

Part B



FACULTY OF FISHERIES AND MARINE SCIENCES & TECHNOLOGY

**Bachelor of Science Honors in Fisheries and Marine Sciences Degree/
Bachelor of Science Honors in Marine and Freshwater Sciences Degree**

Level III, Semester-II Examination -2022/2023

LIM 3252: Groundwater Exploration and Extraction

Time: 1 hour and 30 minutes

Answer **All** questions in **Part A** and **any Two (2)** out of three questions in **Part B**.

Part A

Question 01

(Total 40 Marks)

Part B

Question 02

(Total 30 marks)

Groundwater exploration involves various methods to detect and evaluate groundwater resources. These methods can be classified into direct and indirect methods, each with its own advantages and limitations.

- A) Briefly describe how the multicriteria decision analysis in Geographic Information System (GIS) is used for groundwater exploration. (05 marks)
- B) Explain how the seismic method, specifically seismic refraction and reflection, is used for groundwater exploration. (06 marks)
- C) Imagine you have been assigned to a school water supply project. Your task involves identifying a suitable location for groundwater extraction and evaluating appropriate geophysical methods.
 - (i) Describe how you would identify a suitable location for water extraction and what factors you would consider in your evaluation. (06 marks)
 - (ii) Derive the equation to calculate the apparent resistivity in the Wenner arrangement of the electrical resistivity method. (07 marks)
 - (iii) What are the advantages and limitations of using the electrical resistivity method in groundwater exploration? (06 marks)

Question 03

(Total 30 marks)

- A) Draw and label a diagram of a well, and describe the function of each component. (08 marks)
- B) Explain the concept of well loss in groundwater extraction. (06 marks)
- C) A step drawdown test was conducted on a pumping well. The initial water level was measured at 10 meters below the ground surface. After pumping at a discharge rate of 1000 m³/day, the drawdown was 2.5 meters. Subsequently, when the discharge rate was increased to 2000 m³/day, the stabilized drawdown was 6.43 meters.
 - (i) Calculate the values of the aquifer loss coefficient (B) and the well loss coefficient (C). (10 marks)
 - (ii) Determine the specific capacity of the well at a discharge rate of 1500 m³/day. (06 marks)

Question 04**(Total 30 marks)**

Aquifer tests are important for assessing the hydraulic properties of aquifers and designing effective groundwater extraction systems. These tests involve controlled pumping or injection of water into a well to monitor changes in water levels over time.

- A) Explain the importance of aquifer tests in groundwater hydrology and management. (08 marks)
- B) Discuss the challenges and limitations associated with conducting pumping tests. (08 marks)
- C) A 300 mm diameter well which fully penetrates a confined aquifer of thickness 20 m is pumped at a constant rate of 2000 m³/day. The steady state drawdown in the well is 6 m and the drawdown in a piezometer 100 m from the well is 1.2 m.

The equation for confined aquifer: $\frac{Q}{2\pi Kb} \ln \left(\frac{r_2}{r_1} \right) = h_2 - h_1$

- (i) Ignoring well losses, calculate the transmissivity and the hydraulic conductivity of the aquifer material. (08 marks)
- (ii) Determine the radius of the influence of the well. (06 marks)

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