepal. [4]

2. Extraction of excessive ground water is leading towards lowering ground water table in Kathmandu. List out the possible actions for its sustainable solution. [4]

3. What is meant by design period, base period and peak hour demand? Describe the various types of water demand and discuss the factors which affect the rate of demand in water supply scheme. [8]

4. Discuss the types of impurities present in water. Describe about the fecal-oral transmission route with a neat schematic diagram. [4+4]

5. Define intake. what are the components of intake? Sketch and explain general river intake arrangement. [8]

6. a) A water treatment plant has to purify water for a town with daily peak demand of 9 million liters. Design a rectangular sedimentation tank assuming the velocity of flow as 20cm/min and detention period of 4 hours. [8]

   b) A town with population of 35,000 in the year 2019 AD has a water supply rate of 200 lpcd. Determine the number and dimensions of the slow sand filter for the design year 2039. Assume that annual population growth rate of the town as 4.2%. Sketch with showing each components. [6+2]

   c) State different aspects of chorination for disinfecting water. Briefly describe the affecting factors in disinfection process. [4+4]

7. a) Water is to be supplied to a municipality in Nepal with forecasted population of 150,000 with 110 litres per capita per day. The variation in water demand is mentioned below. Calculate the capacity of service reservoir considering pumping at 6-9am and 6-9pm respectively. Neglect the fire demand and use analytical method. [8]

Time	6am – 9am	9am – 12 noon	12 noon – 3pm	3pm – 6pm	6pm - 9pm	9pm – 6am
% Demand	30	10	10	20	25	5

   b) What are the general considerations to be observed in the planning of distribution system? Under what condition would you recommend the use of intermittent system of water supply? What are its drawbacks? [8]

8. Enlist three materials commonly used for water supply pipe. Also describe their merits and demerits. [4]

9. What are the purpose of values in pipelines? Describe the working and function of cutoff valve with neat sketch. [4]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Ashwin

Exam.		Back	
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Water Supply Engineering (CE 605)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt All questions.
✓ The figures in the margin indicate Full Marks.
✓ Assume suitable data if necessary.

1. What are the major components of water supply system? Discuss briefly with neat sketch. [4]

2. Describe and illustrate the possible water supply scheme components used in rural and urban area in Nepal. [4]

3. Data obtained from a baseline survey of a newly formed municipality in year 2016 A.D. are as follows. Population = 45,000, No. of day scholar students in school = 9500, No. of big animals = 8000, No. of small animals = 15000. There are twenty offices, two hospital with total 50 beds. Calculate the water demand of that municipality in design year with base period of 2 years and design period of 20 years. Assume the population growth rate of the community is 1.5% per annum and fire fighting as per National Board of fire under writers. [8]

4. How do you determine dissolved oxygen of water sample in lab using titrimetric method? Also, briefly illustrate about MPN. [4+4]

5. Sketch and explain the general river intake arrangement. What are the points to be considered for the selection of intake site? [8]

6. a) In a sedimentation tank (dimensions: 6m wide, 18m long and 3m depth), 4 million litres of water passes per day. Calculate a) detention period and b) surface overflow rate. Check the values with standard range. [8]

   b) Design a rapid sand filter for the population of 45,000 in the year 2021. Water demand is 110 lpcd, annual population growth rate is 2.1%. [8]

   c) Differentiate between super chlorination and break point chlorination. What is the significance of residual chlorine? Calculate the daily quantity of bleaching powder required in a treatment plant of capacity 20 million liters per day. Consider chlorine dose of 0.5mg/l assuming 35% chlorine available in bleaching powder. [8]

7. a) Determine velocity, head loss and discharge in the pipes BC, CD, BF and FD. If the diameter of pipes BC, CD, BF and FD are 1200 mm, 800 mm, 1000 mm, and 1000 mm respectively. Assume length of pipes are 100 m and coefficient of friction, f=0.03. [8]
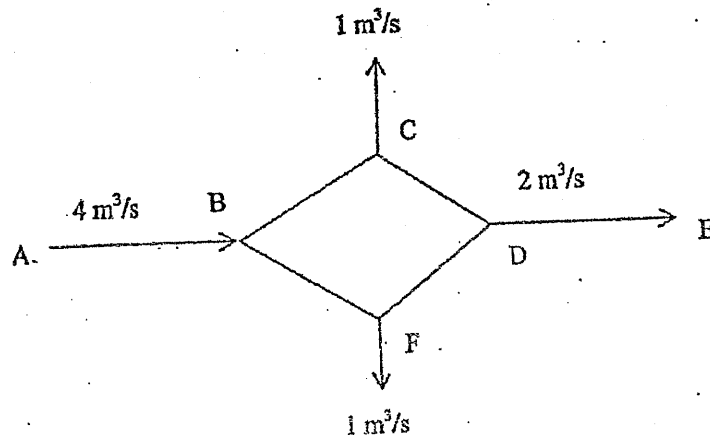
b) A rural area has designed year demand of water 22000 liters per day. The demand is met by a continuous system of supply from a river source with measured safe yield of 0.25 lps. The consumption pattern is as follows: [8]

Time (Hour)	5-7	7-12	12-17	17-19	19-5
Consumption (%)	25	35	20	20	0

8. Write down the requirements of good pipe material. Describe briefly polyethylene (PE), Polyvinyl chloride (PVC), and Polypropylene random copolymer (PPR) pipes. [4]
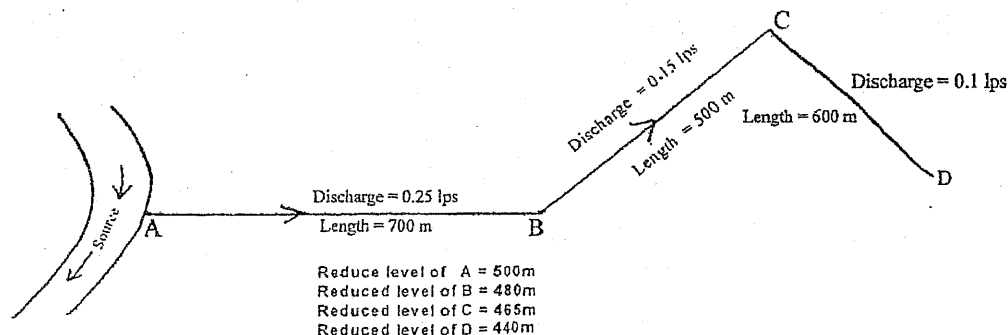
9. Write short notes on: *(Any Two)* [2×2]
   a) Aeration
   b) Service Reservoir and Clear water reservoir
   c) Fecal oral transmission route

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Exam.		Regular	
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Water Supply Engineering *(CE605)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt *All* questions.
✓ The figures in the margin indicate *Full Marks*.
✓ Assume suitable data if necessary.

1. What are the objectives of water supply? Enlist the requirements of wholesome water. [2+2]

2. Among the available sources, which type of source is preferred in the public water supply system in a community for the hilly region of Nepal and why? [4]

3. Data obtained from a baseline survey of a newly formed rural municipality in year 2018 A.D. are as follows. Population = 15,000, No. of day students in school = 1500, No. of big animals = 6500, No. of small animals = 8000. There are altogether 10 offices, one hospital with total 25 beds, No. of tea shops = 12, No. of health post = 2 and number of police check post = 2 Neglect fire fighting demand. Calculate the water demand of that rural municipality in design year with base period of 2 years and design period of 20 years. Assume the population growth rate of that community is 1.8 % per annum. [8]

4. What is an indicator organism? How can you determine E-coli from the membrane filter technique in laboratory? [1+3]

5. Describe spring intake constructed in a rural area with a neat sketch showing plan, elevation, section and protection work. [8]

6. What do you mean by coagulant? What are the affecting factors in coagulation? Briefly describe. [8]

7. Describe the construction of Rapid Sand Filter with neat sketch and its designed considerations. Briefly describe its operation and maintenance showing components in sketch. [8]

8. A layout of water distribution is as shown below. Design pipelines AB, BC and CD considering Hazen-Willium's constant of 120. Minimum pressure required at B, C and D is 12m of water. [8]

Reduce level of A = 500m
Reduced level of B = 480m
Reduced level of C = 465m
Reduced level of D = 440m

9. Define break point chlorination. Describe in details about how pH and temperature affect the relative distribution of hypocholorous (HOCl) and hypochorite ions (OCl⁻) in unit process of chlorination. [2+6]

10. A rural area has a design year demand of water 20,000 litrers per day. The demand is met by an intermittent system of supply two times a day at 7-10 and 17-20 (altogether 6 hrs) [8]

Time (Hour)	5-7	7-12	12-17	17-20	20-5
Consumption (%)	20	35	10	25	10

Determine the balancing reservoir capacity for that rural area.

