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BET4733 Introduction to Coastal Infrastructures

Tides

by

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By Noor Asiah Mohamad

Chapter Description

- **Expected Outcomes**

Analyze the principles of wave mechanics, tides, littoral processes and coastal sediment transport in methods of shore protection and coastal infrastructures.

- **References**

- 1) Kamphuis, J. William, Introduction to Coastal Engineering and Management, Advanced Series on Ocean Engineering-Volume 30, World Scientific, 2010.
- 2) Reeve D., Chadwick A. and Fleming C. Coastal Engineering-Processes, Theory and Design Practice, CRC Press, 2015.
- 3) Kim Y.C., Design of Coastal Structures and Sea Defences, World Scientific, 2015.
- 4) US Army Corps of Engineers. Coastal Engineering Manual, Washington, 1998-now.



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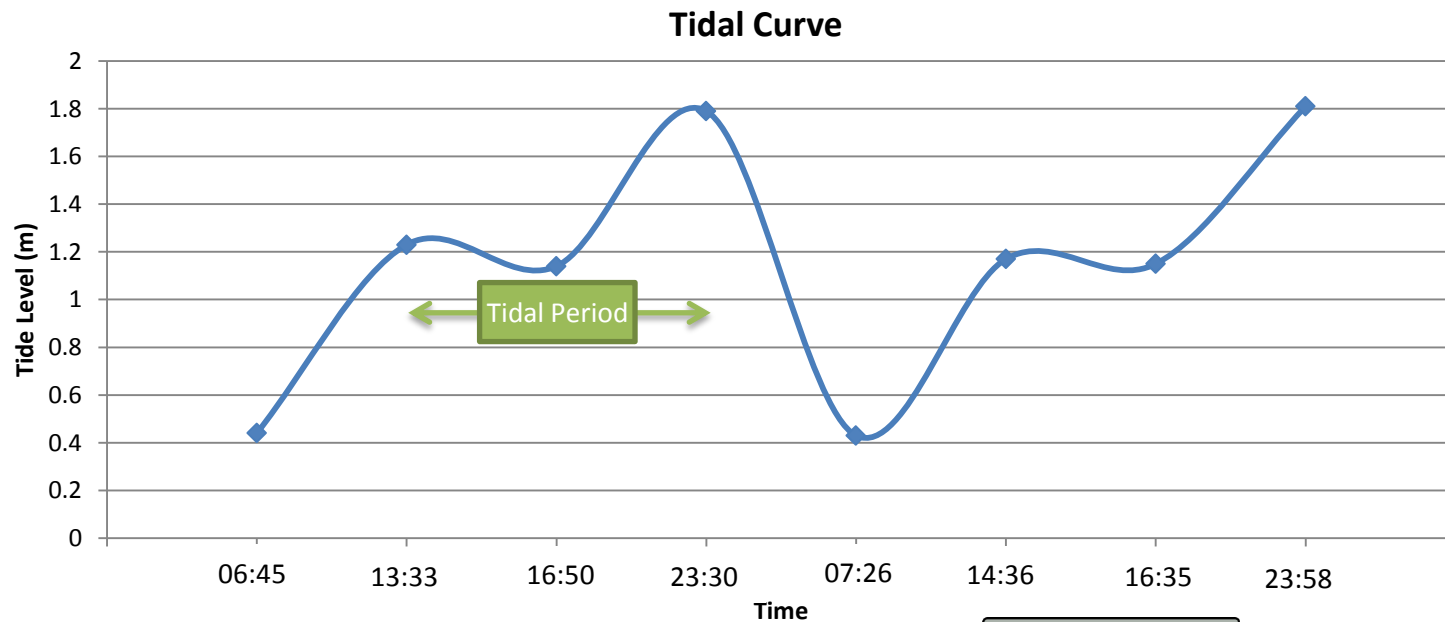
CONTENTS

- Astronomical tides
- Generation of tides
- Types of Tides
- Tidal Cycle
- Tidal Levels, Tidal Range and Datum
- Tides in Malaysia



Astronomical Tides

- The fluctuation of water surface elevation (or sea level) produced due to the gravitational force of the moon, sun and all other celestial bodies (to a smaller extent) to the earth.



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Generation of Tides

Factors governing the generation of tides:

- Gravitational force of the earth
- Centrifugal force generated by the combination of the earth and moon
- Gravitational force of the moon
- Gravitational force of the sun



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Generation of Tides

- Tides follow the moon more closely than the sun.
- In a tidal day, there are usually 2 high waters and 2 low waters.



