



UNIVERSITY OF RUHUNA

Faculty of Engineering

End-Semester 3 Examination in Engineering: March 2026

**Module Number: MN3305 Module Name: Hydrostatics and Stability of Marine Vehicles
(C 23)**

[Three Hours]

[Answer All Questions, Total 70 Marks]

Instructions:

- This question paper has **Six** questions on **04** pages.
- Maximum marks allocated for each section of questions are shown.
- Non-programmable calculators may be used.
- Drawings and sketches should be clear, neat and in approximate proportion.
- Do not use Red ink.

Data and Information:

- Sea water (SW) Density = 1025 kg/m^3
- Cross curve - Ceylon Breeze (Figure Q6)
- Graph sheet

Q1 a) Define the following with aid of sketches.

i) Righting lever(GZ)

(02 Marks)

ii) Righting moment

(02 Marks)

b) A box shaped vessel floats at a draft of 4m in sea water with her keel just clear of the sea bed which is of soft mud of RD 2.8. The tide then falls by 90cm. Calculate her drafts.

(06 Marks)

Q2 a) Define followings

i) Heel

ii) List

(02 Marks)

b) A ship of 4515 tonnes displacement is upright, and has KG 5.4m and KM 5.8m. It is required to list the ship 2 degrees to starboard and a weight of 15 tonnes is to be shifted transversely for this purpose. Find the distance through which it must be shifted.

(08 Marks)

- Q3** a) Define the followings:
- Metacentric height (GM) (01 Mark)
 - Metacentre (01 Mark)
- b) A ship arrives in port with displacement 6000 tonnes and KG 6m. She then discharges and loads the following quantities:
- | | |
|-----------------------|----------------|
| Discharge | |
| 1250 tonnes of cargo | KG 4.5 metres |
| 675 tonnes of cargo | KG 3.5 metres |
| 420 tonnes of cargo | KG 9.0 metres |
| Loads | |
| 980 tonnes of cargo | KG 4.25 metres |
| 550 tonnes of cargo | KG 6.00 metres |
| 700 tonnes of bunkers | KG 1.0 metre |
| 70 tonnes of FW | KG 12.0 metres |
- During the stay in port 30 tonnes of fuel oil (KG 1m) are consumed. If the final KM is 6.8m, find the GM on departure. (10 Marks)

- Q4** a) Define "MCTC" (02 Marks)
- b) A ship is floating at drafts of 6.1 metres F and 6.7 metres A. The following cargo is then loaded:
- 20 tonnes in a position whose centre of gravity is 30 metres forward of amidships.
 - 45 tonnes in a position whose centre of gravity is 25 metres forward of amidships.
 - 60 tonnes in a position whose centre of gravity is 15 metres aft of amidships.
 - 30 tonnes in a position whose centre of gravity is 3 metres aft of amidships.
 - The centre of flotation is amidships, MCT 1cm 200 tonnes and TPC 35 tonnes.

Find the new drafts forward and aft.

(10 Marks)

- Q5** a) With an aid of a diagram explain followings
- Angle of loll. (02 Marks)
 - Capsizing moment. (02 Marks)
- b) A box shaped vessel length 90 ,breadth 20m,and 6.5 m deep is at an even keel draught of 4 m, calculate her Righting Moment at 7° heel.

(04 Marks)

- c) A box-shaped vessel 60 m X 8 m X 6 m floats in salt water on an even keel at 3 m draft Forward and Aft. $KG = 3$ m. Calculate the angle of loll.

(04 Marks)

- Q6** a) Describe the effect of beam on the GZ curve.

(02 Marks)

- b) Construct the curve of stability for M.V. Ceylon Breeze when the displacement is 37500 tonnes and $KG = 8.5$ m. From the curve constructed find the followings,

- i) Range of stability.

(01 Mark)

- ii) The angle of vanishing stability.

(01 Mark)

- iii) The maximum GZ and the angle of heel at which it occurs.

(02 Marks)

- iv) Approximate initial metacentric height.

(02 Marks)

- v) Find the moment of statical stability at 35° of heel.