11. Describe briefly on the layout of distribution system with their pros and cons. Also recommend improvements over traditional layout system. [6+2]

12. Describe reflux valve and air relief valve with necessary sketches. [2+2]

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02

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Ashwin

Exam.		**Back**	
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Water Supply Engineering *(CE605)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
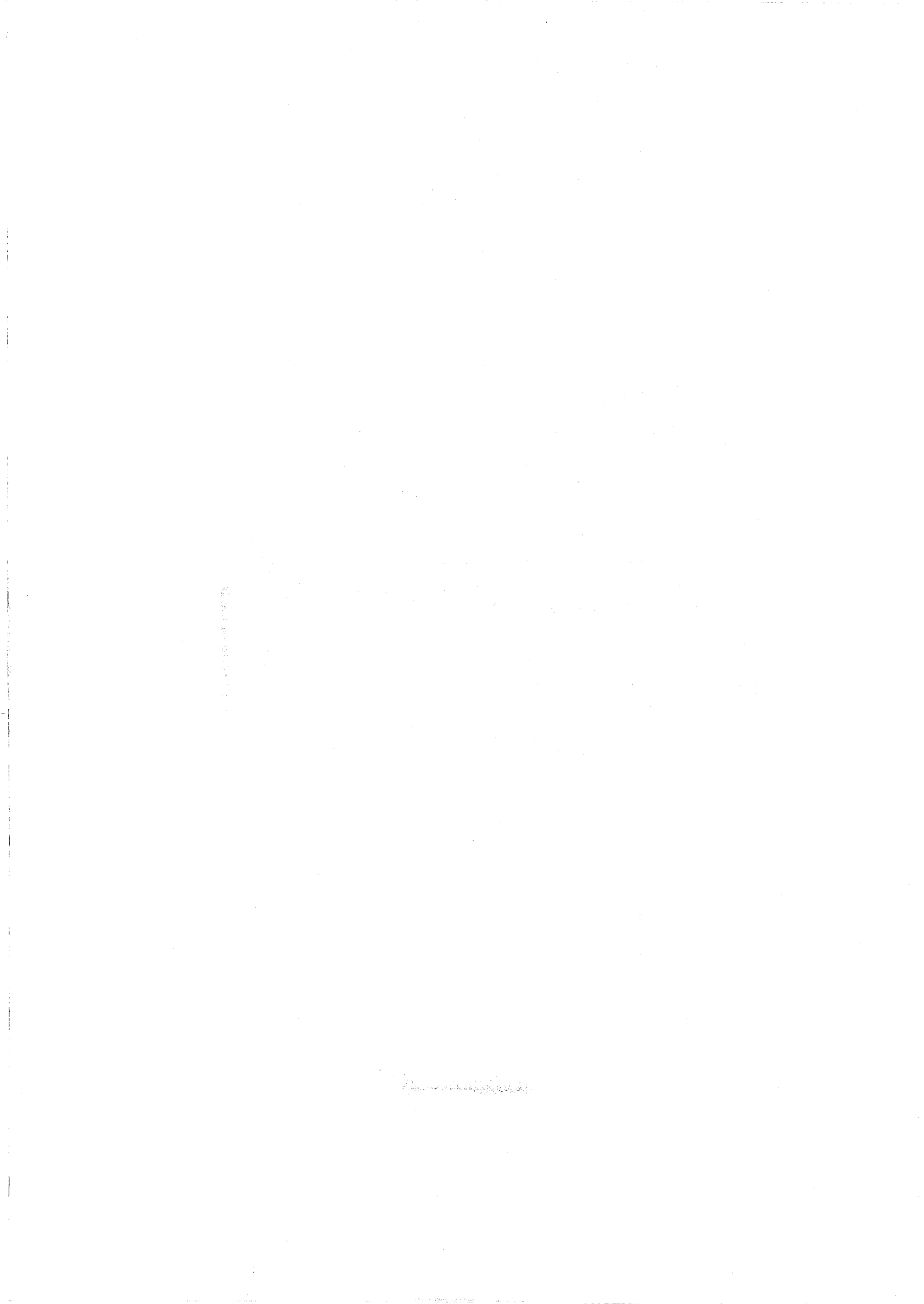✓ Assume suitable data if necessary.

1. Define Potable and Wholesome water. Also, describe the function of water in human body. [2+2]

2. Define wet and dry river intake with neat sketch and briefly describe its operation and maintenance with showing all major components in sketch. [4]

3. The survey is carried out in year 2074 B.S. for a water supply scheme for a new municipality with the per capita water allowance of 110 lpcd. Calculate the total water demand at the service year considering the base and design period of 5 and 30 years respectively if population is forecasted from (a) Geometrical increase method and (b) Decreased rate of growth method. The collected census data of the town is as follows: [8]

Year B.S.	2034	2044	2054	2064	2074
Population (Nos)	45,500	49,000	53,000	57,000	59,500

4. How can you determine MPN of water sample? Also, discuss about significance of WHO guidelines for drinking water quality. [4+4]

5. Design slow sand filter for treating water with 15,000 populations in the community considering water demand of 100 litres per capita per day and filtration rate of 150 litres/hour per square meter. After designing, sketch with all components and their dimension. [4+4]

6. A rectangular sedimentation tank is to be provided to treat water for 3000 persons at per capita daily allowance of 120 liters. Propose the dimensions of the sedimentation tank assuming detention period of 6 hours. [8]

7. Explain how iron and manganese is removed from aeration process. How many kg/day of bleaching powder is required to treat 5 MLD of water if the chlorine demand of water is 0.1 mg/l and residual chlorine requirement is 0.4 mg/l? Assume bleaching powder contains 35% of available chlorine. [4+4]

8. Discuss about the treatment process and impurities removal. Explain the affecting factors in sedimentation tank. Why we use coagulants in water treatment process? [8]

9. A village has design year population of 500 nos and water demand of 45 lpcd. The demand is met by a continuous system of supply from a spring source with safe yield of 0.28 lps. The consumption pattern is as follows: [8]

Time (Hours)	05 - 07	07 - 12	12 - 17	17 - 19	19 - 05
Consumption (%)	15	45	10	20	10

Is balancing reservoir necessary? Calculate its capacity if necessary and justify your answer.

10. Describe continuous and intermittent systems of water supply with its advantages. What are the selection criteria of pipe materials in water supply system? [2+2]

11. Enlist types of layouts of distribution systems in water supply. Illustrate about most suitable layout of distribution system in water supply with positive and negative aspects. [8]

12. Describe the service connection from main pipe to private building service layout with neat sketch and use of each components. [4]

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02   TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2074 Ashwin

Exam.	**Back**		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Water Supply Engineering (CE605)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt _All_ questions.
✓ The figures in the margin indicate _**Full Marks**_.
✓ Assume suitable data if necessary.

1. Differentiate between (a) pure and impure water, (b) potable and wholesome water and (c) polluted and contaminated water. [4]

2. What are the criteria for the selection of water sources in hill and terrai area? [4]

3. Population of a town in Nepal as obtained from the census report is as follows: [8]

Year A.D.	1971	1981	1991	2001	2011
Population	15000	21000	27000	34000	42000

Determine the water demand in the year 2030 if the town has fully plumbed house. Take industrial demand as 20% total demand and water losses wastage as 15 of the total demand. Neglect other demands.