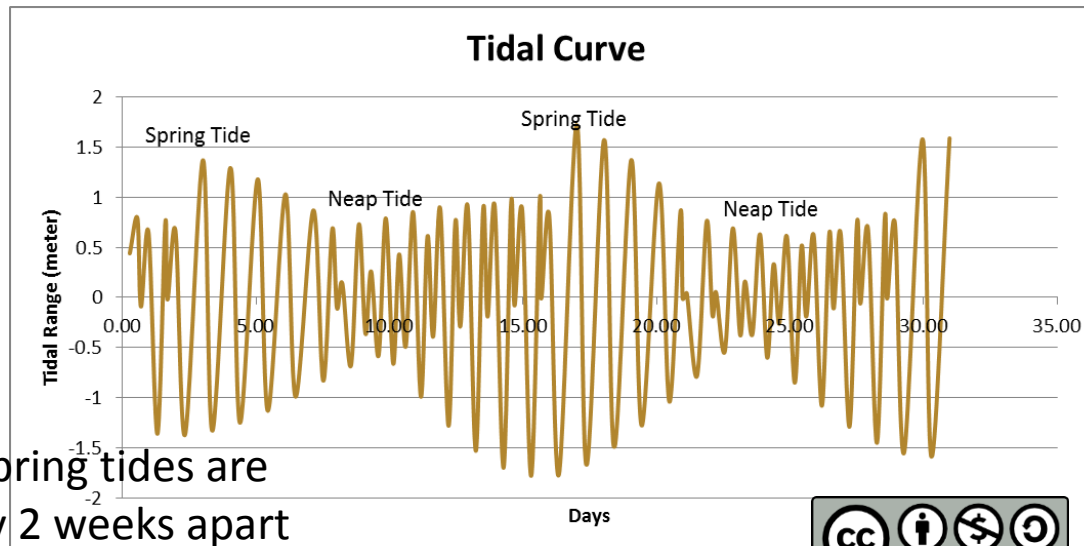
Generation of Tides

Spring Tide

- Tides of higher range which occur approximately twice a month (full moon and new moon).

Neap Tide

- Tides of smaller range which occur approximately twice a month (first and last lunar quarters).



* Spring to spring tides are approximately 2 weeks apart



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Types of Tides

SEMI-DIURNAL

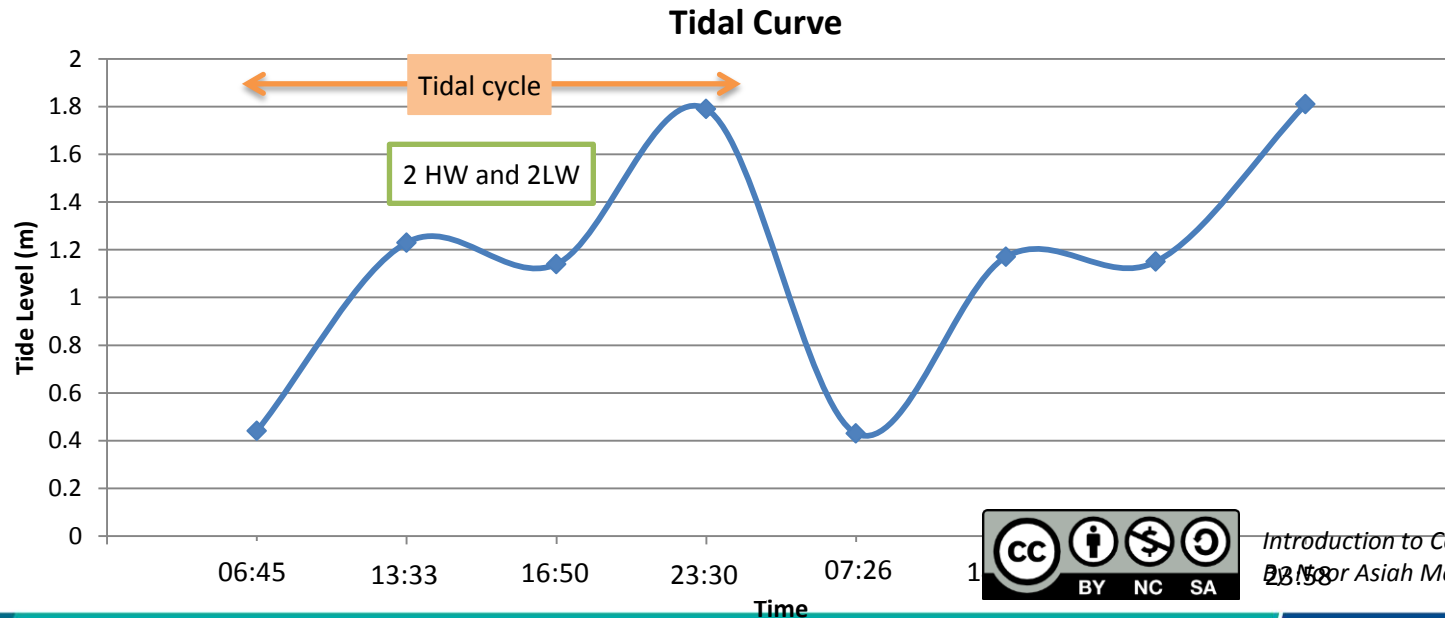
- 2 HW and 2 LW in one day within one tidal cycle

