UNIVERISTY 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:**

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 $10{,}000 m^3 / day$ in 12 hours period the filter is backwashed at the rate of $10 l / m^2 / S$ 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= 187.5m^3/day/m width of the aquifer and storage constant Sc = 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]