4. Describe the various types of living organisms present in water. Discuss their effects on human health. [8]

5. Why an intake structure is necessary for water supply scheme? Describe a dry river intake with neat sketch showing all major components and operation. [8]

6. a) Derive a Stoke's law for the settlement of particles? Under what conditions it is suitable to use for the design of sedimentation tank. Include the temperature effect in the law. [8]

   b) A town with survey year population of 10000 and a growth rate of 1.5% per annum has a base period of 5 years, design period of 15 years and average water consumption rate of 150 lpcd. Taking length as twice of its width, propose number, length and width of a slow sand filter with filtration rate of 150 $l/m^2/day$ to treat water in this average flow rate and sketch also. [8]

   c) A settling tank is designed for an overflow rate of 4000 liters per m^2 per hour. What percentage of particles od diameter (a) 0.05 mm (b) 0.02 mm, will be removed in this tank at 10°C. [8]

7. a) Calculate the storage required to supply the demand shown in the following table if the inflow of water to the reservoir is maintained at a uniform rate throughout 24 hours. [8]

Time (hours)	00-04	04-08	08-12	12-16	16-20	20-24
Demand (million liters)	0.48	0.87	1.33	1.00	0.82	0.54

   b) With a neat sketch discuss grid iron system of water distribution including its advantages and disadvantages. [8]

8. Briefly describe the purpose and use of expansion joint and flanged joint with sketch. [4]

9. Describe the components and purpose in layout connection from main pipe to household service with sketch. [4]

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| Exam.		Regular	
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Water Supply Engineering *(CE605)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. Explain the functions of different components of a rural water supply scheme with a neat sketch. [4]

2. What is infiltration gallery? With a neat sketch, describe its construction. [4]

3. The survey data collected for a water supply scheme in a village of Nepal is given below: [8]

   Survey year = 2013
   Based period = 3 years
   Design period = 25 years
   Population = 1250
   Cows = 200
   Goats = 500
   Chicken = 5000
   Annual population growth rate = 1.5%
   Day scholar students in a school = 100
   Boarder students in a school = 10
   No. of Health post = 1
   No. of tea shop = 1
   No. of VDC office = 1
   Neglect demand for fire fighting
   Calculate average water demand for the design year.

4. The hardness of a water sample was found to be 300 ml/l as $CaCO_3$. The hardness was found due to Ca and Mg ions only. The concentrations of these ions are equal in water. The water analysis showed the concentration of HCO_3 was 150 mg/l. Calculate (i) the concentrations of Ca and Mg, (ii) alkalinity of water and (iii) carbonate hardness and non-carbonate hardness of water. [8]

5. Describe the characteristics of dry and wet river intakes with neat sketch. What modification will you make if the river bank is unstable? [8]

6. a) Describe the construction of slow sand filter with neat sketches and its design consideration. [8]

   b) A settling tank is designed for an overflow rate of 4000 liters per m^2 per hour. What percentage of particles od diameter (a) 0.05 mm (b) 0.02 mm, will be removed in this tank at 10°C. [8]

   c) Describe briefly the types of aeration methods with sketches. [8]

7. a) A part of the water distribution network is shown in figure below. [8]
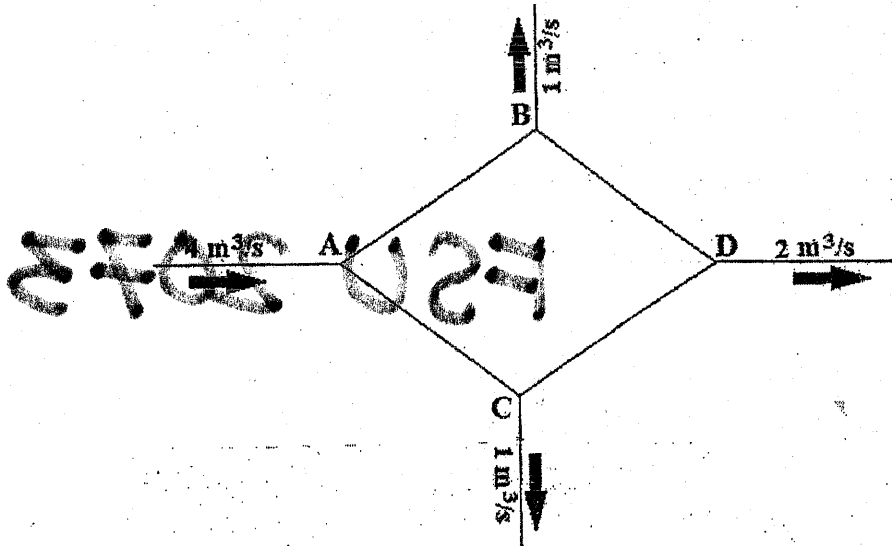
If the diameter of pipes AB, BC, AC and CD are 1200 mm, 800 mm, 1000 mm and 1000 mm respectively, Calculate the head loss and velocity in pipes AB, BC, AC and CD. Assume length of all the pipes are 100 m and coefficient of friction, $f = 0.03$

b) In a part of water distribution system, the source is located at a 'point A' with a RL of 210 m, a 'point B' with RL of 154 m is at a distance of 700 m from 'point A' and another 'point C' with RL of 126 m is at a distance of 550 m from 'point B'. Pipe line AB carries a discharge of 44 lps and pipe line BC carries a discharge of 18 lps. Taking minimum residual head as 10 m and Hazen William's coefficient as 100 for pipes, design pipe AB and BC. [8]

8. Describe the various types of layouts of the water distribution system with their merits and demerits. [4]

9. What are the purposes of values in pipeline? With a neat sketch, describe a reflux valve. [4]

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Subject: - Water Supply Engineering *(CE605)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt ***All*** questions.
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✓ Assume suitable data if necessary.

1. Draw typical layout of water supply schemes for rural and urban areas. Describe briefly the function of each component. [4]

2. Differentiate between shallow and deep wells with neat sketch and their characteristics with respect to water quality and quantity. [4]

3. Data obtained from a baseline survey of a newly formed municipality in year 2016 A.D are as follows. No. of day students in school = 2500, No. of big animals = 4000, No. of small animals = 6400. There are twenty offices, one hospital with 50 beds. The total water demand of municipality in design year with base period of 2 years and design period of 20 years is 800 m^3. The population growth rate of that community is 1.9% per annum. Determine the population in survey year. [8]

4. a) Describe in detail about the multiple tube fermentation technique for the determination of E-coli in lab. [4]

   b) Determine total alkalinity and concentration of calcium and magnesium in the water sample if both calcium and magnesium ions were found equal. Total hardness is 280 mg/l and carbonate hardness is 75 mg/l. [4]

5. Sketch and explain the general river intake arrangement. What are the points to be considered for the selection of site for intake? [8]

6. a) Describe, with the help of a neat sketch, a rapid sand filter. Explain its working and cleaning. [8]

   b) Design a rectangular sedimentation tank for water treatment in a city with population of 20000. Considering the settling velocity of particles 0.4 mm/sec, Length = 2xWidth and detention period of 2 hours. [8]

   c) Design a water softener for a flow 20,000 l/hr, hardness = 450 mg/l as $caco_3$, allowable hardness after treatment = 50 mg/l as $caco_3$ ion exchange capacity of the resin = 20 kg /m^3 of the resin, regeneration period = 7.5 hours. [8]

7. a) Describe briefly on the layout of distribution system with their pros and cons. Also recommen improvements over transitional layout system. [8]

   b) The water demand of a city is 10,000 m^3/day. The water demand is to meet from the river flowing under gravity to the reservoir. The water is supplied to the consumers from the reservoir by continuous system. Calculate the capacity of service reservoir for the consumption pattern as shown in figure below. [8]

Time	05-07	07-12	12-17	17-19	19-05
Water consumption (%)	25	30	15	20	10

   Find the water level in the reservoir at 6, 12, 18 and 24 hours.