DIURNAL

- 1 HW and 2 LW in one day within one tidal cycle

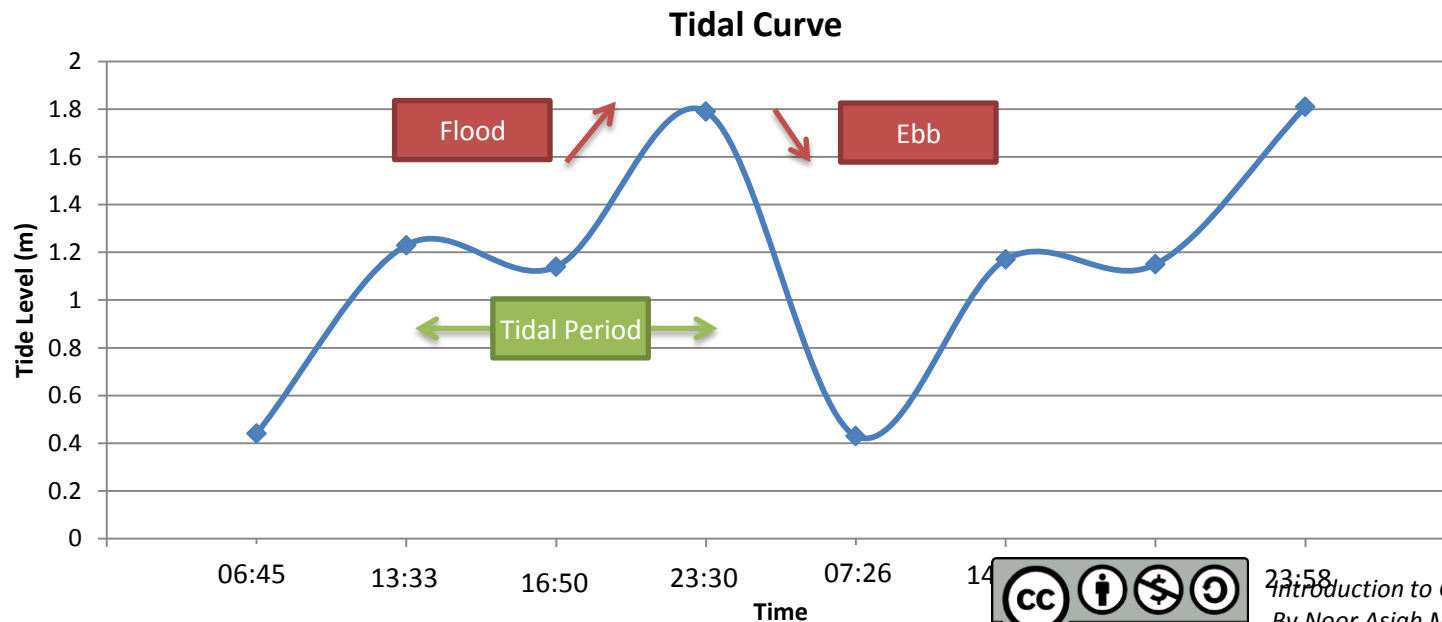
MIXED

- Combined semi-diurnal and diurnal tides within one lunar month.



The Tidal Cycle

- Tidal currents are produced due to differences in water surface elevation
- Flood currents are produced when the tide is coming in.
- Ebb currents are produced when the tide is going out.



