

**NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
 FACULTY OF INDUSTRIAL TECHNOLOGY
 BACHELOR OF ENGINEERING (HONS) DEGREE
 DEPARTMENT OF CIVIL AND WATER ENGINEERING
 PART III SUPPLEMENTARY EXAMINATIONS- JULY 2011**

HYDRAULIC DESIGN I – TCW3203

INSTRUCTIONS

Answer **ANY FOUR** questions

Time: 3hours

All questions carry the same marks

QUESTION 1

- a. Describe the functions of storage structures in a water supply scheme. (5 marks)
- b. The water supply for a city is pumped from a deep well to a distribution reservoir with both pump and reservoir designed to operate at a uniform pumping rate for 24 hours. The hourly demand for maximum day is as shown in the table below:

Hour	1	2	3	4	5	6	7	8	9	10	11	12
Demand M ³	273	206	256	237	257	312	438	627	817	875	820	773
Hour	13	14	15	16	17	18	19	20	21	22	23	24
Demand M ³	759	764	729	671	670	657	612	525	423	365	328	309

Due to power shortage the pumping station will only receive power between 1900hrs and 0700hrs. Estimate the percentage increase in pumping rate and volume of storage reservoir to ensure continued supply of water to the city. (20 marks)

QUESTION 2

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)

QUESTION 3

- a. Describe with aid of neat sketches, the procedures followed in laying and testing the water supply mains. (10 marks)
- b. Explain the importance of providing for fire demand in a water supply system. How would you provide for that fire demand? (5 marks)
- c. Describe 5 types of water demand in the design of a public water supply system. (10 marks)

QUESTION 4

- a. With the aid of a flow chart describe the components of a water supply system for an urban setting. Discuss the factors to be considered when designing a water distribution system. (10 marks)
- b. Briefly describe the Hardy-Cross Method and derive the equation related to this method. (10 marks)
- c. Discuss the merits and demerits of the various water distribution system layouts. (5 marks)

QUESTION 5

- a. What is meant by the design period and population forecast with regards to water supply systems. Describe the different methods which can be applied in population forecasting. (15 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? (10 marks)

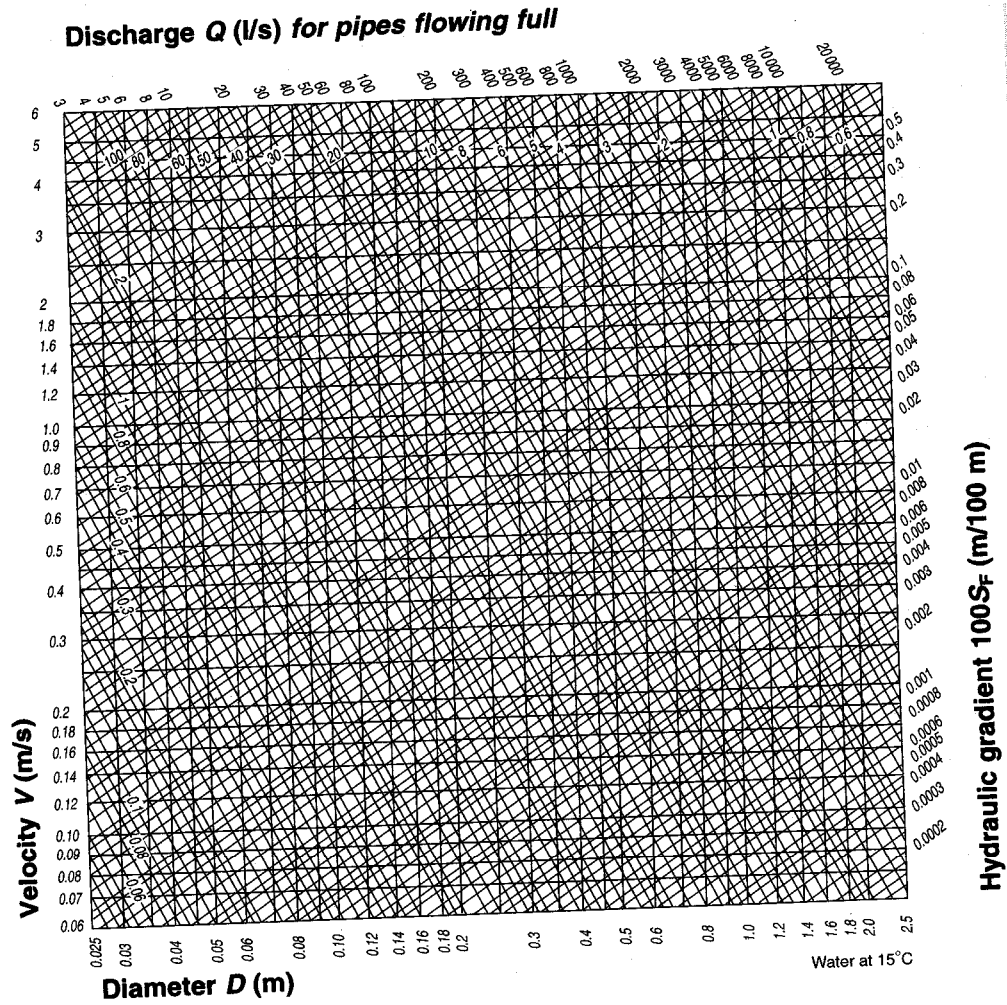


Figure 6.15 Hydraulics Research chart for $k = 0.15$ mm [courtesy HR, Wallingford]