8. Enlist three materials commonly used for water supply pipe. Also describe their merits and demerits. [4]

9. Describe a public stand post with neat sketches. [4]

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Subject: - Water Supply Engineering *(CE605)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. What do you understand by water supply system? Describe its historical development. [4]

2. Determine the storage capacity of impounded reservoir for a city with a water demand of $4 \times 10^6 m^3$ per month. The run off discharge in river is given as in table: [4]

Month	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	March
Inflow ($10^6 m^3$)	5.1	5.9	8.3	8.9	7.5	5.0	3.5	3.0	2.0	1.6	2	2.4

3. Briefly describe the factors affecting water demand and variation of hourly water demand. [8]

4. a) Describe about the fecal-oral transmission route with neat schematic diagram. [4]
   b) The total hardness of water is 150 mg/l and carbonate hardness is 60 mg/l. All the three bi-valent metallic ions causing hardness are same. Determine the non-carbonate hardness, alkalinity and concentration of bi-valent metallic ions. [4]

5. With neat sketches describe the factors that should be considered while constructing the spring intake. [8]

6. a) Explain briefly the theory of settlement of discrete particles through quiescent liquids. How do you modify the theory to consider the temperature affect? [8]
   b) The population of a city is 50,000. Design a rapid sand filter including design of filter media, base material and underdrainage system. [8]
   c) What dose will be necessary pH = 8 if 0.5 mg/l of total chlorine is required for disinfection of water at pH = 7.0. Find the contact time required at pH = 8.0, if it is given that initially 10 minutes contact time is required at pH = 7.0. Take n = 1.5 in the equation $c^n t$ = constant, Ki = 2.7×10^{-8} mol/lit. [8]

7. a) Describe a purpose and construction of service reservoirs with neat sketches. [8]
   b) Determine the velocity, head loss and discharge in the pipes BC, CD, BF and FD

   The length of pipe BC, CD, BF and FD are 100 m, 200 m, 300 m and 100 m respectively and dia of all pipes are 0.1m and Darcy's coefficient of friction, f = 0.03. [8]
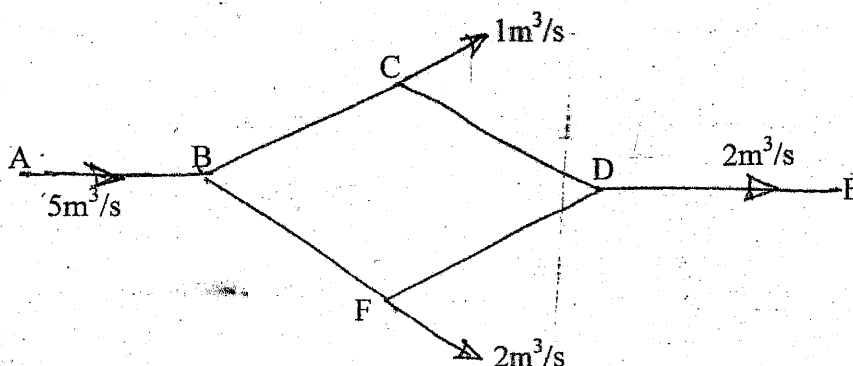
8. Describe briefly the process of pipe laying and joining. [4]

9. Why break pressure tank is necessary in a water supply scheme? Discuss its construction with neat sketches. [4]

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Exam.	**New Back (2066 & Later Batch)**		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Water Supply Engineering *(CE605)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ *Attempt All questions.*
✓ *The figures in the margin indicate Full Marks.*
✓ *Assume suitable data if necessary.*

1. Discuss about the importance of water. Enlist the objectives and necessity of water supply schemes. [4]

2. Discuss the selection criteria to choose a source of water supply. [4]

3. Determine the population of the town in the year 2088 by (a) Arithmetical increase method (b) Geometrical increase method and (c) Decreased rate of growth method. The census population of the city is as follows: [8]

Year	2068	2058	2048	2038	2028
Population	65,500	57,000	47,000	37,000	29,000

Calculate the design year and total water demand for a Nepalese town assuming the per capita demand of 120 lpcd.

4. Define indicator organisms. Describe the procedure of determining coliform in laboratory by MPN method. [8]

5. What are the components of intake? Enlist and discuss the factors governing the site selection for intake. [8]

6. a) In a continuous flow settling tank 30 m long and 3 m deep, what detention time would you recommend for effective removal of 0.03 mm particles at 25°C. Assume specific gravity of particles = 2.65. Also determine the percentage of 0.025 mm particles removed in the same tank at 20°C. [8]

   b) Describe the effects of hardness. Explain zeolite water softener with advantage and disadvantages. [8]

   c) Mention the common methods of disinfection. Calculate the daily quantity of alum and bleaching powder required in a treatment plant of capacity 25 million liters per day. Consider optimum does of alum as 15 mg/l and chlorine does of 0.5 mg/l assuming 30% chlorine available in bleaching power. [8]

7. a) Describe the design steps for designing water supply distribution system with mentioning design criteria. [8]

   b) A village has design year demand of water 20000 liters per day. The demand is met by a continuous system of supply from a spring source with measured yield of 0.25 lps. The consumption pattern is as follows. [8]

Time (Hours)	5-7	7-12	12-17	17-19	19-5
Consumption (%)	25	35	20	20	0

Is balancing storage tank necessary? Calculate its capacity if necessary. Justify your answer.

8. What are the requirements of good pipe material? [4]

9. What is the function of air valve? Describe its working with a neat sketch. [4]

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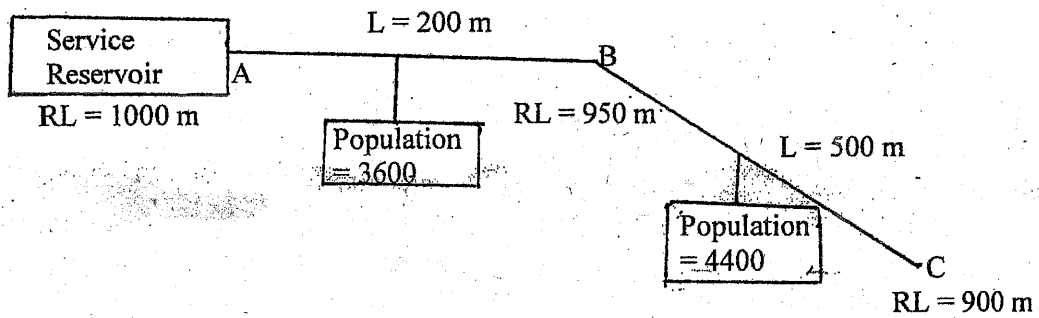| Exam.		Regular	
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Water Supply Engineering *(CE605)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Draw a schematic diagram for rural and urban water supply scheme. Describe the functions of each component. [4]

2. Differentiate between shallow and deep wells. Discuss their suitability with respect to water quantity and quality. [4]

3. Calculate the design discharge for design year 2030 for a village in Surkhet District. The data collected in survey year 2015 is as below: [8]

   Survey year population = 1500
   Population growth rate = 2.0% per year
   Number of buffalos = 345
   Number of cows = 450
   Number of goats = 800
   Number of chickens = 2000
   Number of boarder students = 64
   Number of day scholar students = 450
   Number of offices = 3

4. a) Describe the types of water washed diseases and its preventive measures. [4]

   b) The analysis of water showed the following results in mg/l: [4]

   Ca = 65; Mg = 35; Na = 101.5; K = 21.5; HCO_3 = 248; SO_4 = 221.8

   Find the total hardness, carbonate hardness and non-carbonate hardness.

