CLASS - 3

Principle of Navigation

EARTH

01. Define - a) Nautical mile b)Geographical mile

    Explain clearly with diagram, why the length of nautical mile varies with Latitude.

02. Show by drawing a suitable figure, the difference between 'Geocentric latitude' and "Geographic latitude"

SOLAR SYSTEM

01. Explain how seasons are caused on earth.

02. What do you understand by the term Equinox and Solstice? When do they occur and what can be stated regarding the duration of day and night at such times?

03. With the aid of suitable figure, explain the reasons for unequal duration of day and night

04. Explain how the duration of daylight dependent upon observer latitude and Sun's declination.

05. Define the terms and explain with the help of figure –
    i) Elongation ii) Conjunction iii) Opposition and iv) Quadrature of a Planet

06. Explain with a suitable diagram, why Venus is sometimes referred to as a morning or and evening star.

07. The SHA of the sun decrease constantly, while that of the planet sometimes increases and sometimes decreases. Explain the phenomena for the Sun and a planet.

08. State the laws of planetary motion enunciated by Kepler.

09. If the distance of planet Mercury from the Sun is 0.3871 of the distance between the Earth and Sun, find the maximum elongation of Mercury.

CELESTIAL SPHERE AND EQUINOCTIAL SYSTEM OF CO-ORDINATES AND HOUR ANGLE

01. Define with suitable diagram: Rational Horizon, Equinoctial, True Altitude, Observer Zenith and Ecliptic

02. Define with suitable diagram: Vertical Circle, Declination, Amplitude, SHA and First point of Aries

03. Describe Equinoctial systems of co-ordinates with reference to Equinoctial and celestial

Meridian.

04. What is the Geographical Position of a Heavenly body? What are the co-ordinates used to specify a Geographical Position?

05. What is the GP of the First Point of Aries, when LHA y was 112° for an observer in longitude 20° E.

06. The planet Venus was on the meridian of an observer in longitude 62°E. If the RA of Venus at that instant was 87°, find the GHA of a Star, the SHA of which then was 162°.

SEXTANT AND ALTITUDE CORRECTIONS

01. What are Sextant errors? How they are caused? What are the remedy?
02. Describe the various methods of finding Index Error of Sextant.
03. Define: Visible Horizon, Sensible Horizon, Rational Horizon, Observed Altitute and True Altitute
04. What is Dip? Why Dip correction necessary and on what does the amount of the correction depends?
05. Prove that Parallax in Altitute= Horizontal Parallax x Cos apparent altitude
06. Why is it necessary to apply a correction for semi-diameter to an observed altitude of the sun or the moon? Explain clearly why the semi-diameter is augmented in the case of the moon.
07. What do you understand by 'augmentation of the Moon's SD? Why is augmentation correction not necessary in the case of the sun?
08. Find the true altitude of the Sun at visible sunrise on 14th October 1991, HE 18m.
09. When observing the Sun for amplitude, what should be the observed altitude of the sun's lower limb? Explain your answer.
10. Sextant Altitude of Sun's UL by back angle was 116°52.5' . IE 2.5' off the arc. HE 6.2m. Find the true altitude of the sun.
11. Calculate the distance from the centre of the Earth to the centre of the moon when Moon's HP is 59' assuming the radius of the Earth to be 3990 miles.

TIME AND EQUATION OF TIME

01. Define Sidereal day, apparent solar day, mean solar day, mean sun and dynamic mean sun
02. Explain terms Standard Time , Zone time and Local mean time

03. Define Equation of Time and explain the two components of equation of time

04. Explain how Equation of Time becomes Nil four times in a year.

05. What is International Date Line? How time changes while steaming east or west and while crossing International Date Line.

06. What is Precession of the Equinox? Explain the effect of the Precession.

07. Discuss Nutation and its effect.

08. Why does a star appear to rise, culminate and set 4 minutes earlier each day?

09. What is Sidereal year, Tropical year and Anomalistic year? Why are they not of the same length?

10. A vessel sailed from 167˚W, at 04h 35m LMT on 15th July. She arrived in longitude 173˚ E at 14h 21m LAT on the 16th (Equation of time +7m). Find the steaming time.

11. Vessel to arrive and anchor at Chittagong Outer Anchorage at Apparent Noon on 13th of Sept'1992 and depart at Sunset on the same day. Position of Anchorage 22˚18'N 091˚45'E. Calculate the Standard Time of arrival and departure of the vessel at Chittagong Outer Anchorage. (Time Zone GMT+6).

12. Explain the meaning of the terms Local Mean Time, Local Apparent Time, Standard Time. At 1530 Standard Time on 16th January 1991 in Penang, Malaysia (5 ˚25'N, 100 ˚21'E), find the LMT, LAT and Standard Time in Havana, Cuba (23 ˚09'N 082 ˚20'W)

NAUTICAL ALMANAC

01. The Nautical Almanacs includes a tabulation of 'v' correction for the moon and planets. Give reason for this. Explain why similar entries are not included for the Sun and Aries.

EQUIDISTANT PROJECTION

01. Draw an equidistant projection of the celestial sphere on the plane of the rational horizon using following conditions: Latitude 40°N, Declination 30°N and LHA 050°.
And find the Zenith distance and True bearing of the heavenly body.

02. Draw an equidistant projection of the celestial sphere on the plane of the rational horizon using following conditions: Latitude 20°S, Declination 50°S and LHA 320°.
Find the True Altitude, Zenith distance and True bearing of the heavenly body.

SAILING

01. Describe the advantage and disadvantage of Mercator chart.

02. Describe the advantage and disadvantage of Gnomonic chart.

03. Two dump barges in latitude 30ºS are in longitude 179º11'W and 179º39'E respectively. Both barges drift with a current setting 150ºT for 50 miles. Find their new positions and distance apart.

