

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. Define Polluted and Contaminated water. Also, describe the function of water in human body. [2+2]
2. Discuss the major surface source of water with respect to quantity and quality. Also, list out factors are to be considered while selecting water sources. [2+2]
3. Determine the population of a city in the year 2070 by a)Arithmetical increase method. b)Geometrical increase method C) Decrease rate growth rate method. The census population of the city is as follows: [8]

Year	2010	2020	2030	2040	2050
Population	25,000	35,000	45,000	55,000	60,000

Also calculate the total water demand for the city in 2080.

4. Define water based diseases. Describe and explain the bacteriological examination of water. [2+6]
5. Describe with an illustration about the general reservoir intake arrangement. List out the factors to be considered while selecting site for intake. [4+4]
6. a) Discuss about the treatment process and impurities removal. Explain the affecting factor of hydraulic subsidence in sedimentation tank. [8]
 - b) In continuous flow settling tank 30 m long and 3.0 meter deep, what detention time would you recommend for effective removal of 0.02 mm particles at 20° C ? Assume specific gravity of particles = 2.50. Also, describe how temperature affects the removal efficiency of a sedimentation tank. [6+2]
 - c) Define break point chlorination. Describe in details about how pH and temperature affect the relative distribution of hypochlorous (HOCl) and hypochlorite ions (OCl) in unit process of chlorination. [2+6]
7. a) Describe briefly on the layout of distribution system with their merits and demerits. [6+2]
 - b) A remote rural area has a design year demand of water 20000 liters per day. The demand is met by a continuous system of supply from a river source with measured safe yield of 0.25lps. The consumption pattern is as follows: Estimate the capacity of the balancing reservoir. What will be the water level in the tank at 6PM if the cross section area of the tank is "X"?

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

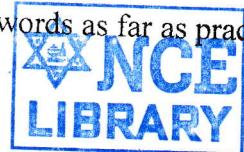
8. List out three materials commonly used for water supply pipe. Also describe their merits and demerits. [4]
9. What is the requirement of installing the Break Pressure Tank (BPT) in a water supply system? Also explain why certain residual head to be maintained at the Stand post. [2+2]

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Bhadra

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. What is the necessity of water supply scheme in the community? Describe the impacts of water supply schemes. [2+2]
2. What are the criteria for selection of water source? [4]
3. Determine the population of a city in the year 2090 by (i) Arithmetical increase method (ii) Geometrical increase method, (iii) Decrease rate growth rate method. The census population of the city is as follows: [8]

Year	2030	2040	2050	2060	2070
Population	28,000	38,000	48,000	58,000	70,000

Also calculate the total water demand for the city in 2090 using 110 lpcd.

4. a) What are the types of impurities according to its characteristics and state? Describe water washed diseases and its preventive measures. [2+2]
- b) Define water quality standards for drinking purpose. Discuss about significance of WHO guidelines for drinking water quality. [4]
5. Explain with sketches the operation and characteristics of a wet reservoir intake for an earth dam. What are the factors that should be considered to ensure maximum stability and safety of intake works? [8]
6. a) Discuss about the unit operation and process with respect to corresponding impurities removal. Also describe how the temperature and diameter affects the theory of particle settlement in sedimentation tank. [4+4]
- b) In a continuous flow, settling tank 20 m long and 3.5 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 15°C. [8]
- c) Describe the causes and effects of hardness in relation to water supply system. How can permanent hardness be removed in water? Calculate the quantity of bleaching powder required to be added in the treatment plant to disinfect 2 MLD of water if the dose of chlorine is 0.5 ppm and 30% chlorine available in bleaching powder. [2+2+4]
7. a) List out the different type of layout systems in the distribution system. Explain with examples why different types of layout systems are suggested in the distribution system. [2+6]
- b) A village has a design year demand of 80000 liter per day. This demand is to meet by continuous system of supply from a spring source with safe yield 0.8 lps. The consumption pattern is as follows: [1+3]

Time: hour	Consumption %
5.00 – 7.00	20
7.00 – 12.00	30
12.00 – 17.00	20
17.00 – 19.00	25
19.00 – 5.00	5

Is a balancing storage tank necessary? Calculate its capacity if necessary. [8]