5. Which type of intake do you recommend in rural hilly area? Describe its construction with neat sketch. [8]

6. a) Determine the size of rectangular sedimentation tank having its length as twice of its width to settle the particles with settling velocity of 0.2 mm/sec with a settling period of 3 hours to treat water for population of 20000 with a peak allowance of 112 lpcd. [8]

   b) What do you mean by aeration of water? Why it is required? Describe the various methods of aeration. [8]

   c) Explain break point chlorination. Calculate the required quantity of commercial bleaching powder for the disinfection of water in rural water supply schemes: [8]

   i) Chlorine content in the commercial bleaching powder = 35%
   ii) Dose of chlorine = 2.00 mg/l
   iii) Water demand per day = 500000 liters

7. a) Differentiate between continuous and intermittent systems of supply with their merits and demerits. [8]

   b) Design pipelines AB and BC for the water distribution network shown below. [8]

   Take per capita demand of water 160 lpcd. Assume peak factor = 3 Hazen William's Constant C = 100. The residual head at any point in the distribution system should not be less than 10 m.


8. Why pipe joints are required? Describe expansion joint with a neat sketch. [4]

9. Why maintenance of water supply is necessary? Discuss different type maintenance of water supply. [4]

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Exam.	**New Back (2066 & Later Batch)**		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Water Supply Engineering (CE605)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt _All_ questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Differentiate potable and wholesome water, polluted and contaminated water. Write down the requirements of wholesome water in brief. [4]

2. Why ground water source is generally chosen for supplying drinking water scheme? What are the common ground water quality parameters? Discuss them with reference to health and treatment. [4]

3. Safe yield of a proposed spring is 5 liter per second and per capita water demand is 65 lpcd. Calculate the current population that can be taken under the scheme if design period is 20 years and population growth rate is 1.7% per annum. [8]

4. The hardness of a water sample was found to be 300 ml/l as $CaCO_3$. The hardness was found due to Ca and Mg ions only. The concentrations of these ions are equal in water. The water analysis showed the concentrations of HCO_3, was 150 mg/l. Calculate (i) the concentrations of Ca and Mg (ii) alkalinity of water and (iii) carbonate hardness and non-carbonate hardness of water. [8]

5. Generally, which type of intake is used in hilly area of Nepal? Why? Describe such intake with a neat sketch showing plan, elevation, section and protection work. [8]

6. a) A rectangular sedimentation tank is to treat 10 MLD of water. A detention basin of width to length ratio of 1/3 is proposed to trap all particles larger than 0.04 mm is size. Assuming a specific gravity of particles at 20°C is 2.65. Compute the tank dimensions. If the depth of the tank is 3.5 m, calculate the detention time. [8]

   b) Determine amount of bleaching powder required annually in a water treatment plant treating 10MLD of water if 0.3 ppm of chlorine dose is required. Available bleaching powder contains 27% of chlorine. Describe the break point chlorination in water treatment process. [8]

   c) Write down the purpose of aeration. Describe methods of aeration with sketch. [8]

7. a) Design pipes PQ, PR and RS. Minimum pressures have to be maintained at 1 kg/cm² in all taps. Take Hazen William constant C = 110 [10]
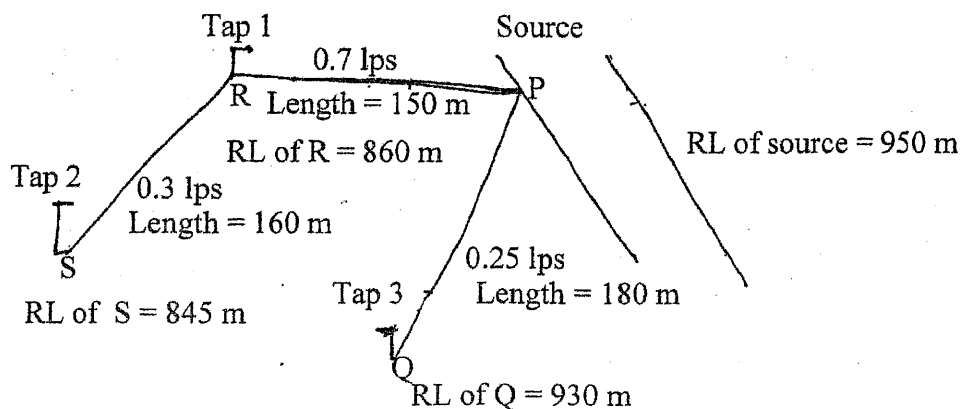
   b) Briefly describe the layout of distribution system. [6]

8. Write down the requirements of good pipe material. Describe briefly concrete pipe, C.I pipe and PPR pipe. [4]

9. Enlist the requirements of the public stand post along with its importance in rural areas. [4]

***

Subject: - Water Supply Engineering (CE605)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Draw a schematic diagram of a typical urban and rural water supply system and briefly describe the function of each component. [4]

2. For the water supply of a town with the daily requirement of 0.25 MLD, it is proposed to construct a distribution reservoir. The consumption pattern is as follows: [4]

7 AM to 8 AM	30% of days supply
8 AM to 5 PM	35% of days supply
5 PM to 6:30 PM	30% of days supply
6:30 PM to 7 AM	5% of days supply

   The pumping is to be done at a constant rate of 0.032 l/hr for 8 hrs (8AM to 4PM). Determine the required capacity of balancing reservoir by analytical method.

3. Data obtained from a baseline survey of a village in year 2070 B.S. are as follows. Population of village = 2700, No. of day scholar students = 220, No. of big animals = 240, No. of small animals = 460. There are two offices, one health post. Calculate the water demand of that village in design year with base period of 5 years and design period of 20 years. Assume the population growth rate of that village as 1.89% per annum. [8]

4. What are E-coli? Are they harmful to human beings? Why is their presence tested in water for drinking purpose. Describe the membrane filtration technique method. [8]

5. What are the factors that should be considered during selection of an intake site? Describe the characteristics of wet reservoir intake with neat sketch. [8]

6. a) Differentiate between super chlorination and break-point chlorination. Explain break-point chlorination with a neat sketch explaining the types of chlorine form available in the various stages of the break-point curve. What is the significance of residual chlorine? [8]

   b) An old tank having dimension of 11m×5m×3m is available in a village. It is proposed to use as a settling tank. At least 93 percent of particles having diameter of 0.025mm, specific gravity 2.65 is expected to remove on the tank at 20°C. What will be an overflow rate on using that tank? Does the tank dimension is enough to remove 99 percentages of particles having diameter 0.05 mm at same conditions? [8]

   c) Differentiate between slow sand filter and rapid sand filter. [8]

7. a) State the factors you would take into consideration and the procedure you would follow in designing a distribution system for the water supply of a city. [8]

   b) A layout of water distribution is shown in figure below. Design pipelines AB and BC considering Hazen-William's Coefficient = 100. Minimum pressure required at B and C is 10m of water. [8]
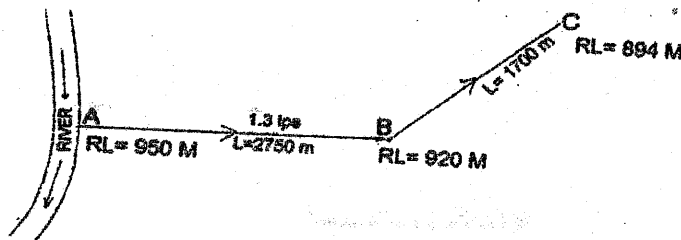
8. Describe in detail the process of pipe laying of a water supply system. [4]

9. Why break pressure tank is necessary in a water supply scheme? Describe its construction with neat sketches. [4]

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Exam.	**New Back (2066 & Later Batch)**		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Water Supply Engineering *(CE605)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. Why a systematic water supply scheme is necessary in the community? Describe the impacts of such water supply schemes.   [2+2]

2. Describe the selection criteria of a good source for drinking water supply project.   [4]

3. In a rural village, the survey is carried out in the year 2070 BS and the following data is obtained: [8]
   Population = 5000 nos   No of cows = 50 nos
   No of goats = 250 nos   No of chickens = 2000 nos
   No of VDC offices = 2 nos   No of tea shops = 3 nos
   No of schools = 2 with overall 350 day scholar students
   Annual population growth rate = 1.5% and
   Annual growth rate for students = 1%

   If the base year is taken as 2073 BS and the design period is of 20 years, calculate the total water demand of the village for the service year?

