

**NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
FACULTY OF INDUSTRIAL TECHNOLOGY
DEPARTMENT OF CIVIL AND WATER ENGINEERING
BACHELOR OF ENGINEERING (HONOURS) DEGREE
PART III SECOND SEMESTER EXAMINATIONS – JUNE 2010
WATER RESOURCES MANAGEMENT – TCW 3201**

Instructions:

Answer any 4 questions. All questions carry equal marks

Total marks: 100

Time: 3 Hours

QUESTION 1

“Our old institutions, laws, regulations, treaties and agreements are straining to meet new demographic realities in water resources planning and management”

Discuss the above statements in relation to the Water Act and ZINWA Act of Zimbabwe.

How does the current policy environment in Water Resources Management promote integrated water resource management and sustainable development? (25 marks)

QUESTION 2

- a) In economic evaluation of projects the benefit-cost ratio is often used. What are the merits and demerits of the benefit-cost ratio? Give examples where applicable. (6 marks)
- b) What is the cost effectiveness index and when is it used in project evaluation? (4 marks)
- c) A dam is to be constructed for the sum of \$2.6M for a community of 5,000 people. The annual maintenance cost of the dam is \$40,000.00 and annual benefits from irrigation and livestock is \$680,000.00. Using a 50-year economic life for the project, and a nominal interest rate of 18%, compute the benefit/cost ratio for the project. If another alternative of this dam project has an initial cost of \$4.2M for the same community, and an annual maintenance cost of \$60,000.00, and annual benefits from irrigation and livestock is \$940,000.00, which of the alternative would you prefer? What is the cost effectiveness index for the preferred project? (15 marks)

QUESTION 3

- a) “Demand management has become the watchword for water conservation” Discuss this statement. Discuss the various options available for water demand management. (10 marks)
- b) What is meant by user function? Outline some of the user functions of the river and its flood plain. (8 marks)
- c) What is the importance of gender mainstreaming in water resources management? What are the possible constraints to gender sensitive programming? (7 marks)

QUESTION 4

- a) Explain systems analysis as applied to water resources management (5 marks)
- b) Compare optimization and simulation in water resources management (5 marks)
- c) A water utility corporation obtains water from two sources. The major resources for

abstraction are piping and pumping. The requirement for a m^3 of water from each source are shown in Table 4b.

Since the quality of the water is different, the water from Source 1 fetches $\$3/m^3$ while that from Source 2 fetches $\$4/m^3$. How much water should be abstracted from each source in order to maximize daily contributions? (15 marks)

Table 4b

	Source 1	Source 2	Available
Pump	2	1	6
Pipe	2	3	9
Contribution \$ / m^3	3	4	

QUESTION 5

- a. Discuss the problems of reservoir operation for a single purpose reservoir and for a multipurpose reservoir (8marks)
- b. The figures in Table Q5b show the river flow in $10^6 m^3$ at a potential reservoir site during a drought year. To be viable, the reservoir must provide a least $5 \times 10^6 m^3$ per month. Assume that the reservoir is initially full, that it must refill by the following April, and that all months are of equal length. Determine:
 - i. whether or not the reservoir could sustain the demand during this drought year
 - ii. The volume of storage required
 - iii. Whether any water passes over the dam's spillway (17 marks)

Table Q5b

Month	Apr	May	Jun	Jul	Aug	Oct	Sep	Nov	Dec	Jan	Feb	Mar
Inflow	3.15	2.53	2.05	1.88	1.50	1.85	8.70	9.13	13.85	12.65	10.98	6.83