KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2010/2011

OPEN, DISTANCE AND E-LEARNING EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE (WATER ENGINEERING)

SET 519: INDUSTRIAL WASTEWATER COLLECTION AND TREATMENT

DATE: Friday 8th July 2011 **TIME: 2.00p.m – 4.00p.m**

INSTRUCTIONS

This paper contains FIVE questions. Attempt THREE questions only.

Question 1

a) Discuss in detail pressure force due to external loads acting on a sewer pipe laid underground. [10marks]

b) A 200 mm diameter sewer is to flow at 0.4 depth on a grade ensuring a degree of self-cleansing equivalent to that obtained at full depth at a velocity of $0.75ms^{-1}$. Find the required grade and associated velocity and rate of discharge at this depth. Assume Manning's rugosity coefficient n as 0.012. the variation of n with depth may be neglected. [10marks]

Question 2

a) Explain how you would test a newly laid sewer line before bringing it into commissioning. [10marks]

b) Design an outfall sewer of separate system for a tow with a population of 500,000 persons with a water supply at 90 litres per day. The sewer can be laid at a slope of 1 in 1000 with n as 0.012. A self cleaning velocity of $0.8\ ms^{-1}$ is to be developed. The dry weather flow may be taken as $^1/_3$ of the maximum discharge. [10marks)

Question 3

Design a three based siphon for carrying sewer across a stream. The total length of the siphon measured along the centre line including slopes is about 80m. The invert level at the inlet and the outlet ends of the sewer are 202.38m and 201.80, respectively. The average flow of sewage is 180 litres per second, and the maximum flows are 250%, and 40%, of average respectively. Assume the minor losses to be about 6cm. [20marks]

Question 4

Describe in detail the major characteristics of industrial wastewater and treatment options available [20marks]

Question 5

Describe in order, the various stages followed in the construction of sewers. [20marks]