



**DIRECTORATE OF MERCHANT SHIPPING  
GOVERNMENT OF SRI LANKA**

**CERTIFICATE OF COMPETENCY EXAMINATION**

GRADE : OFFICER IN CHARGE OF A NAVIGATIONAL WATCH ON SHIPS OF  
500 GT OR MORE (UNLIMITED)  
SUBJECT : PRINCIPLES OF NAVIGATION  
DATE : 17.08.2023

Time allowed THREE hours

Total marks : 180

Answer all questions

Pass marks : 60%

Formulae and all intermediate steps taken in reaching your answer should be clearly shown.  
You may draw sketches wherever required.

1) With the aid of diagrams explain the following;

a) i) GHA ii) SHA iii) Declination iv) Geographical Position

(16 marks)

b) With the aid of diagrams derive the followings;

i)  $LHA^* = GHA\gamma + SHA^* + Long (E)$

ii)  $LHA^* = GHA\gamma + SHA^* - Long (W)$

(04 marks)

2) a) Describe with the aid of a diagram the phases of the Moon.

(08marks)

b) Why does the duration of the Moon's Synodic Period is longer than Sidereal Period

(04 marks)

c) With the aid of a sketch describe 3 types of Lunar Eclipses.

(08 marks)

3) a) Explain how to find equation of time from Nautical Almanac with a suitable example.

(06 marks)

b) Find the equation of time at 1400hrs GMT, when the GHA of the Sun was  $31^{\circ} 00'$ .

(08 marks)

c) Describe the following;

i) Sidereal Year

ii) Tropical Year (06 marks)

4) a) Explain the Kepler's three laws of planetary motion (10 marks)

b) What are the approximate perihelion and aphelion distances and dates of the earth? (05 marks)

c) With the aid of a diagram explain the Apparent Motion of planet "Jupiter". (05 marks)

5) a) Describe the following;

i) Civil Twilight

ii) Nautical Twilight

iii) Astronomical Twilight (09 marks)

b) What condition must be satisfied for Twilight to last all night? (06 marks)

c) Explain the reason why Twilight last longer in higher latitudes. (05 marks)

6) a) Describe the following with suitable diagrams.

i) Elongation

ii) Conjunction

iii) Opposition

iv) Quadrature (14 marks)

b) Calculate the LHA of a star whose RA is  $74^\circ$ , for an observer in longitude  $40^\circ\text{E}$ , when  $\text{GHA}_\gamma$  is  $205^\circ$ . (06 marks)