

**UNIVERSITY EXAMINATIONS  
2013/2014 ACADEMIC YEAR**

**FOURTH YEAR SECOND SEMESTER EXAMINATION**

**FOR THE DEGREE OF  
BACHELOR OF SCIENCE  
IN  
CIVIL AND STRUCTURAL ENGINEERING**

**COURSE CODE: CSE 452**

**COURSE TITLE: DRINKING WATER SUPPLY AND SYSTEMS**

**DATE:**

**TIME:**

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**INSTRUCTIONS TO CANDIDATE**

- Answer only FOUR questions
- Marks for each question are indicated in the parenthesis

1.
  - (a) State the aim of jar test [2 Marks]
  - (b)
    - (i) What is the objective of coagulant rapid mixing in water treatment [2 Marks]
    - (ii) Describe two groups of devices used to provide rapid mixing in water treatment [9 Marks]
  - (c) Give two purposes of water softening and demineralization [2 Marks]
  - (d) With the aid of a sketch describe the breakpoint curve when chlorine is added to water containing free and saline ammonia [5 Marks]
  
2.
  - (a)
    - (i) Outline the significance of groundwater spring protection and development [2 Marks]
    - (ii) List **FOUR** factors considered in spring protection and development [4 Marks]
  - (b)
    - (i) Outline the design guidelines for the location of a River Intake [4 Marks]
    - (ii) Design a bell mouth canal intake for a city of 80,000 persons drawing water from a canal which runs for 10 hours a day with a depth of 1.8 m. Draw a neat sketch of the canal intake. Assume average consumption per person = 150 l/day. Assume the velocity through the screens and bell mouth to be less than 16 cm/s and 32cm/s respectively [10 Marks]
  
3.
  - (a)
    - (i) List **THREE** advantages of rapid sand filters [3 Marks]
    - (ii) A filter unit is 4.5m by 9.5m with four wash water troughs. After filtering  $10,000m^3 / day$  in 12 hours period the filter is backwashed at the rate of  $10l / m^2 / S$  for 15 minutes. Compute the average filtration rate, quantity and percentage of treated water used in washing and the rate of wash water flow in each trough [8 Marks]
  - (b)
    - (i) Describe the object of drinking water supply sterilization and list **FOUR** methods that can be used to achieve the same [5 Marks]
    - (ii) Differentiate between simple chlorination and super chlorination with de-chlorination as practiced in the water works industry [4 Marks]

4. (a) (i) What do you understand by “Total Water Demand”? Outline how the projection for water demand is made? [3 Marks]
- (ii) List FOUR types of valves encountered in drinking water supply systems [2 Marks]
- (iii) Discuss the merits and demerits of the various drinking water distribution options [6 Marks]
- (b) (i) What is ‘Safe drinking water’ as envisaged by drinking water standards? [2 Marks]
- (ii) Describe the prioritisation scheme for Selection of contaminants for setting national water drinking standards as outline in the WHO guidelines for drinking water standards [7 Marks]
5. (a) (i) List FOUR benefits of rain water harvesting [4 Marks]
- (ii) A rock catchments system is to be designed for Habaswein Township. Given the following established demands and climate data, design the rock catchment storage

**Established Demand**

	Users	Rate L/C/d
Hospital	200	8
District Headquarters	20	5
Schools	500	5

**Habaswein Weather Station (Mean monthly rainfall amounts in mm)**

Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
8.1	6.0	21.9	87.4	9.5	0.3	0.5	0.3	1.3	21.8	64.6	27.2

Monthly Evaporation Losses = 10 mm

Area of exposed rock catchment = 2.2 Ha [10 Marks]

- (b) (i) Outline the significance of test pumping for new wells and boreholes [2 Marks]
- (ii) A 30cm well is in an aquifer of transmissibility  $T = 187.5 \text{m}^3/\text{day}/\text{m}$  width of the aquifer and storage constant  $S_c = 0.009$ . What rate of pumping  $Q$  can be

adopted so that the draw down should not exceed 10.5m within the next two years?

[4 Marks]