4. a) What do you understand by water vector disease? Describe any two types of water vector diseases.   [4]

   b) The total hardness value obtained from the analysis of a water sample is 150 mg/l. If all three (Ca, Mg and Sr) catious concentration causing hardness are numerically same and carbonate hardness is 77 mg/l, calculate the following: [4]
      i)   The value of non carbonate hardness
      ii) The concentration of principal catious and
      iii) The value of total alkalinity in mg/l.

5. a) Describe spring intake with a neat sketch showing plan, elevation, section and protection work.   [8]

   b) A small village has design year population of 600 with 65 lpcd per capita demand. The demand is to be fulfilled by spring sources with safe yield 0.5 l/s. The consumption pattern in % of a day is as below.   [8]

Time	05-07	07-12	12-17	17-19	19-05
Water consumption (%)	30	30	15	20	5

   Is balancing reservoir necessary? Calculate capacity of balancing reservoir if needed.

   c) Describe briefly the design criteria and design steps involved in rural water supply distribution system.   [8]

6. a) With neat sketches, describe the various types of mixing devices used in mixing the coagulant with water.   [8]
   b) In a continuous flow settling tank 30 m long and 3 m deep, what detention time would you recommend for effective removal of 0.02 mm particles at 25°C? Assume specific gravity of particles = 2.65. Also determine the percentage of 0.01 mm particles removed in the same tank at 10°C.   [8]
   c) Describe in detail the various forms of chlorination.   [8]

7. Describe the public stand post with neat sketch and necessary criteria.   [4]
8. What are the requirements of a good pipe material? Describe a flanged joint with neat sketch.   [2+2]

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04   TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2069 Chaitra

Exam.	**Old Back (2065 & Earlier Batch)**		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: – Water Supply Engineering *(EG628CE)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt any **Five** questions.
✓ **All** questions carry equal marks.
✓ Assume suitable data if necessary.

1. a) Compare the water quantity and quality of surface and groundwater sources. Explain with reasons the suitability of these sources for rural and urban areas.
   b) The survey data collected for a water supply scheme in a village of Nepal is given below:

   Survey year = 2012   Base period = 3 years   Design period = 30 years
   Population = 500   No. of cows = 20   No. of goats = 25
   No. of chickens = 100   Annual population growth rate = 1%
   No. of day scholars in school = 125   No. of boarders in school = 40
   No. of health post = 1   No. of tea shops = 2   VDC office = 1

   Calculate total water demand for that design year.

2. a) What are the factors that should be considered during selection of an intake site? With neat sketches, describe the construction of a wet type river intake.
   b) The hardness of a water sample was found to be 300 ml/l as $CaCO_3$. The hardness was found due to Ca and Mg ions only. The concentrations of these ions are equal in water. The water analysis showed the concentration of HCO_3 was 93 mg/l. Calculate (i) the concentrations of Ca and Mg, (ii) alkalinity of water and (iii) carbonate hardness and non-carbonate hardness of water.

3. a) Describe the various types of impurities present in water with their effects.
   b) In a continuous flow settling tank 30 m long and 3 m deep, what velocity of water would you recommend for effective removal of 0.02 mm particles at 25 °C? Express the velocity in mm/min. Assume specific gravity of particles = 2.65 and kinematic viscosity of water = 0.01 cm^2/sec.

4. a) With neat sketches describe the various mixing devices used to mix coagulants in water.
   b) Determine the number and sizes of slow sand filter to serve a town with present population of 5,000 having water supply rate of 110 lpcd. Take design period as 20 years and annual population growth rate as 2.5% Assume necessary data suitably.

5. a) Describe the various types of materials used for conveying water in water supply schemes.
   b) A town with a design year population of 120,000 and per capita demand of 100 liters/day is to be supplied with continuous system of supply by uniform pumping from 5:00 hrs to 17:00 hrs. The consumption pattern of the town is given table below. Calculate the capacity of the service reservoir. Provide allowance for fire fighting and emergency breakdown as 20% of daily domestic demand.

Time (hour)	5:00 -7:00	7:00 -12:00	1200 -17:00	17:00 -19:00	19:00 -5:00
Consumption (%)	20	40	15	20	5

6. Write short notes on any four:
   (a) Variation in water demand   (b) Iron and manganese removal   (c) Flanged joint
   (d) Air releasing value   (e) Residual head

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Exam.		Regular	
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Water Supply Engineering *(CE605)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Enlist objectives of water supply system focusing for rural water supply in Nepal. Draw its schematic diagram mentioning components. [4]

2. The city has an average water demand of 6202 million liters per month. Calculate the capacity of impounded reservoir. The flow in the river is shown below. [4]

Month	Inflow (m³/s)	Month	Inflow (m³/s)	Month	Inflow (m³/s)
January	2.97	May	0.51	September	4.00
February	1.99	June	1.00	October	5.00
March	1.00	July	2.00	November	4.00
April	0.00	August	3.00	December	2.80

3. The survey data collected for a water supply scheme in a village of Nepal is given below: [8]
   Survey year = 2013
   Base period = 3 years
   Design period = 15 years
   Population = 250
   No. of cows = 200
   No. of goats = 500
   No. of chickens = 5000
   Annual population growth rate = 1.5%
   No. of day scholars in school = 100
   No. of boarders in school = 10
   No. of health post = 1
   No. of tea shop = 1
   VDC office = 1
   Calculate total water demand for design year.

4. a) Describe fecal-oral transmission route of disease with a neat schematic diagram. [4]

   b) If 400ml of water with a pH of 6 is mixed with 700ml of water with a pH of 8, what will be the resultant pH of the mixture? [4]

5. What are the factors that should be considered during selection of an intake site? With neat sketches, describe the construction of a spring intake. [8]

6. a) Find the settling velocity of silica particle of size 0.02cm with specific gravity 2.65 in water at 20°C? Take kinematic viscosity of water at 20°C as 1.007 centistokes. [8]

   b) Design rapid sand filter for a population of 60000 nos for a newly growing urban area. [8]

   c) What is break point chlorination? How can you obtain the break point? Describe. How much quantity of bleaching power is to be added in the treatment plant to disinfect 2 MLD of water, if the does of chlorine is 0.5 ppm? [8]

7. a) Briefly describe the layout of distribution system with their advantages and disadvantages. How can you improve the traditional layout system for betterment? [6+2]

b) Design pipes RA and AB for the water distribution network shown below: [8]
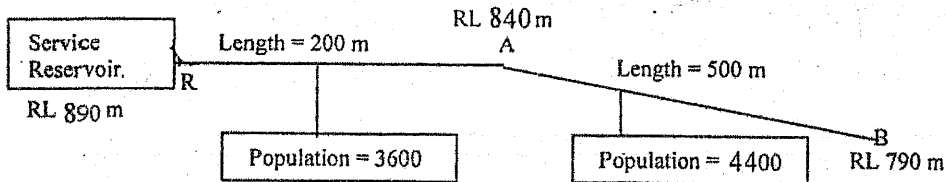
Take per capita demand of water as 200 lpcd. Assume peak factor = 3 and Hazen Williams Constant C = 100. The residual pressure at any point in the distribution system should not be less than 15m. Check velocity in the pipes also.

8. Describe briefly the process of pipe laying and jointing. [4]

9. Why pressure relief valves are necessary? Describe with a neat sketch. [1+3]

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Exam.		Regular	
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Water Supply Engineering (CE 605)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt All questions.
✓ The figures in the margin indicate Full Marks.
✓ Assume suitable data if necessary.

