NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF SCIENCE AND TECHNOLOGY EDUCATION

DEPARTMENT OF TECHNICAL AND ENGINEERING EDUCATION AND TRAINING

WATER RESOURCES MANAGEMENT AND PLANNING

PTE 6457

Examination Paper

May 2019

This examination paper consists of 3 pages

Time Allowed:	**3 hours**
Total Marks:	**100**
Special Requirements:	**NONE**
Examiner's Name:	**DR. E. MAKAYA**

INSTRUCTIONS

1. Answer any four (4) 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**
5.	**25**
TOTAL	**100**

Question 1

(a) How would you define 'Integrated Water Resources Management" and what distinguishes it from "Sustainable Water Resources Management"?[5 marks]

(b) Describe the background, the current status and the future needs for Integrated Water Resources Management (IWRM) in Zimbabwe. [10 marks]

(c) Discuss your understandings of "The Planning Cycle of IWRM", from the "Initiation stage" to the "Evaluation stage"? [10 marks]

Question 2

(a) Why does a water resources specialist need to study engineering economics? [3 marks]

(b) A project to develop the water supply system infrastructure in Harare is being considered, and four alternatives have been proposed. All alternatives have a 20-year design life, and projected economic conditions indicate a 6% interest rate should be used in comparing alternatives. The first alternative will lead to a lump sum return of $100,000 at the end of the first 10 years, and a lump sum return of $200,000 at the end of the second 10 years. The second alternative yields annual returns of 15,000 for all 20 years of the project. The third alternative yields a return of $6,000 at the end of the first year, and the return increases by $1000 per year in subsequent years. The forth alternative yields a return of $6,000 at the end of the first year, and the returns are projected to increase by 8% per year in subsequent years. Determine the equivalent present worth of each alternative. If all projects have approximately the same cost, which of the four alternatives provides the greatest return on investment? [12 marks]

(c) Many water resource systems planning problems involve considerations that are very difficult if not impossible to quantify, and hence they cannot easily be incorporated into any mathematical model for defining and evaluating various alternative solutions. Briefly discuss what value these admittedly incomplete quantitative models may have in the planning process when non-quantifiable aspects are also important. Can you identify some planning problems that have such intangible objectives? [10 marks]

Question 3

(a) How has the issue of state sovereignty been treated in various international water law agreements? [8 marks]

(b) What is the current status of the issue as included in the 1996 UN Convention on the Law of the Non-navigational Uses of International Watercourses? [5 marks]

(c) How do these four principles form a continuum of thought on the subject:
(i) principle of territorial sovereignty of a water course state; (ii) principle of equitable utilization by all riparian states; (iii) principle of common jurisdiction; and (iv) principle of territorial integrity of a watercourse? [12 marks]

Question 4

(a) State four (4) basic steps in SWOT analysis. [4 marks]

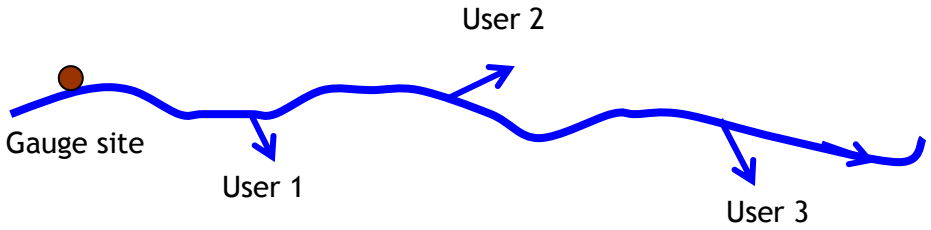
(b) With reference to any water resources project explain how SWOT analysis could aid the project planning process. [5 marks]

(c) Draw a detailed SWOT matrix that could be used in strategy formulation for a new irrigation project. [8 marks]

(d) Cost benefit Analysis is an approach that is used to analyse project characteristics, main benefits and cost components. How can Cost Benefit Analysis be used by Gwanda Town as they develop a water supply system for peri-urban farmers. [8 marks]

Question 5

(a) Consider the allocation problem illustrated below.



The allocation priority in each simulation period t is:

First 10 units of streamflow at the gauge remain in the stream.
Next 20 units go to User 3.
Next 60 units are equally shared by Users 1 and 2.
Next 10 units go to User 2.
Remainder goes downstream.

Assume no incremental flow along the stream and no return flow from users. Define the allocation policy at each site. This will be a graph of allocation as a function of the flow at the allocation site. [10 marks]

(b) Nyamandlovu aquifer system supplies water to the city of Bulawayo and small scale irrigation farms surrounding the aquifer. In light of the challenges posed by rising water tables in some areas, and declines in the water resources a 'more planned conjunctive-use approach' is being implemented. Propose an approach which utilises extensive datasets and associated analysis to understand the hydrogeological, agronomic and socioeconomic situation. [15 marks]

END OF EXAM