EGERTON UNIVERSITY

UNIVERSITY EXAMINATIONS

NJORO CAMPUS

FIRST SEMESTER 2012/2013

FOURTH YEAR EXAMINATIONS FOR THE DEGREE OF BACHELOR OF SCIENCE IN AGRICULTURAL ENGINEERING

AGEN 454: WATER RESOURCES AND SUPPLY ENGINEERING

STREAM: 2009 (Y4) B. SC. AGEN **TIME:** 2 hours

DAY/TIME: TUESDAY, 08.30 – 11.30 PM **DATE:** 15-01-2013

INSTRUCTIONS:

1. The paper contains **SIX (6)** questions
2. Attempt **any FIVE (5)** questions.
3. All questions carry equal marks
4. Shown in parenthesis are marks for each question.
5. **EACH QUESTION SHOULD BE STARTED ON A NEW PAGE**

QUESTION ONE

(a) Using sketches, explain the hydrologic cycle. **(4 marks)**

(b) Briefly discuss the following;

(i) Different types of wells adopted for collection of ground water.

(ii) Reasons why ground water is preferred to surface water for domestic water supply.

(iii) Reasons why ground water is not suitable for certain specific purposes. **(10 marks)**

(c) Explain the following well development methods.

(i) Over-pumping.

(ii) Surging.

(iii) Backwashing with air. **(6 marks)**

QUESTION TWO

(a) (i) Briefly describe the basic elements of a rainwater harvesting system **(3 marks)**

(ii) Explain how the semi-circular and trapezoidal bunds are used in rainwater harvesting. **(3 marks)**

(b) (i) State any **FIVE** factors that need to be considered during planning for a public water supply system. **(5 marks)**

(ii) With the aid of a flow diagram, **LIST** the main elements of a public water supply system **(4 marks)**

(c) In a given year, a 28900 km^2 catchment received 506 mm of precipitation. The average rate of flow measured in the river draining the area was found to be 175 m^3/s. Make an estimate of the combined amounts of water evaporated and transpired from the region during the year of record. **(5 marks)**

QUESTION THREE

(a) Differentiate between the following terms as used in water supply

(i) Reservoir and dam

(ii) Raw water and hard water

(iii) Contaminated water and polluted water

(iv) Potable water and palatable water **(4 marks)**

(b) Explain any **THREE** different methods of forecasting the future population of a community. **(6 marks)**

(c) (i). Assuming a geometric rate of growth of population of a town, calculate its population in 2011 based on the following census records.

Year	1981	1991	2001
Population in '000	242	485	710

(ii) If the water consumption in the town is estimated at 350 litres per household of 5 persons and 45% of the household keep two dairy cows that consume 5 litres per head per day, compute the daily water requirement for the town in 2011. **(10 marks)**

QUESTION FOUR

(a) Explain what happens when the following operating troubles occur in a water filter unit.

(i) Air binding

(ii) Mud ball formation

(iii) Sand incrustation **(6 marks)**

(b) Give **FOUR** differences between a rapid sand filter and a slow sand filter. **(4 marks)**

(c) List **ALL** the processes in the order that they occur in the treatment of surface water to drinking quality standards. **(4 marks)**

(d) Design a continuous type sedimentation tank for treating water for a population of 80,000 persons with an average consumption of 125 litres per person per day. Assume a retention period of 6 hours. Indicate any other assumptions made. **(6 marks)**

QUESTION FIVE

(a) With the aid of well labelled diagram, explain the following terms used in reservoirs

(i) Useful storage

(ii) Normal pool level

(iii) Surcharge storage **(4 marks)**

(b) List any **FOUR** factors you would consider in the selection of a suitable site for an impounding reservoir which is to be constructed for supplying water to a community. **(4 marks)**

(c) Discuss in detail **THREE** methods of water distribution **(6 marks)**

(d) It is necessary to pump 300 litres per minute of water from a reservoir at an elevation of RL 1240m to a storage tank located 475 m away at an elevation of RL 1310 m. If the pipe diameter is 5.10 cm and minor losses in the pipeline is estimated at 1.8 m, calculate;

(i) The maximum lift of the pump required (take f = 0.015)

(ii) The power required to drive the pump assuming a pump efficiency of 75%

Assume the suction pipe is very short with negligible losses. **(6 marks)**

QUESTION SIX

(a) (i) Enumerate the various routine physical tests for water quality **(4 marks)**

(ii) Discuss in detail **any TWO** of the tests giving their significance **(3 marks)**

(b) List **FIVE** factors upon which the amount of chlorine (and its compounds) added to water of any quantity depends on **(5 marks)**

(c) A new well has been constructed and properly protected. It is required that the well water should be disinfected with 50 mg/l of chlorine before it is passed for community use. The well has a diameter of 1.8 m; the level of water in the well is 1.5 m. Sodium hypochlorite is available at a shop at KES 60/- per kilogram. Given that the available chlorine in sodium hypochlorite is 5%, calculate;

(i) Volume of water in the well

(ii) The amount of sodium hypochlorite required

(iii) The cost of chlorinating the well water **(8 marks)**

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