1. Draw a schematic diagram of a typical water supply system and list its components. [4]

2. What are indicator organism? Describe in detail about the membrane tube fermentation technique for the determination of E-coli in laboratory. [8]

3. a) An old tank having dimension of 12m × 5m × 3m is available in a village. It is proposed to use as a settling tank. At least 95 percentage of particles having diameter of 0.025mm, specific gravity 2.65 is expected to remove on that tank at 20°C. What will be an overflow rate on using that tank? Does tank dimension is enough to remove 99 percentage of particles having diameter 0.04mm at same conditions? [10]

   b) Suppose you are a team member of a pre-feasibility study for a rural water supply project. How do you convince the community during disputes regarding the ownership of water sources and priorities of using water sources? [4]

4. a) Enlist the requirements of the public stand post along with its importance in rural areas. [4]

   b) Explain break point chlorination in relation to water supply system. Explain significance of residual disinfectant. [6]

5. a) Design pipelines AB, BC and AD for the following pipe network. A minimum pressure of 1 kg/cm² is required at the tap. Take Hazen william constant C = 100. [8]
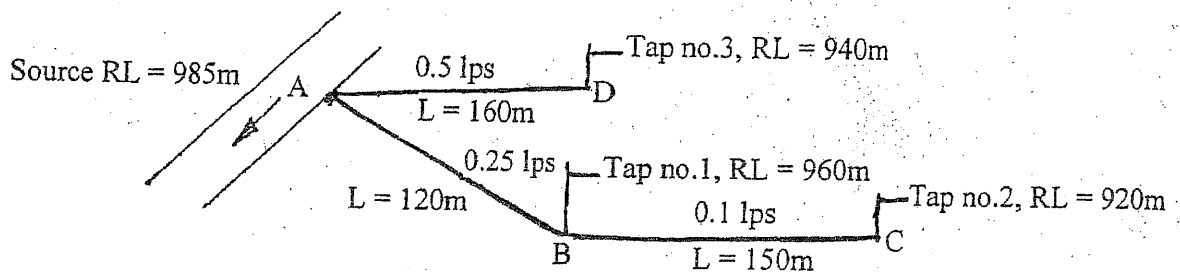
   b) Describe, with their respective merit and demerit, of various methods of distribution of water. [8]

6. When reservoir intake is constructed? Describe a typical reservoir intake. [8]

OR

Describe a dry type river intake with a neat sketch.

7. With neat sketches describe the construction of rapid sand filter. [8]

OR

What are the purpose of aeration? Describe the various methods of aeration.

8. Why pipe joints are required? Describe socket and spigot joint with a neat sketch. [4]

9. Determine the population of the town in the year 2021 and 2026 by (i) Arithmetical increase method (ii) Geometrical increase method and (iii) Decreased rate of growth method. [8]

Year A.D	1961	1971	1981	1991	2001	2011
Population	18000	27000	38000	51000	66000	83000

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Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Water Supply Engineering

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt any *Five* questions.
✓ The figures in the margin indicate *Full Marks*.
✓ Assume suitable data if necessary.

1. a) Draw typical flow diagrams of rural and urban water supply schemes showing the essential components. Describe the function of each component. [4+4]

   b) The yield of water form a catchment area is given below. Determine analytically the minimum storage capacity of impounded reservoir to maintain a constant draft of 4.4 milling m³ of water per month. Neglect all losses and wastage. [8]

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Inflow million m³	1.5	2.0	2.5	5.0	6.0	8.2	9	7.5	5.0	3.5	3.1	2.0

2. a) Briefly describe about variation of demand and factors affecting the water demand. [8]

   b) Estimate the total water requirement for a rural area for the year 2025 AD by forecasting the population by incremental increase method with the following data. [8]

Year	1950	1960	1970	1980	1990	2000
Population	7150	7680	8425	9265	11780	14339

   There are 4 schools with 125 day scholar students and staffs in each school, livestock (3520 chicken/ducks and 170 big animals), 2 health posts with 5 beds capacity and other offices with 345 staffs altogether.

3. a) Describe different types of water borne diseases, their transmission mechanism and preventive measures in brief. [8]

   b) In a continuous flow settling tank 30m long and 3m deep, what velocity of water would you recommend for effective removal of 0.02mm particles. Express the velocity in mm/min. Assume specific gravity of particles = 2.65 and kinematic viscosity of water = 0.01 cm²/sec. [8]

4. a) With neat sketches describe a spring intake. [8]

   b) Average water consumption rate is 150 lpcd in an urban area. Design a slow sand filtration unit for a community having the population of 10000 at the base year 2068. [8]

5. a) Describe the factors that should be considered while selecting pipe materials for water supply schemes. Give comparative merits and demerits of cast iron and steel pipes. [4+4]

b) A newly established town with a population of 1.2 million is to be supplied with water daily at 45 liters per capita. Water have to be stored also for fire demand keeping at least 1% of total demand. The variation in demand is as follows: [8]

Time	Consumption %
05.00 – 07.00	25
07.00 – 12.00	35
12.00 – 17.00	20
17.00 – 19.00	20
19.00 – 05.00	0

Determine analytically the balancing reservoir capacity assuming pumping to be done at on uniform rate and the period of pumping is 5.00 A.M. to 10.00 A.M. and 5.00 P.M. to 8.00 P.M. in two shifts.

6. Write short notes on: (any four)   [4×4]
   a) Public Standpost
   b) Systems of Water Supply
   c) Socket and Spigot Joint
   d) Maintenance of Water Supply Scheme
   e) Laying of Pipeline
   f) Infiltration Gallery

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Exam.		Regular/Back	
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Water Supply Engineering

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt any *Five* questions.
✓ *All* questions carry equal marks.
✓ Assume suitable data if necessary.

1. a) List out various sources of water used in water supply scheme. Explain surface sources of water with respect to suitability, water quality and quantity.

   b) The yield of water from a catchment area during each successive month is given below:

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Inflow million m³	1.40	2.10	2.80	2.80	8.40	11.90	11.90	7.70	2.52	2.25	1.96	1.68

   Determine analytically the storage capacity required of impounded reservoir to maintain a constant draft of 4.78 million m^3 of water per month.

2. a) What do you understand by indicator organisms? Describe in brief about various water borne diseases, their transmission mechanism and preventive measures.

   b) Estimate the population of a town for design year 2030 AD by any three methods and calculate the design quantity of water in litres/day. The census data are as follows:

Year (AD)	1970	1980	1990	2000
Population	40000	45000	55000	62000

   Also consider fire demand and losses and wastage.

3. a) What do you mean by aeration of water? Why is it required? Describe briefly about various methods used for aeration of water.

   b) Design a rectangular sedimentation tank for a town to purify the water of at a rate of 8×10^6 litres per day. Assume velocity of flow as 15cm/minute and detention period as 5 hrs.

4. a) What do you understand by sedimentation with coagulation? Why is it necessary? Explain the different processes involved in sedimentation with coagulation.

   b) If 0.7 mg/lit of total chlorine is required for satisfactory disinfection of water at pH = 7.0. What dosage will be necessary at pH = 8.0. If it is given that initially 12 minutes contact time is required at pH = 7.0. Find the contact time required at pH = 8.0, if n = 1.5 in the equation $c \times t$ = constant, take $k_i = 2.7 \times 10^{-8}$ mol/lit.

5. a) Define intake? Describe the construction of a spring intake generally used in hilly areas of Nepal.

   b) Design pipeline AB and BC in the pipe network as shown in figure.
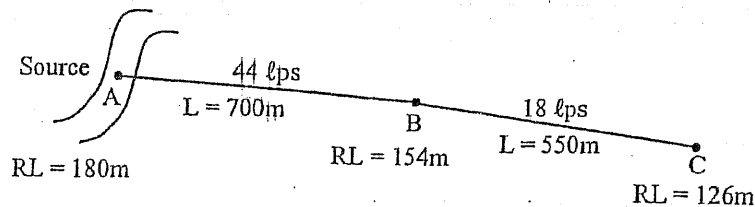
   Minimum pressure in pipe line should be 1.5 kg/cm². Take Hazen William's coefficient as 100.