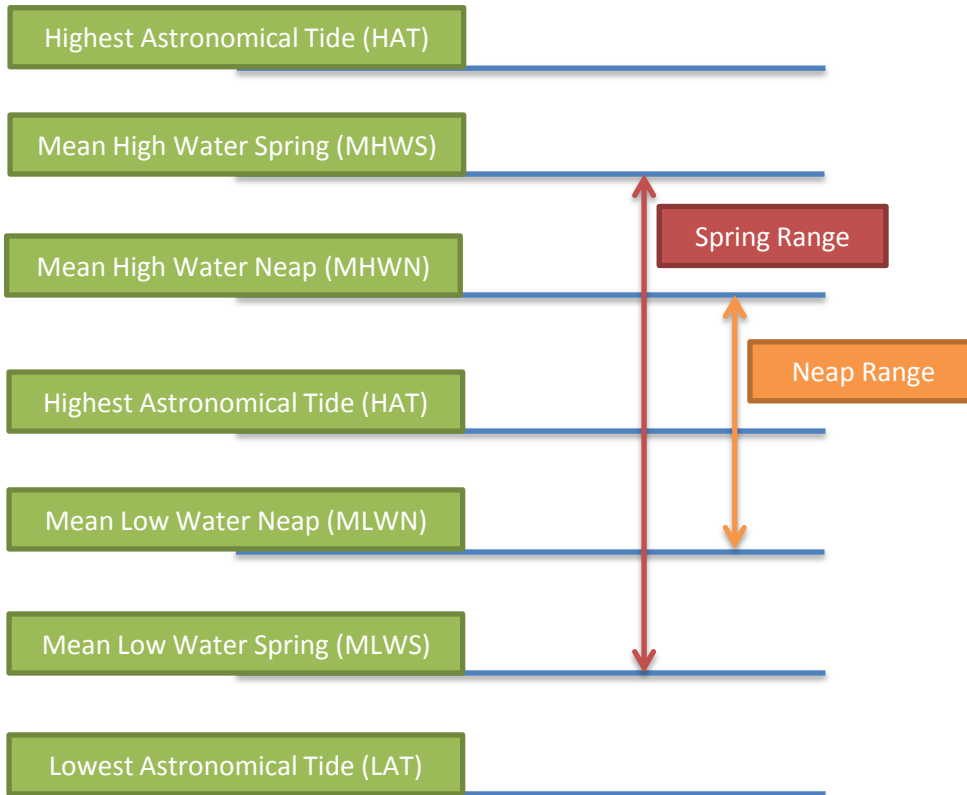
Tidal Level

| Day | Time | Tide level |
|--------|-------|------------|
| 02-Nov | 6.45 | 0.44 |
| | 13.33 | 1.23 |
| | 16.50 | 1.14 |
| | 23.30 | 1.79 |
| 03-Nov | 7.26 | 0.43 |
| | 14.36 | 1.17 |
| | 16.35 | 1.15 |
| | 23.58 | 1.81 |
| 04-Nov | 8.11 | 0.44 |
| 05-Nov | 0.29 | 1.81 |
| | 8.59 | 0.48 |
| 06-Nov | 1.04 | 1.77 |
| | 9.52 | 0.52 |
| 07-Nov | 1.45 | 1.70 |
| | 10.50 | 0.57 |
| 08-Nov | 2.36 | 1.60 |
| | 11.47 | 0.61 |
| 09-Nov | 3.53 | 1.48 |
| | 12.41 | 0.65 |
| | 20.45 | 1.33 |
| 10-Nov | 0.58 | 1.23 |
| | 5.49 | 1.37 |
| | 13.27 | 0.69 |
| | 20.43 | 1.42 |
| 11-Nov | 2.30 | 1.06 |
| | 7.36 | 1.32 |
| | 14.08 | 0.74 |
| | 20.59 | 1.53 |
| | 3.28 | 0.87 |
| 12-Nov | 8.59 | 1.30 |
| | 14.44 | 0.81 |
| | 21.22 | 1.66 |
| | 4.18 | 0.67 |
| 13-Nov | 10.10 | 1.28 |
| | 15.17 | 0.89 |
| | 21.49 | 1.78 |



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Tidal Levels and Tidal Range



