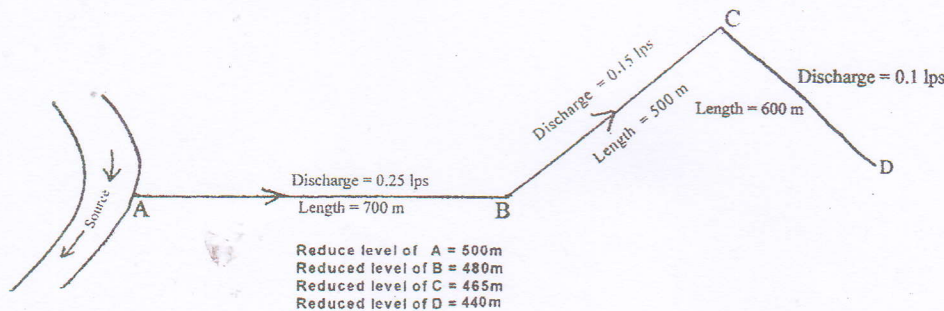


Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

**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-William'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<sup>-</sup>) in unit process of chlorination. [2+6]

10. A rural area has a design year demand of water 20,000 liters 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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Exam.	New Back (2066 & Later Batch)		
	Level	BE	Full Marks
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<sup>3</sup>. 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<sub>3</sub>, allowable hardness after treatment = 50 mg/l as CaCO<sub>3</sub> ion exchange capacity of the resin = 20 kg /m<sup>3</sup> 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<sup>3</sup>/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)**

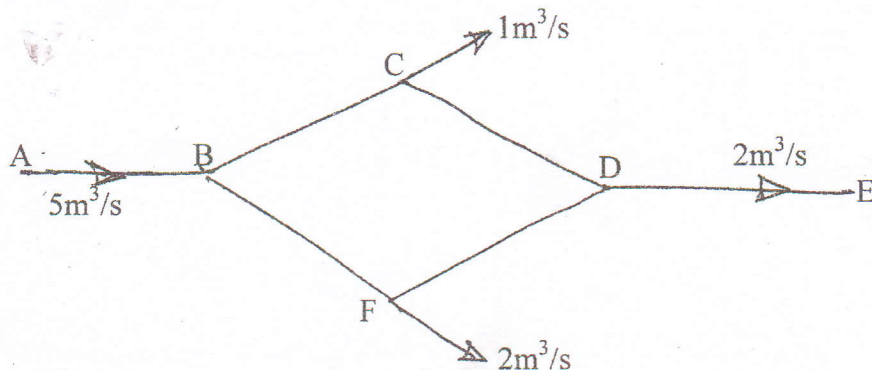
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt **All** questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

- What do you understand by water supply system? Describe its historical development. [4]
- 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 ( $10^6 \text{ m}^3$ )	5.1	5.9	8.3	8.9	7.5	5.0	3.5	3.0	2.0	1.6	2	2.4

- Briefly describe the factors affecting water demand and variation of hourly water demand. [8]
- Describe about the fecal-oral transmission route with neat schematic diagram. [4]
  - The total hardness of water is  $150 \text{ mg/l}$  and carbonate hardness is  $60 \text{ mg/l}$ . 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]
- With neat sketches describe the factors that should be considered while constructing the spring intake. [8]
- Explain briefly the theory of settlement of discrete particles through quiescent liquids. How do you modify the theory to consider the temperature affect? [8]
  - The population of a city is 50,000. Design a rapid sand filter including design of filter media, base material and underdrainage system. [8]
  - What dose will be necessary  $\text{pH} = 8$  if  $0.5 \text{ mg/l}$  of total chlorine is required for disinfection of water at  $\text{pH} = 7.0$ . Find the contact time required at  $\text{pH} = 8.0$ , if it is given that initially 10 minutes contact time is required at  $\text{pH} = 7.0$ . Take  $n = 1.5$  in the equation  $c^n t = \text{constant}$ ,  $K_i = 2.7 \times 10^{-8} \text{ mol/lit}$ . [8]
- Describe a purpose and construction of service reservoirs with neat sketches. [8]
  - 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.	BE	Full Marks	80
Level	BE	Pass Marks	32
Programme	BCE	Time	3 hrs.
Year / Part	III / I		