8. Describe the factors that should be considered while selecting pipe materials. What are advantages and disadvantages of PPR pipes? [1+3]
9. What is the function of air valve? Describe its working with a neat sketch. [4]

TRIBHUVAN UNIVERSITY
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Examination Control Division
 2078 Bhadra

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. Enlist objectives of water supply system focusing for rural water supply in Nepal. Draw its schematic diagram mentioning components. [2+2]
2. Describe the selection criteria to choose a source of water supply? [4]
3. A survey was carried out in 2019 in rural area of Nepal and following data were obtained: Population = 4460, Offices = 3 nos, Day students = 654, boarding students = 145, Cows and buffaloes = 480, goats and pigs = 855. A 15% of net water demand is considered as compensation for loses and wastage. Estimate the total water demand for the scheme if base period is 2 years and design period is 20 years. Consider the annual population growth rate as 1.77%. [8]
4. a) Describe fecal-oral transmission route with a neat sketch. What are the preventive measures that can be adopted to avoid or break this route? [2+2]
 - b) The total hardness of water is 160 mg/l and carbonate hardness is 70 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. What is an intake? What are the functions of intake? Enlist the factors affecting the site selection of intake. [1+2+5]
6. a) Design the plain sedimentation tank for treating 4 MLD of water. Assume necessary data suitably. Sketch designed sedimentation tank with dimensions. [8]
 - b) Propose the number and dimensions of a rapid sand filter for a town having population of 1,20,000 numbers. Assume average water supply rate as 120 lpcd with a filtration rate of 3000 lph/m² and length width ratio as 1.5. [8]
 - c) Explain the forms of chlorination? What are the factors affecting chlorination? [6+2]
7. a) Which layout of distribution of water do you prefer for a haphazardly growing city of Nepal and why? With a neat sketch, enlist its advantages and disadvantages. How you can improve those layout with minimum works? [2+6]
 - b) Determine the storage capacity of balancing reservoir by analytical method for 10 hours pumping (5 am to 10 am and 2 pm to 7 pm) and continuous water supply. The population of a city is 3 million has a water demand of 110 lpcd. The consumption pattern as follows: [8]

Time	5-10	10-14	14-19	19-22	22-25
Consumption	35	15	25	15	10

8. What are the requirements of a good pipe? Explain the expansion joint with a neat sketch. [2+2]
9. Why Break Pressure Tank is necessary in water supply scheme? Explain BPT with neat sketch. [4]

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 Kartik

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. Draw the schematic flow diagram of gravity water supply system for rural area and briefly describe major objectives of each component. [4]
2. List out the major sources of water with respect to quantity and quality. Briefly describe them with examples. What are the key factors to be considered while selecting a water source? [3+3]
3. Estimate the total water requirement for rural village for the year 2092 BS by forecasting the population by incremental increase method with the following Census data. [8]

Year (BS)	2018	2028	2038	2048	2058	2068
Population	7200	8100	9300	11000	13000	16000

There are 3 school (350 days and 50 boarder scholars), livestock (5000 chickens, 1500 goats and 60 cows), 2 health posts with 10 beds capacity and other offices with 100 staffs altogether. Neglect the fire demand for rural area.

4. a) Describe pathways of fecal oral disease transmission route with neat sketch. [4]
- b) What will be the MPN/100 ml, if 6 tubes for each diluted samples of 1.0 ml, 0.1 ml, 0.01 ml and 0.001 ml are taken and the no. of positive tubes are found to be 3, 4, 2 and 0 respectively in a multiple tube fermentation technique of coliform analysis? [4]
5. Illustrate and describe the spring intake arrangement. Describe its protection works with neat sketch and their components. [4+4]
6. a) In continuous flow settling tank of 15 m length, 4 m width and 2.5 m effective depth, what detention time would you recommend to remove 96% of particles having diameter of 0.015 mm and specific gravity 2.65 at 15°C. Does the tank is enough to remove 99% of particles having size 0.020 mm at same conditions? [8]
- b) Design and draw a neat sketch of a rapid sand filter for a community having 5000 number of persons. Assume necessary data with appropriate values. [8]
- c) Briefly describe the break point chlorination with sketch. What are the affecting factors in chlorination process? Discuss. [8]
7. a) Describe dead end system of water distribution system with a neat sketch. Also point out its merits and demerits. [4+4]
- b) A rural area has a design year demand of water 20000 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: Estimate the capacity of the storage tank. What will be the water level in the tank at time of 10 if the cross section area of the tank is "A". [8]