6. Write short notes on: (any four)
   a) Removal of iron and manganese
   b) Infiltration wells
   c) Membrane filter technique
   d) Break pressure tank
   e) Negative and positive impacts of w/s scheme
   f) Factors affecting water demand

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Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Water Supply Engineering

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt All questions.
✓ All questions carry equal marks.
✓ Assume suitable data if necessary.

1. a) With a neat sketch, describe the construction of a spring intake.

    b) The water demand of a community is 400m³/day. The flow in the river in various months of the year is given below. If the river is to be used as a source for water supply system, calculate the capacity of the impounded reservoir.
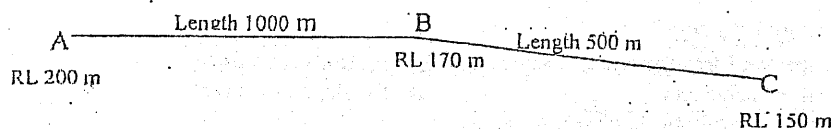
Month	January	February	March	April	May	June
Inflow (ℓps)	2.40	4.00	5.60	4.80	5.60	6.40
Month	July	August	September	October	November	December
Inflow (ℓps)	7.20	6.40	1.12	0.00	5.60	6.40

2. a) Define rate of demand. Enumerate the different factors affecting the rate of demand.

    b) Calculate the design water demand for the year 2025 for a rural village of Nepal. Use Geometrical method for population forecasting. Census population is:

Year	1961	1971	1981	1991	2001
Population	8500	10050	14000	18400	22800

Take 1 school with 80 boarders and 300 day scholars. Consider live stock demand also.

3. a) Describe in detail the process of pipe laying of a water supply system.

    b) 700 mℓ of water sample A with pH of 6 is mixed with 300 mℓ of sample B with pH 7 and 500 mℓ of sample C with pH 8. Calculate the pH of the mixture of A, B and C.

4. a) What is filtration? Explain the theory of filtration as used in the purification of water.

    b) In a continuous flow settling tank 20m long and 2.5m deep, what velocity of water would you recommend for effective removal of 0.02mm particles at 25°C? Assume specific gravity of particles = 2.65 and kinematic viscosity of water = 0.01 cm²/sec.

5. a) What do you understand by sedimentation with coagulation? Explain the different processes involved in sedimentation with coagulation.

    b) A part of water distribution system is shown in figure below. The average water requirement is 150 ℓpcd and water is distributed only from the point C for the population of 20,000. The service reservoir is located at A. Design pipes AB and BC. The minimum pressure to be maintained is 15m and Darcy's coefficient of friction f is 0.04. Assume peak factor of 3. Calculate velocity of water in pipes AB and BC.

```
              Length 1000 m         B
   A ──────────────────────────────   Length 500 m
                              RL 170 m ──────────────
   RL 200 m                                          C

                                                RL 150 m
```

6. Write short notes on any four:
    a) Infiltration gallery
    b) Variation in demand of water
    c) Pressure relief valve
    d) Wholesome water and its requirement
    e) Expansion joint
    f) Break pressure chamber

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Exam.		Regular/Back	
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Water Supply Engineering

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt any **Five** questions.
✓ **All** questions carry equal marks.
✓ Assume suitable data if necessary.

1. a) Describe briefly the sources of water available for water supply. Also describe the factors governing the selection of a source.

   b) 700 ml of water sample A with pH of 6 is mixed with 300 ml of sample B with pH 7 and 500 ml of sample C with pH 8. Calculate the pH of the mixture.

2. a) What do you understand by indicator organisms? Describe the multiple tube fermentation technique for the determination of coliforms.

   b) Calculate the total water demand in the design year 2023 AD for a rural village. The data collected during field survey are as follows:

Survey year	=	2007
Population in survey year	=	5345
Annual population growth rate	=	1.6%
Number of cows	=	4225
Number of goats	=	1670
Number of chickens	=	6300
Number of students	=	220 boarders and 1200 day scholars
Number of offices	=	3

3. a) Define intakes? With neat sketches, describe the construction of a spring intake generally used in hilly areas of Nepal.

   b) Determine the surface area of a sedimentation tank for 0.5 m³/s of design flow, using the design overflow rate of 35 m³/day/m². Find the depth of the tank for the overflow rate and detention time of 90 minutes. Assuming suitable data, recommend the dimensions of the tank.

4. a) Describe with a neat sketch, the working of a rapid sand filter. What are its advantages over the slow sand filter?

   b) Design a set of rapid sand filters for treating water required for population of 45000; the rate of supply being 120 lpcd. The filters are rated to work at 5200 litres per square meter per day.

5. a) Describe the process of pipe laying for a water supply system.

   b) Determine the storage capacity of a service reservoir for a daily requirement of 2,50,000 litres. The pumping rate is 8 hours (8AM to 4PM) constantly. The draw-off is as follows:

   7AM – 8AM = 30% of daily supply
   8AM – 5PM = 35% of daily supply
   5PM – 7PM = 30% of daily supply
   7PM – 7AM = 5% of daily supply

6. Write short notes on: (any four)
   a) Removal of iron and manganese
   b) Aeration
   c) Public standpost
   d) Expansion and flanged joint
   e) Drain value

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03   TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2064 Falgun

Exam.			Back	
Level	BE		Full Marks	80
Programme	BCE		Pass Marks	32
Year / Part	III / I		Time	3 hrs.

Subject: - Water Supply Engineering

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ *Attempt any Five questions.*
✓ *All questions carry equal marks.*
✓ *Assume suitable data if necessary.*

1. a) Describe the importance of public water supply scheme in the present day community.

   b) Determine the daily water demand for a rural village for the year 2030 AD as per following statistical data of 2005 AD.
      i)   No. of households (HHS)   = 200
      ii) Average population per household = 7 nos.
      iii) Annual population growth rate   = 2.2%
      iv) No. of schools   = 10 with 150 day scholar students and staff
      v)   Domestic animals   = 1500 (chickens, ducks)
      vi) Offices with 200 personnel capacity
      vii) Health post   = 1 with 10 beds capacity
      viii) Police station   = 1 with 15 cadets

2. a) List the various sources of water available for water supply. Describe the surface sources with respect to water quantity and quality.

   b) The analysis of water from a well showed the following results in mg/l:
      $Ca = 65, Mg = 55, Na = 101, K = 22, HCO_3 = 248, SO_4 = 221, Cl = 79$
      Find the total hardness, carbonate hardness and non-carbonate hardness.

3. a) What do you understand by per capita demand? Describe various types of variations in water demand and factors affecting the water demand.

   b) Find the diameter of the particles with specific gravity 1.4 removed in a sedimentation tank having a surface area of 250m^2 and treating 8 million litres of water per day. The temperature of water is 23°C.

4. a) Define intake. Why is it necessary? Describe a river intake with a neat sketch.

   b) Determine the surface area of a sedimentation tank for a design flow of 0.5 m^3/s, using the design surface overflow rate as 35 m^3/day/m^2. Find the depth of the tank for a detention period of 2 hours. Assume suitable data if necessary.

5. a) List the various systems of layout of the pipes of a water distribution system. Describe the Gridiron system and its advantages and disadvantages with a neat sketch.

   b) For the water supply of a small town with the maximum daily demand of 1.5×10^5 litres, find the capacity of a distribution reservoir for the consumption pattern as under
      7 A.M. to 8 A.M.   30% of day's supply
      8 A.M. to 5 P.M.   35% of day's supply
      5 P.M. to 6.30 P.M. . 30% of day's supply
      6.30 P.M. to 7 A.M.   5% of day's supply
      The pumping is to be done at a constant rate of 8 hours (8 A.M. to 4 P.M.)

6. Write short notes: (any four)
   a) Multiple tuble fermentation technique   b) Flocculation
   c) Removal of iron and manganese   d) Non-return valve
   e) Laying of pipes

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