(02 Marks)

- vi) Use the drawn curve to verify whether the IMO Stability Criteria (1) is complied with.

(04 Marks)

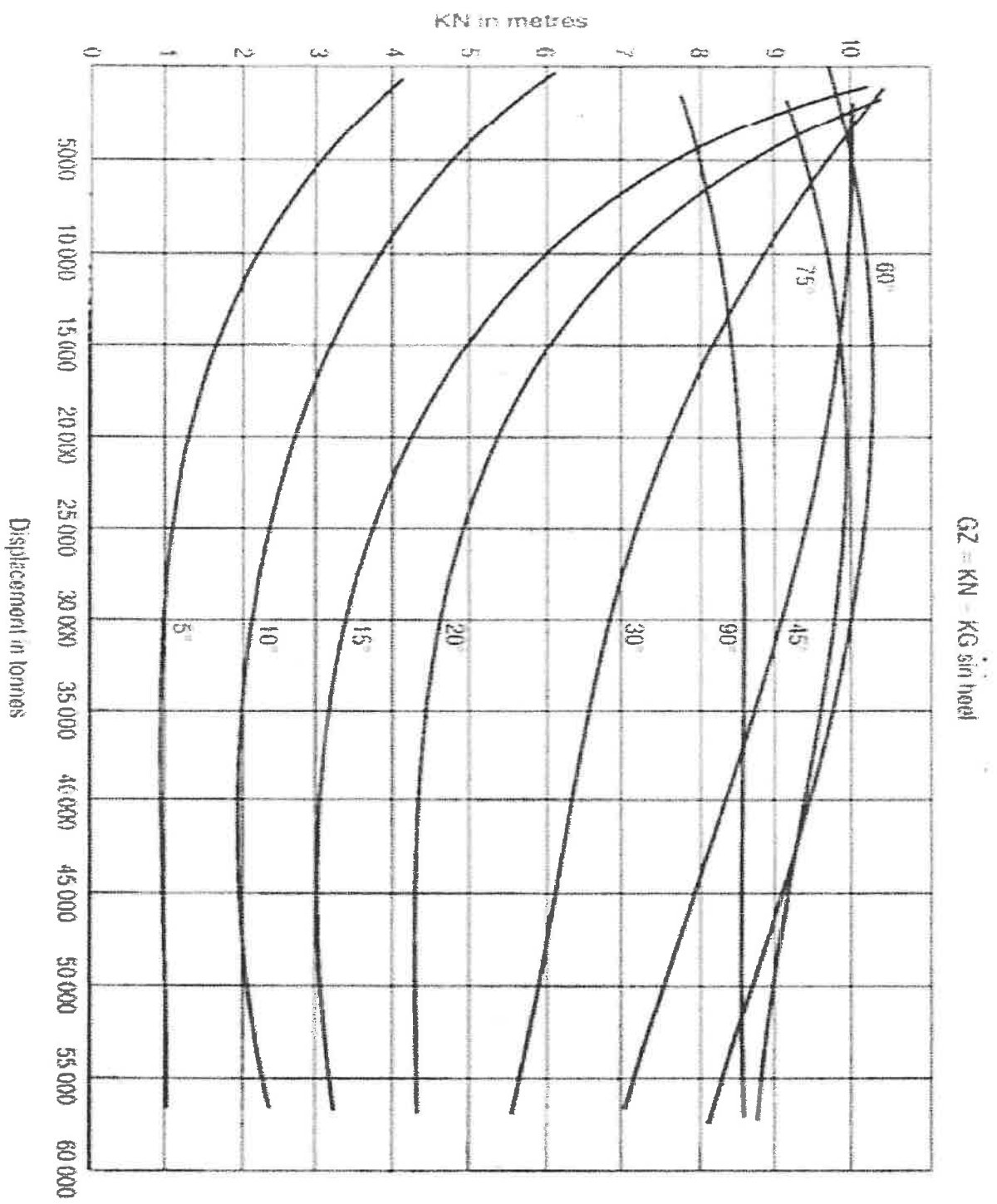


Fig Q6 – Cross Curve of MV Ceylon Breeze