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

8. List out three commonly used materials for water supply pipe with their merits and demerits. [3]
9. What is break pressure tank? Describe it with a neat sketch. [1+2]

TRIBHUVAN UNIVERSITY
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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 typical urban water system and briefly describe the function of each components. [4]

2. Differentiate 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.

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]

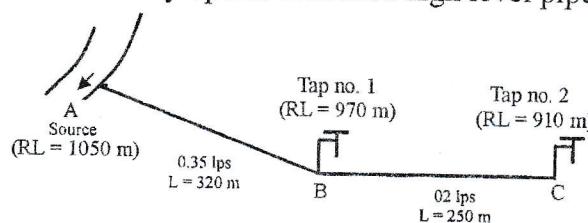
6. a) Design a settling tank for a town having design year population of 41,600 numbers with a water supply rate of 120 lpcd. The detention period is expected as 4 hours, length width ratio as 4 and effective depth as 3.5 m. Also check for SOR and velocity. Sketch neat diagram with dimensions as designed. [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/cm² 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 laying 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]

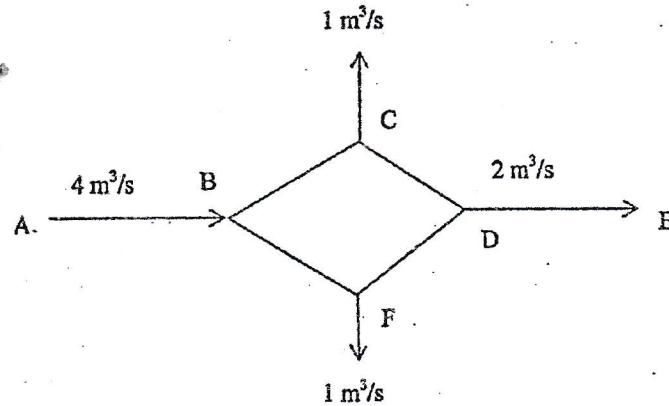
TRIBHUVAN UNIVERSITY
 INSTITUTE OF ENGINEERING
Examination Control Division
 2076 Ashwin

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.
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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*)

[2x2]

- a) Aeration
- b) Service Reservoir and Clear water reservoir
- c) Fecal oral transmission route

4

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.
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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 chlorination 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 valves in pipelines? Describe the working and function of cutoff valve with neat sketch. [4]

Exam.	Back	
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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. [8]

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]

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.
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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.
 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/m²/day to treat water in this average flow rate and sketch also.
 c) A settling tank is designed for an overflow rate of 4000 liters per m² 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	0.7	1.23	1.00	0.82	0.54

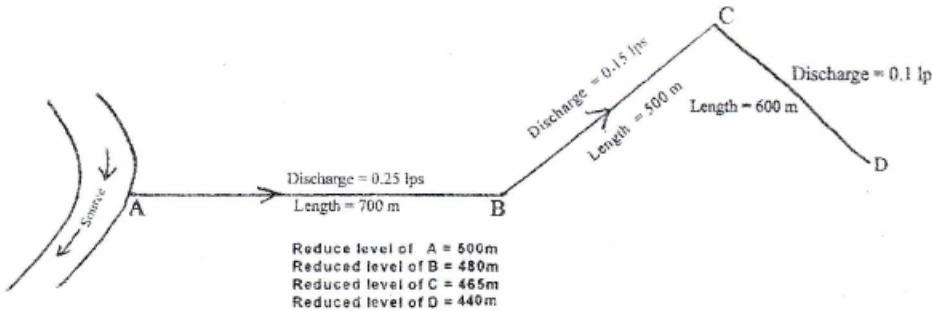
- b) With a neat sketch, discuss grid iron system of water distribution including its advantages and disadvantages. [8]
8. Briefly describe the purpose and use of expansion joint and flanged joint with sketch. [4]
9. Describe the components and purpose in layout connection from main pipe to household service with sketch. [4]

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- ✓ 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]