04. A ship is to sail on a Rhumb line track for a passage from Cape Leewin, Western Australia (Time Zone -8) to Durban, South Africa (Time Zone -2). The following Way points (WP) are used:

- Departure WP1 : 34˚18'S 115˚00' E
- WP2 : 34˚18'S 100˚00' E
- Destination WP3: 30˚00'S 031˚10' E

(a) Calculate the total distance of the ocean passage

(b) The ETD Cape Leewin is 30th Sept at 2130 hrs Standard Time and ship's speed is 15.6 knots. Calculate the ETA in Standard time, at Durban.

05. A ship proceeding at 18 Kts was to steer 310 ˚T, for the next 4 1/2 hours. After covering the distance, it was found that the compass error of 8 ˚E had been wrongly applied. Find how far she is from the anticipated position.

06. Ship A in Lat 42 ˚S, steers due West at 20 Knots. Ship B in lat 30 ˚ S, also steers due West. They commenced from the same longitude. If after 24 hours, they remained due North and South of each other, calculate B's speed.

07. Two ships X and Y depart from the same meridian and steer 090˚T. X is on the equator and Y in a north latitude. X proceeds at 1¼ times of the speed of Y. Find Y's latitude, if she remains true North of X throughout.

08. From a position in latitude 24˚17'N, 017˚12 W, a course was set to a position 24˚54'N, 017˚12 W. After steaming for 34 miles, it was discovered that the compass error had been applied the wrong way and the ship had reached the position 24˚49'N, 017˚24.6' W. Find the actual error of the compass.

09. By sailing N44 ˚W for 1600 miles, a vessel arrived in position 12 ˚13'S 176 ˚17'E, Find the vessels departure position.

10. A vessel left Latitude 46 ˚50'N and steering 253 ˚(T), making a d'long of 15 ˚31'. Find the latitude reached.

11. From a position 24°00´N 074°15´E a vessel sailed at 0800hrs on the following courses at 14 knots. Find the position finally arrived:

Time	Co..
From 0800 to 1000hrs	343° T

" 1000 to 1600hrs 035° T
" 1600 to 1900hrs 120° T
" 1900 to 2200hrs 160° T

Current was experienced setting 240° T at 2.5 kts throughout.

POSITION LINES

01. Find the LMT meridian passage of Jupiter in longitude 60˚ E, on 13th October 1991.

02. On 14th October 1991, required the LMT of upper and lower transits of star Schedar for an observer in longitude 82 ˚30'E

03. A star with declination 52 ˚12' South had a true altitude of 24 ˚15' at lower transit. Find the sextant altitude of the same star at upper transit. I.E 1.5' of the arc. HE 10m.

04. An observer on the North pole finds the true altitude of a star 15 ˚10'N, In what latitudes will an observer find the meridian altitude of the same star to be doubled?

05. In Latitude 20˚S, a star had a maximum azimuth of S70˚E, Find its declination.

06. Find the maximum azimuth of a star of declination 66˚47'S for an observer in latitude 43˚39S.

07. To an observer, star Formalhaut, declination 29˚44.6' S bore 180˚(T) when on the meridian. If its true altitude when at maximum azimuth was 26˚03', find the observer latitude.

RISING SETTING AND TWILIGHT

01. Explain the meaning of the term 'Circumpolar'. Describe the condition necessary for a body: a) to be circumpolar b) to cross the prime verticals?

02. Explain why twilight last longer in higher latitude than in lower latitude.

03. If the Sun's declination is 15 ˚S, in what latitudes will there be:
a) the phenomenon of the Midnight Sun
b) Twilight all night
c) Continuous night

04. Which is the best time for stellar observation and Why? What condition must be satisfied for twilight to last all night?

05. *If the Sun's amplitude at Summer solstice was E31*˚N, to a stationary observer, find its altitude when on the prime vertical.

06. Find the length of daylight to an observer in latitude 55˚ N, declination 18˚ N assuming that declination remains constant over the period of daylight.

07. If on the longest day the Sun's centre just touches the observer rational horizon when on the meridian below the pole, find the observer latitude.

08. An unknown star rose bearing 123˚(T). When bearing east, it had a true altitude of 24˚30'. Find the latitude of the observer and the body's declination.

Nav Aid Part of questions

1. Describe the segments of e-Loran system
2. Describe the errors and limitations of GPS
3. Describe China's BeiDou (COMPASS) Navigation Satellite System
4. Identify the main components on a simple block diagram of an echo-sounder, and states the function of each
5. Briefly describe the Instrumental errors of Echo sounding system and measures to remove from tracing
6. Describe the construction of a liquid card magnetic compass
7. Explain the need for checking magnetic compass error when the vessel is laid off for long time, after a major alteration of course and in every watch
8. Define Gyroscope and Free gyroscope. Briefly describe the properties of a free gyroscope.
9. Briefly describe using the Gravity control how a free gyroscope can be changed to North seeking device.
10. Briefly describe using the Damping control how the North seeking device can be converted to North settling device.
11. With the aid of diagrams briefly describe the working principle of a TMC
12. Briefly describe the main components of an Auto pilot system
13. List and explain the functions of the manual settings of an auto pilot
14. Briefly describe the working principle of an adaptive steering module and its benefit
15. Describe the working principles of the electromagnetic speed log and its advantages and disadvantages

16. Describe the working principles of the Doppler log and its advantages and disadvantages

17. Briefly describe the objective of AIS, AIS types, message types and updating time of each message.

18. Briefly describe the usage of AIS

19. With the aid of a diagram briefly describe the International Routing rules of LRIT APR

20. Briefly describe the Difference between VDR and SVDR