**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.

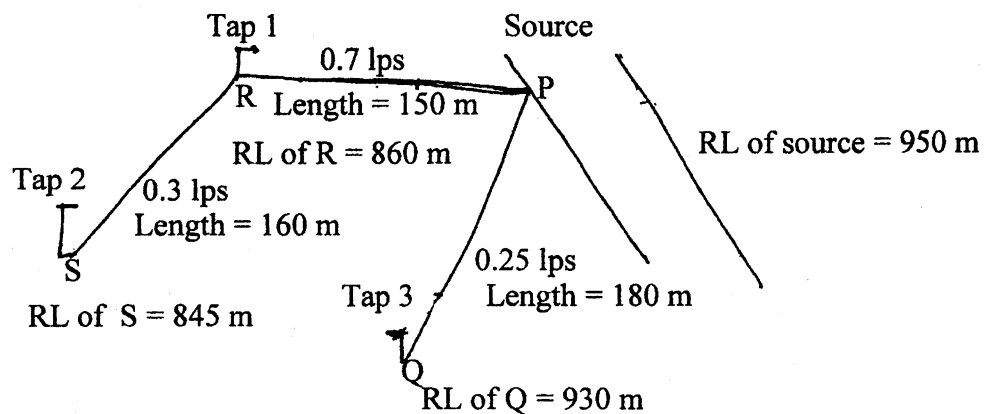
8. What are the requirements of good pipe material? [4]
9. What is the function of air valve? Describe its working with a neat sketch. [4]

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.

- ✓ 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<sub>3</sub>. 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<sub>3</sub>, 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 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<sup>2</sup> 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]

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<sub>3</sub> = 248; SO<sub>4</sub> = 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

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]

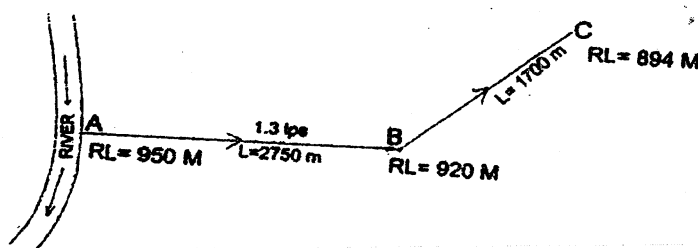
6. a) Differentiate between super chlorination and break-point chlorination. Explain break-point chlorination with a neat sketch explaining the types of chlorine form available in the various stages of the break-point curve. What is the significance of residual chlorine? [8]

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 with neat sketches. [4]



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) Discuss briefly about the faecal oral transmission route. Draw the schematic flow diagram of water supply system in rural and urban sectors and briefly describe major function of each component.
- b) A newly established town with a population of 1.3 million is to be supplied with water daily at 110 liters per head. The variation in demand is as follows.

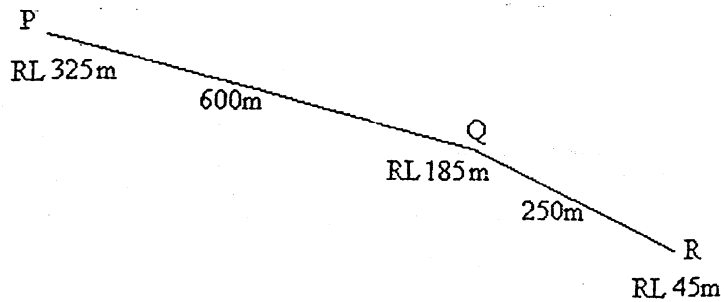
Time	Consumption %
05.00-10.00	55
10.00-14.00	10
14.00-18.00	20
18.00-22.00	10
22.00-05.00	5

- Determine analytically the balancing reservoir capacity assuming pumping to be done at a uniform rate and the period of pumping is 5 A.M to 6 P.M. Neglect fire demand.
2. a) What are indicator organisms? Describe in detail about the membrane filter technique for the determination of E-coil in laboratory.
  - b) Determine the settling velocity of a discrete particle having the diameter 0.17 mm; specific gravity 2.65 in water. The temperature of fluid is 21°C.
  3. a) Explain theory of sedimentation with coagulation in water supply system. What are the factors affecting chlorination?
  - b) Determine the population of a rural area for the year 2055AD (any four methods). Compute the expected daily water quantity requirement for one proposed population with justification.

Year	1971	1981	1991	2001	2011
Population	32000	36000	44000	52000	57000

4. a) Describe the various water borne diseases that are transmitted through polluted water and their preventive strategies.
- b) Average water consumption rate is 45 lps in the village. Design a slow sand filtration unit for a community having the population of 3500 at the base year 2048AD. Assume necessary data suitably.