9. Define break point chlorination. Describe in details about how pH and temperature affect the relative distribution of hypochlorous (HOCl) and hypochlorite ions (OCl^-) in unit process of chlorination. [2+6]
10. A rural area has a design year demand of water 20,000 litres 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]

Examination Control Division

2073 Shrawan

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. 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 = 2x Width 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 recommend improvements over transitional layout system. [8]
 - b) The water demand of a city is $10,000 \text{ m}^3/\text{day}$. 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]

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

Chickens = 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]

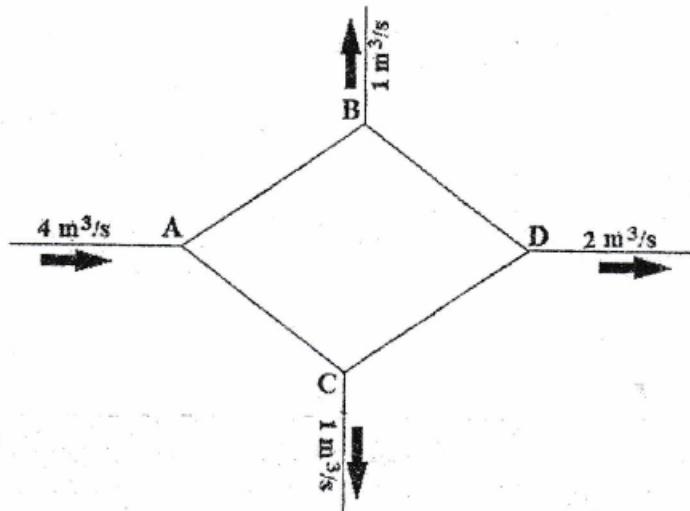
6. a) Describe the construction of slow sand filter with neat sketches and its design consideration. [8]

- b) A settling tank is designed for an overflow rate of 4000 liters per m^2 per hour. What percentage of particles of 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. Describe the various types of layouts of the water distribution system with their merits and demerits.
9. What are the purposes of valves in pipeline? With a neat sketch, describe a reflux valve.

[8]

[4]

[4]

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 doses of alum as 15 mg/l and chlorine doses 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]

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 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 $4 \times 10^6 \text{ m}^3$ 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]

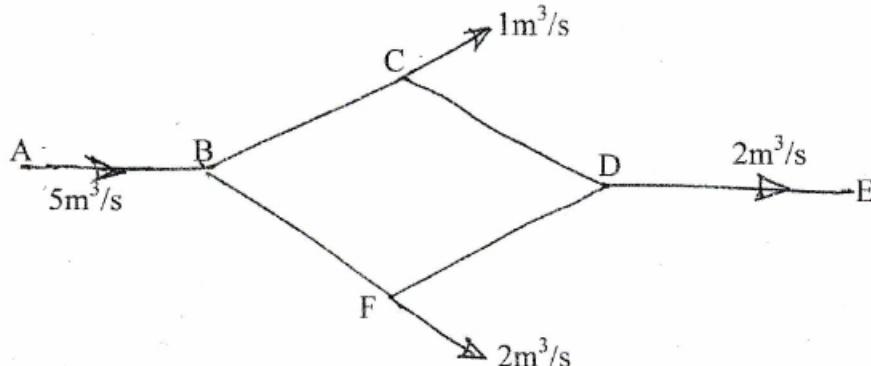
b) The total hardness of water is 150 mg/l and carbonate hardness is 60 mg/l. All the three bi-valent metallic ions causing hardness are same. Determine the non-carbonate hardness, alkalinity and concentration of bi-valent metallic ions. [4]
5. With neat sketches describe the factors that should be considered 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 $c^n t = \text{constant}$, $K_i = 2.7 \times 10^{-8} \text{ mol/lit}$. [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, $f = 0.03$.