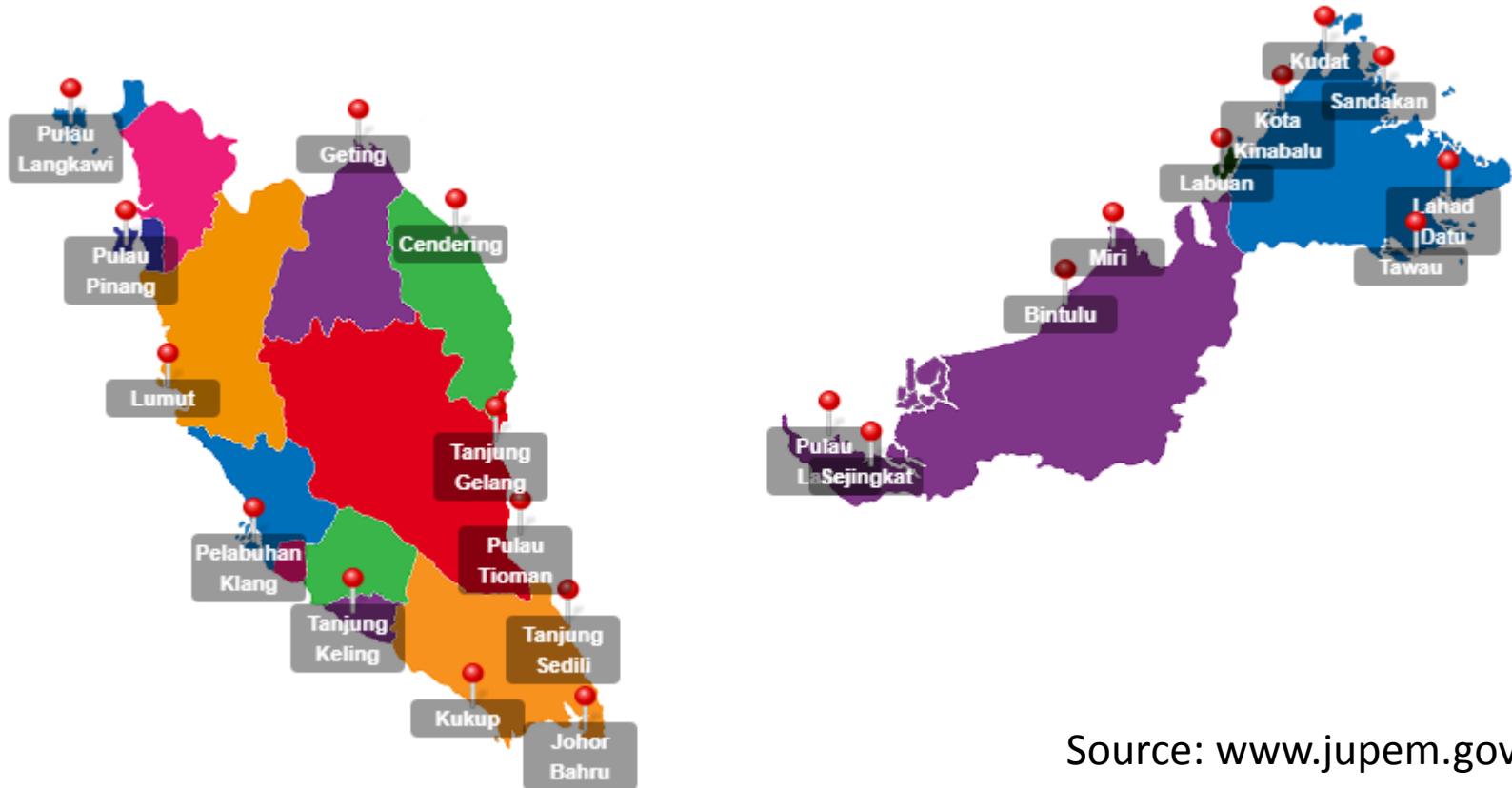
Tidal Level and Datum

| TIDAL LEVELS & DATUM | DESCRIPTION |
|-----------------------------|---|
| Admiralty Chart Datum (ACD) | Reference datum used by navigators and hydrographic surveyors (normally coincides with the lowest astronomical tide level) |
| Land Survey Datum (LSD) | Reference datum used by land surveyors to indicate the ground level with respect to the mean tide level |
| Sounding Depth (in meter) | Bed levels measured below ACD + = below ACD - = above ACD |
| Water Levels (Tidal Levels) | Sea water levels measured in meters from ACD + = above ACD - = below ACD |
| Water Depth | Vertical distance from water level (surface water) to bottom of seabed Water depth = sounding depth + water level |



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Tides in Malaysia



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