



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF INDUSTRIAL TECHNOLOGY

DEPARTMENT OF CIVIL AND WATER ENGINEERING

HYDRAULIC DESIGN I

TCW 3203

Supplementary Examination Paper

August 2015

This examination paper consists of 4 pages

Time Allowed: 3 hours

Total Marks: 100

Special Requirements: NONE

Examiner's Name: ENG. A CHINYAMA

INSTRUCTIONS

1. Answer ALL questions
2. Each question carries 25 marks
3. Use of calculators is permissible

MARK ALLOCATION

QUESTION	MARKS
1.	25
2.	25
3.	25
4.	25
TOTAL	100

QUESTION 1

- a. Describe the procedure for designing sanitary sewers, stating the design considerations. (10 marks)
- b. With the aid of neat sketches describe the types of intake structures and the protection measures required for these structures. Discuss factors influence the siting of intake structures? (15 marks)

[25 marks]

QUESTION 2

- a. Discuss the importance of population forecast in the design of public water supply systems and describe the different methods employed for this purpose. (10 marks)
- b. A city has a present population of 1million. By the arithmetic method the population is expected to be 1.4 million in 10 years. The existing treatment plant capacity is 18 000m³/day. The rate of input to the treatment plant is 0.5m³ per person per day. For how long will the treatment plant be adequate? (15 marks)

[25 marks]

QUESTION 3

A rectangular loop ABCD is described by the following data:

Pipe	AB	BC	CD	DA
Length (m)	3.0	1.5	3.0	1.5
Diameter (mm)	450	350	400	550

The inflow at node D is 360l/s and the rest of the nodes have got outflows.

- i. Using Hazen- Williams formula, $Q=0.278C_H D^{2.63} S_f^{0.54}$ Where $C_H=120$ for all pipes, determine the discharges in the loop. (15 marks)
- ii. If the total energy at node A was given as 68.42m, and that node B is 5m above node A, What would be the pressure head at B? (10marks)

[25 marks]

QUESTION 4

Using the rational method and the information given below, design a storm water drainage system for a community. The pipes are concrete with roughness $k=0.15\text{mm}$. The sewers are to be designed for a return period of 1 in 5 years and it can be assumed that rainfall intensity is given by $i=650/(t+8)\text{mm/h}$. Assume time of entry as 5 min, $t_f = L/60V$ and $C=0.98$.

Sewer Ref No.	Length (m)	Gradient	Catchment area (km ²)	Comments
1.0	41	1 in 250	0.004	Main sewer
1.1	39	1 in 400	0.005	Main sewer
2.0	35	1 in 160	0.002	Branch
2.1	40	1 in 160	0.003	Branch

[25 marks]

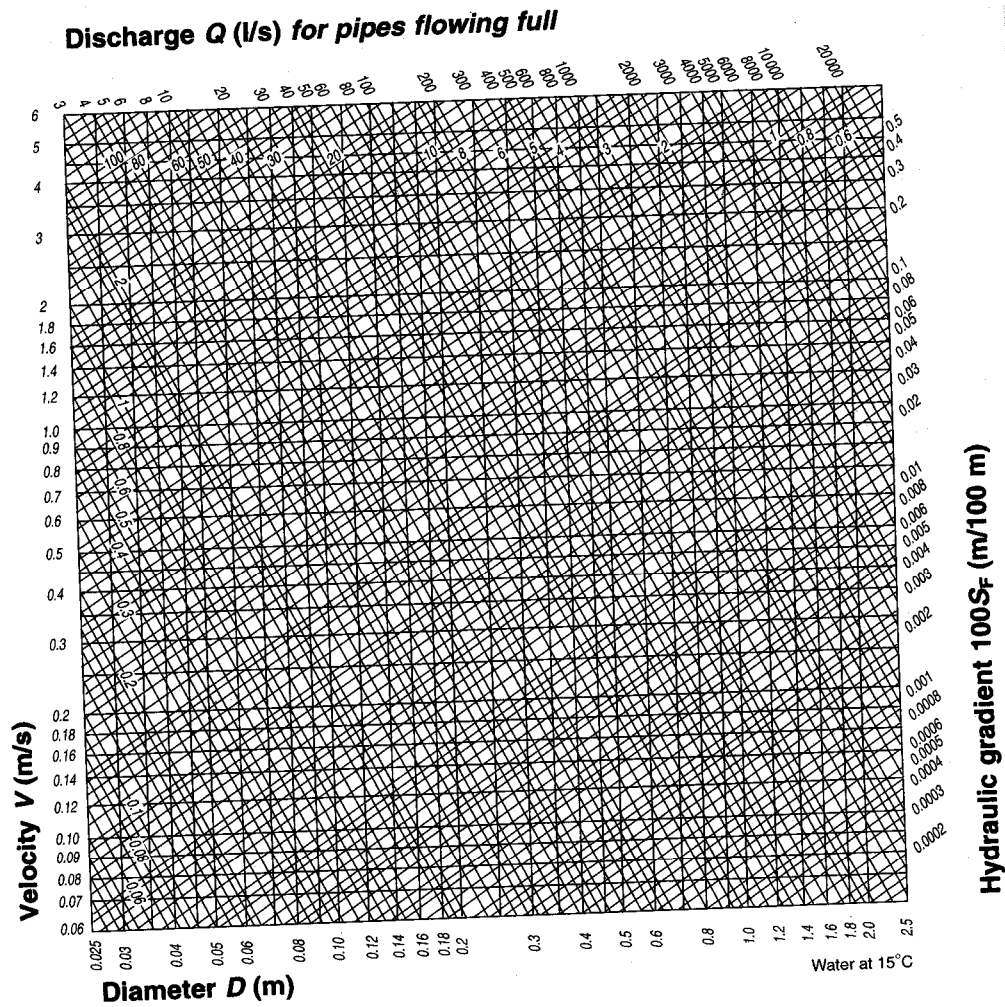


Figure 6.15 Hydraulics Research chart for $k = 0.15$ mm [courtesy HR, Wallingford]