5. a) What is the purpose of aeration? Discuss various aeration methods commonly used in water treatment.
- b) Design suitable diameter of continuous main transmission pipe lines PQ and QR shown below. The average water requirement is 60 lpcd. The storage tank is fixed at point P of R.L. 325.0m. The water is distributed only after the point Q for a population of 2500 and R for a population of 21000. If the minimum pressure head of water is to be 15.0m at Q and R. Assume Hazen Williams' coefficient C as 100 and other necessary requirements if necessary.



6. Write short notes on: (any four)

- GI and CI pipe
- Jar test
- Public stand post
- Spigot and socket joint
- Globe valve

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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]

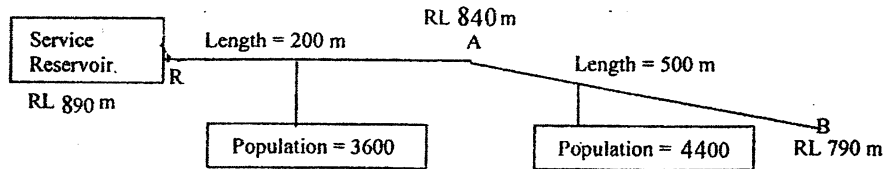
Month	Inflow (m <sup>3</sup> /s)
January	2.97
February	1.99
March	1.00
April	0.00

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

Month	Inflow (m <sup>3</sup> /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 dose 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.	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.
- ✓ Attempt **All** questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

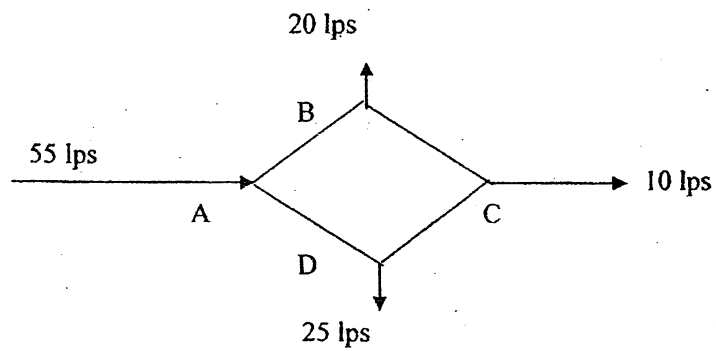
1. Describe briefly about objectives of water supply and its necessary components for water supply system. [4]
2. Describe various sources of surface water with respect to their quantity and quality. [4]
3. Draw a schematic diagram of a typical water supply system and list its components. Determine the 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-coil 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]

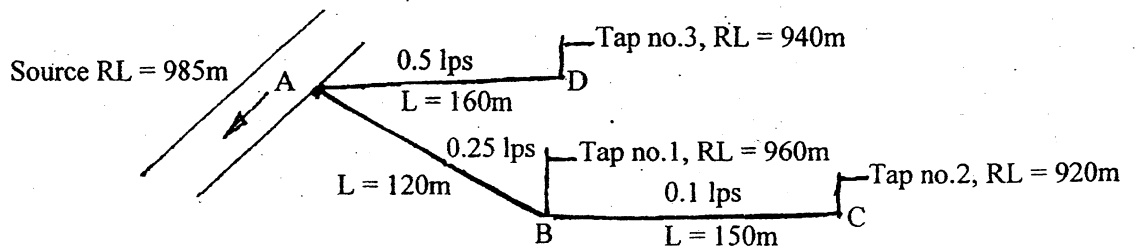
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Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

**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/cm<sup>2</sup> 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
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 from a catchment area is given below. Determine analytically the minimum storage capacity of impounded reservoir to maintain a constant draft of 4.4 million m<sup>3</sup> 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 m <sup>3</sup>	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 cm<sup>2</sup>/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 Level	Regular/Back	Full Marks	80
		BE	Pass Marks
Programme	BCE	Time	3 hrs.
Year / Part	III / I		

59  
80

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 m <sup>3</sup>	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<sup>3</sup> 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.

