



**DIRECTORATE OF MERCHANT SHIPPING  
GOVERNMENT OF SRI LANKA  
CERTIFICATE OF COMPETENCY EXAMINATION**

GRADE : CHIEF MATE ON SHIPS OF 500 GT OR MORE (UNLIMITED)  
SUBJECT : Electronic Navigation Systems  
DATE : 12<sup>th</sup> August 2021

Time allowed **THREE** hours

Total marks : 180

**ANSWER ALL QUESTIONS**

Pass marks : 50%

Formulae and all intermediate steps taken in reaching your answer should be clearly shown. You may draw sketches wherever required. Electronic devices capable of storing and retrieving are **NOT** allowed.

1)

a) Write short notes on the following:

- i. Secular Change
- ii. Transient Changes
- iii. Lunar Changes
- iv. Irregular Disturbance
- v. Local Disturbance (magnetic Anomalies)

(02 marks each)

b) List down the known causes for heeling error.

(10 marks)

c) On a particular day with overcast skies during your passage Yokohama to Trincomalee, the vessel was swung, and the following deviations were obtained on ship's head by compass.

N	NE	E	SE	S	SW	W	NW
10 <sup>0</sup> E	15 <sup>0</sup> E	02 <sup>0</sup> E	15 <sup>0</sup> E	10 <sup>0</sup> W	9 <sup>0</sup> E	14 <sup>0</sup> E	07 <sup>0</sup> E

Analyze the above deviations and determine the values of the approximate coefficients and briefly add your suggestions.

(10 marks)

- 2) A free Gyroscope has been controlled its movement by using Mercury pots. But, the North end does not settle on the North meridian
- a) With a suitable sketch describe the path traced by the North end of the axel in Northern Hemisphere. (15 marks)
- b) Describe the forces acting at the under-mentioned position of the North end using proper vector length and correct direction:
- i. At a position in between maximum Easterly drift and maximum tilted up position.
  - ii. At a position between maximum tilted up position and maximum westerly drift position
  - iii. At the horizon when in Westerly sector.
  - iv. At maximum tilted down position
  - v. At maximum easterly drift position
- (03 marks each)
- 3) With the aid of a diagram show the internal parts and the instruments connected to AIS. (30 marks)
- 4) Describe the errors encountered in GPS system? (30 marks)
- 5) Show the comparison diagram of transmission signal formats of Basic Loran-C, Eurofix, Ninth-Pulse systems and describe the importance of Secondary Additional Factors(ASF) (30 marks)
- 6)
- a) Explain basic step by step process of calculating the position of a vessel by the GPS receiver.
- b) With aid of a sketch, explain the operation of the DGPS System. (15 marks each)