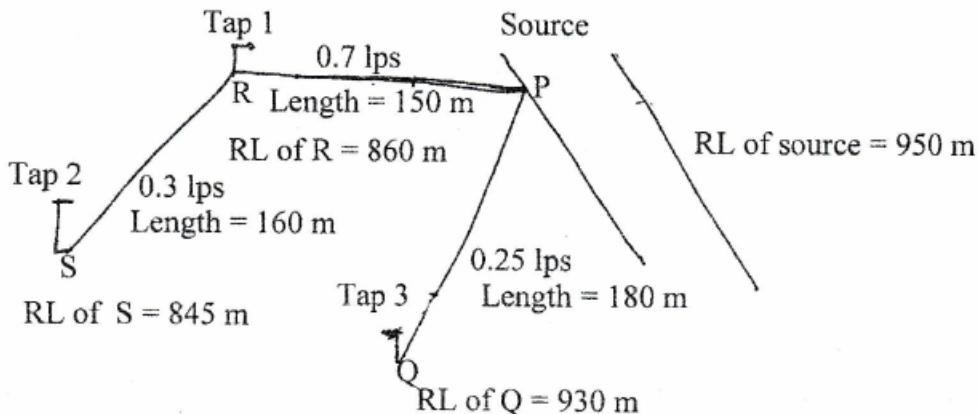
8. Describe briefly the process of pipe laying and joining. [4]
9. Why break pressure tank is necessary in a water supply scheme? Discuss its construction.

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 in 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/cm^2 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]

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Examination Control Division
 2071 Chaitra

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.

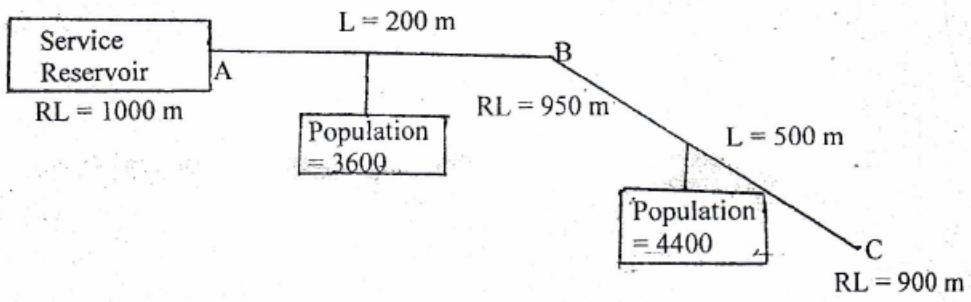
1. Draw a schematic diagram for rural and urban water supply scheme. Describe the functions of each component. [4]
2. Differentiate between shallow and deep wells. Discuss their suitability with respect to water quantity and quality. [4]
3. Calculate the design discharge for design year 2030 for a village 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:
 $\text{Ca} = 65; \text{Mg} = 35; \text{Na} = 101.5; \text{K} = 21.5; \text{HCO}_3 = 248; \text{SO}_4 = 221.8$
 Find the total hardness, carbonate hardness and non-carbonate hardness. [4]
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:
 i) Chlorine content in the commercial bleaching powder = 35%
 ii) Dose of chlorine = 2.00 mg/l
 iii) Water demand per day = 500000 liters [8]

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]

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]

- The value of non carbonate hardness
- The concentration of principal catious and
- 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

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 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]

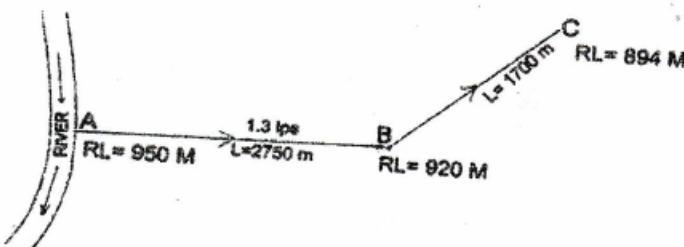
6. a) Differentiate between super chlorination and break-point chlorination. Explain break-point chlorination with a neat sketch explaining the types of chlorine form available in the various stages of the break-point curve. What is the significance of residual chlorine? [8]

- 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

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 (CE 605)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
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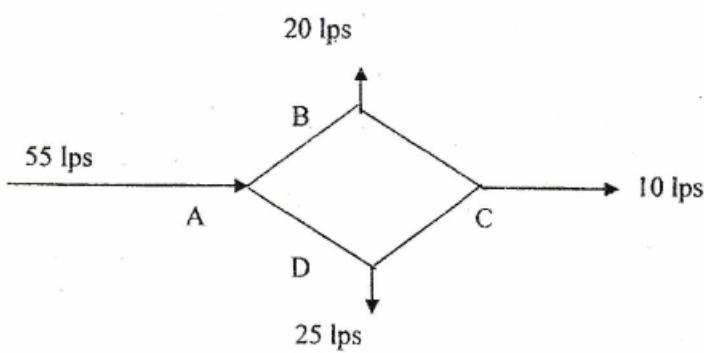
1. Describe briefly about objectives of water supply and its necessary components for water supply system. [4]
2. Describe various sources of surface water with respect to their quantity and quality. [4]
3. Draw a schematic diagram of a typical water supply system and list its components. Determine the population of the town in year 2021 and 2026 by (i) Arithmetical increase method and (ii) Decreased rate of growth method from the following details: [8]