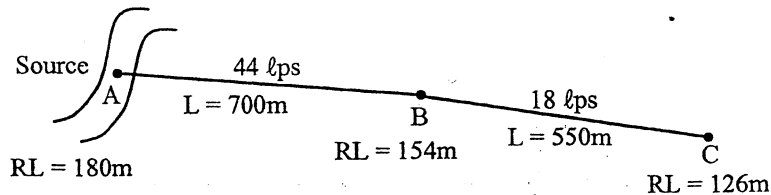
b) Design a rectangular sedimentation tank for a town to purify the water of at a rate of  $8 \times 10^6$  litres per day. Assume velocity of flow as 15cm/minute and detention period as 5 hrs.

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  $c \times t = \text{constant}$ , take  $k_1 = 2.7 \times 10^{-8}$  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/cm<sup>2</sup>. 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

Exam.	Back		
	Level	BE	Full Marks
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 factors affecting the water demand. How a peak demand is calculated?
- b) The city has an average water demand of 9688 million liters per month. Calculate the capacity of impounded reservoir. The flow in the river is shown below.

Month	Inflow (m <sup>3</sup> /s)	Month	Inflow (m <sup>3</sup> /s)
January	2.51	July	1.30
February	2.11	August	3.00
March	1.20	September	4.00
April	0.00	October	5.2
May	0.11	November	4.00
June	1.00	December	1.80

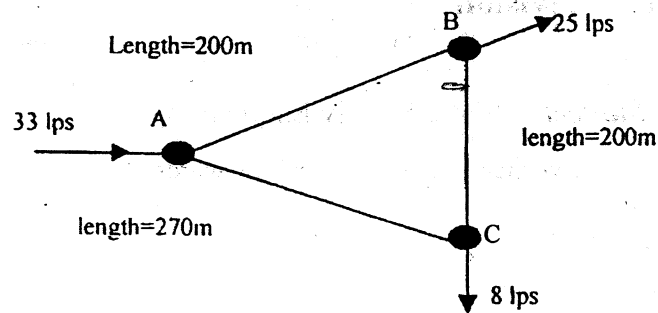
2. a) Describe the membrane filtration technique for the determination of coliforms.
- b) Population of a town as obtained from the census report is as follows:

Year A.D.	1951	1961	1971	1981	1991	2001
Population	18000	27000	38000	51000	66000	83000

Determine the population of the town in the year 2011 and 2016 by (i) Arithmetical increase method, (ii) Geometrical increase method and (iii) Decreased rate of growth method.

3. a) If there are two samples P and Q from the different treatment plants having the pH values of 6.5 and 7.8. Calculate how many times the sample is acidic than sample B.
- b) With neat sketch, describe the construction of an infiltration gallery.
4. a) Describe the layout of distribution system with advantages and disadvantages for water supply systems.
- b) Determine the settling velocity of a discrete particle having the diameter 0.14mm: specific gravity 2.61 in water. The temperature of fluid is 25°C.
5. a) Explain about the chlorination and its applications in water supply system. What are the affecting factors in chlorination?

- b) Design the pipes AB, BC and AC for the water distribution network given below. Take Hazen William's co-efficiency as 110 for all the pipes and assume suitable data as required.



Consider RL of points A, B and C are same. The pressure available at A is  $15 \text{ kg/cm}^2$  and the minimum pressured required at B and C is  $1.5 \text{ Kg/cm}^2$ .

6. Write short notes on any four:
- Break pressure tank
  - Air relief valve
  - Spigot and socket joint
  - WI and concrete pipe
  - River intake

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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. (5)
- ✓ 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  $400\text{m}^3/\text{day}$ . 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.

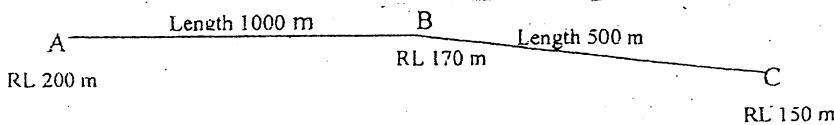
Month	January	February	March	April	May	June
Inflow (lps)	2.40	4.00	5.60	4.80	5.60	6.40
Month	July	August	September	October	November	December
Inflow (lps)	7.20	6.40	1.12	0.00	5.60	6.40

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  $25^\circ\text{C}$ ? Assume specific gravity of particles = 2.65 and kinematic viscosity of water =  $0.01\text{ cm}^2/\text{sec}$ .
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.



6. Write short notes on any four:

- a) Infiltration gallery
- b) Pressure relief valve
- c) Expansion joint

- d) Variation in demand of water
- e) Wholesome water and its requirement
- f) Break pressure chamber