[06 marks]
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UNIVERSITY OF RUHUNA

FACULTY OF FISHERIES AND MARINE SCIENCES & TECHNOLOGY

Academic Year 2023/2024

Bachelor of Science Honours in Marine and Freshwater Sciences Degree/ Bachelor of Science Honours in Fisheries and Marine Sciences Degree

Level III Semester II Examinations – April/May 2025

OCG 3232: Coastal Processers and Morphology

Time: 2 hours

Answer only Four ~~Question~~ (04) Questions

= 20 marks]

1.

a) A beach has incoming waves approaching at an angle of 10° relative to the shore. The waves have a period of 6 seconds, a height of 1.5 meters, and are traveling at a speed of 12 m/s in deep water. The beach slope is mild, and the depth at the breaking point is approximately 1.2 meters.

i. Calculate the Longshore Current Velocity (V_{ls}) at the breaking point, assuming the following simplified relationship for longshore current:

$$V_{ls} = K \cdot H_b \cdot \sin(\theta_b) \cdot \cos(\theta_b) \quad (eq.Q1)$$

where:

K is an empirical constant, typically around 0.5,

Hb is the wave height at breaking, approximately equal to 0.78 times the water velocity depth at breaking,

θb is the angle of the wave as it approaches the shore at the breaking point (here assumed to remain close to 10°).

[25 marks]

ii. How would the longshore current change if the wave period increased to 8 seconds and the wave height doubled? Describe in qualitative terms which factors contribute to this change and why. *[35 marks]*

b) Describe the formation and characteristics of barrier islands, including their significance in coastal system? *[40 marks]*

2.

a) A coastal region experiences waves with a height of 2 meters and a period of 8 seconds.

i. Calculate the Wave Energy per unit length of wave crest (E) using the following formul

$$E = 1/8\ \rho\ g\ H^2 \quad (eq.Q2)$$

where:

- ρ is the water density (1025 kg/m^3)
- g is the gravitational acceleration (9.81 m/s)
- H is the wave height.

[20 marks]

ii. If 10,000 waves hit the coastline in a day, calculate the total energy impacting a one km stretch of coast.

[30 marks]

b) Consider waves approaching a shoreline at an angle of 15° relative to the beach. The breaking wave height Hb is 1.2 meters, and the wave period T is 7 seconds.

i. Calculate the Longshore Sediment Transport Rate Q using the CERC formula:

$$Q = K \cdot Hb^{2.5} \cdot \cos(\vartheta_b) \cdot \sin(\vartheta_b) \quad (eq.Q3)$$

where:

- K is an empirical constant typically around 0.39 m$^{0.5}$ s^{-1}
- H_b is the wave height at breaking
- θ_b is the wave angle at breaking

[20 marks]

ii. Calculate the impact on the transport rate if the wave height increases to 1.5 meters. Explain why even a small change in wave height can significantly impact sediment transport.

[30 marks]

3.

i. Describe the main types of waves and their roles in coastal erosion and deposition. *[40 marks]*

ii. How does longshore drift affect the shape and features of a coastline? *[30 marks]*

iii. What are the differences between constructive and destructive waves? *[30 marks]*

4.

i. How are features such as sea cliffs, wave-cut platforms, and sea arches formed? *[40 marks]*

ii. Describe the formation and characteristics of depositional landforms like spits, bars, and tombolos. *[30 marks]*

iii. Describe how beach profiling and sediment analysis contribute to understanding coastal change. *[30 marks]*

5.

i. How do coastal structures (e.g., groynes, seawalls, jetties) affect sediment transport and coastal erosion? *[35 marks]*

ii. What are the geomorphological impacts of sand mining along the coast? *[30 marks]*

iii. Discuss the role of integrated coastal zone management in mitigating coastal erosion. *[35 marks]*

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