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

4. What are indicator organism? Describe in detail about the membrane tube fermentation technique for the determination of E-coli in laboratory. [8]
5. What is an intake? Describe spring intake with neat sketches. [8]
6. a) Find the quantity of alum and chlorine required in a treatment plant of capacity 12 million lit/day. If optimum dose of alum is 3 mg/l and residual chlorine is expected in the distribution pipe is at the concentration of 0.2mg/l. [8]
 - b) Find the settling velocity of silica particle of specific gravity 2.65 at 10°C if the diameter of the particle is 0.05cm. Assume kinematic viscosity at 10°C is 0.91 centistokes. [8]
 - c) Design a rectangular shape plane sedimentation tank to treat 3.75 l/s of water. Assume effective depth as 2.1m and detention time as 4 hours. [8]
7. a) Compare the continuous and intermittent system of water supply. [6]
 - b) Calculate the discharge in pipes AB, BC, AD and CD for the water distribution network giving below by using Hardy-cross method. The available data of network are as follows: [10]

Pipe	Length (in meter)	Diameter (in mm)
AB	400	300
BC	300	200
AD	500	400
CD	500	300

Hazen Williams coefficient as 100 for all pipes. Assume other necessary data suitably.



8. Describe briefly the flanged joint and reflux valve with neat sketches. [4]

9. Describe the construction of break pressure tank with neat sketches. [4]

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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 (m ³ /s)
January	2.97
February	1.99
March	1.00
April	0.00

Month	Inflow (m ³ /s)
May	0.51
June	1.00
July	2.00
August	3.00

Month	Inflow (m ³ /s)
September	4.00
October	5.00
November	4.00
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]

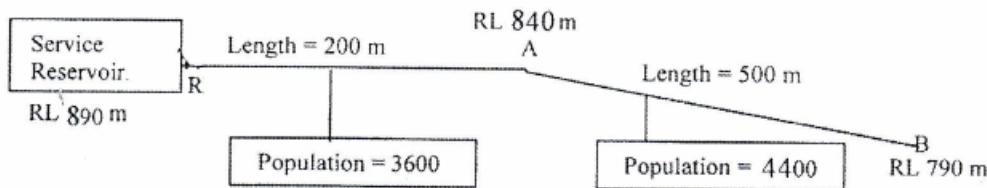
5. What are the factors that should be considered during selection of an intake site? With neat sketches, describe the construction of a spring intake. [8]

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.

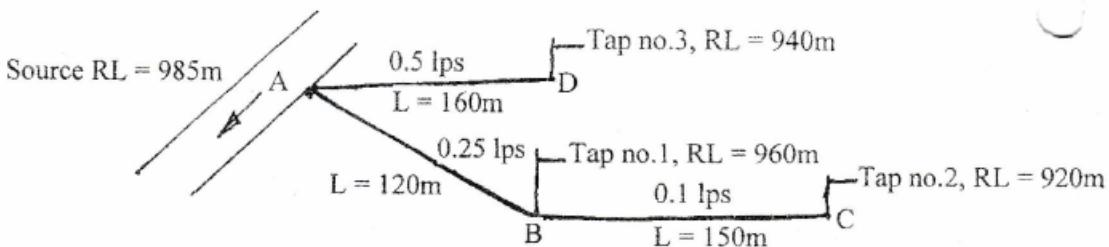
8. Describe briefly the process of pipe laying and jointing. [4]
9. Why pressure relief valves are necessary? Describe with a neat sketch. [1+3]

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)

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- ✓ Attempt All questions.
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- ✓ 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 $12m \times 5m \times 3m$ 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]
3. 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]
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/cm^2 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
