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

GRADE : CHIEF MATE ON SHIPS OF 500 GT OR MORE (UNLIMITED)
SUBJECT : NAVIGATION
DATE : 18th November 2016

Time allowed **THREE hours**	Total marks : 180
ANSWER ALL QUESTIONS	Pass marks : 70%

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 fully loaded vessel with a service speed of 19.0 knots has to proceed on a voyage from a position 32° 48'.0N, 79°51'.0 W towards 18° 03'.0 N, l6°18'.0W.
   a) Calculate the shortest distance on passage. **(10 marks)**
   b) Determine the latitude and longitude of the vessel at the northernmost point along the track. **(10 marks)**
   c) Determine the distance off an island (32° 21' N, 64° 48' W) when the vessel crosses longitude 64° 48' W, stating whether the vessel passes North or South of the island. **(10 marks)**
   d) If the vessel departs at 1000 hrs (UTC-5hrs) on 28th June and on her service speed, find the ETA at the Landfall position (UTC-01 hr). **(10 marks)**

2) Whilst in DR position 28° 42'.0 S, 94° 36'.0 W the Master requests the OOW to obtain a set of star sights to check the vessel's GPS receiver. The vessel clocks are on UTC -6hrs and the vessel is steaming on a course of 235° (T) at 14 knots. Weather conditions are clear with some low broken cloud cover to the Northwest of the vessel.

   a) The OOW obtains the following results:

Time	Star	Azimuth	True Alt	Calc Alt
1745	Canopus	142°(T)	42° 19'.7	42° 23'.6
1750	Arcturus	270° (T)	54° 12'.3	54° 13'.7
1758	Alphard	062° (T)	28° 15'.6	28° 09'.7
1815	Antares	224° (T)	19° 16'.0	19° 21'.7

   i. Plot all FOUR stars for 1800hrs. **(15 marks)**
   ii. State, with reasons, which of these are best suited for determining the vessel's position. **(05 marks)**

   b) Determine the vessel's position at 1800hrs. **(10 marks)**

3) A vessel has been chartered to an area with sea ice and ice bergs during the winter time.
   a) State the signs of approaching ice.   **(10 marks)**
   b) State action to reduce the ice accumulation on ships.   **(08 marks)**
   c) Under SOLAS Chapter V, the Master of every ship encountering dangerous ice or conditions that will cause ice accumulation on ships is required to report these conditions. What information should be reported in each of these circumstances?
                                                                              (10 marks)
   d) Where you find the format of reporting?   **(02 marks)**

4) Answer the following questions with regard to master-pilot relationship:
   a) What are the Duties and Expectations of a Pilot?   **(10 marks)**
   b) Give a step by step action procedure you will take as Master of the vessel for having found that the pilot's participation in offering his services tend to jeopardized the vessel.   **(20 marks)**

5) Give an introductory explanation on the following current display charts commonly known and used by the mariner.
   a) Current rose charts
   b) Vector mean charts
   c) Predominant current charts

                                                                              (10 marks each)

6) You are on fully laden ULCC heavily restricted in maintaining UKC entering Malacca Straits from Bay of Bengal, bound for Singapore.

   List down important facts you should have to consider for your passage plan in connection to maintaining the declared ETA for pilot boarding ground Singapore.
                                                                              (20 marks)

Q1)

PA = 90 00 – 32 48 = 57 12
PB = 90 00 – 18 03 = 71 57
P = 79 51 – 16 18 = 063 33 E
R A = 50 ÷ tan 32 48 = 78 mm
R B = 50 ÷ tan 16 48 = 153 mm
a) cos AB = cos P x sin PA x sin PB + cos PA + cos PB
Dis – cos$_{-1}$ (cos 063 33 x sin 57 12 x sin 71 57 + cos 57 12 x sin 71 57) = 58 24 39.38 x60
   1. Dis = 3504.7 NM
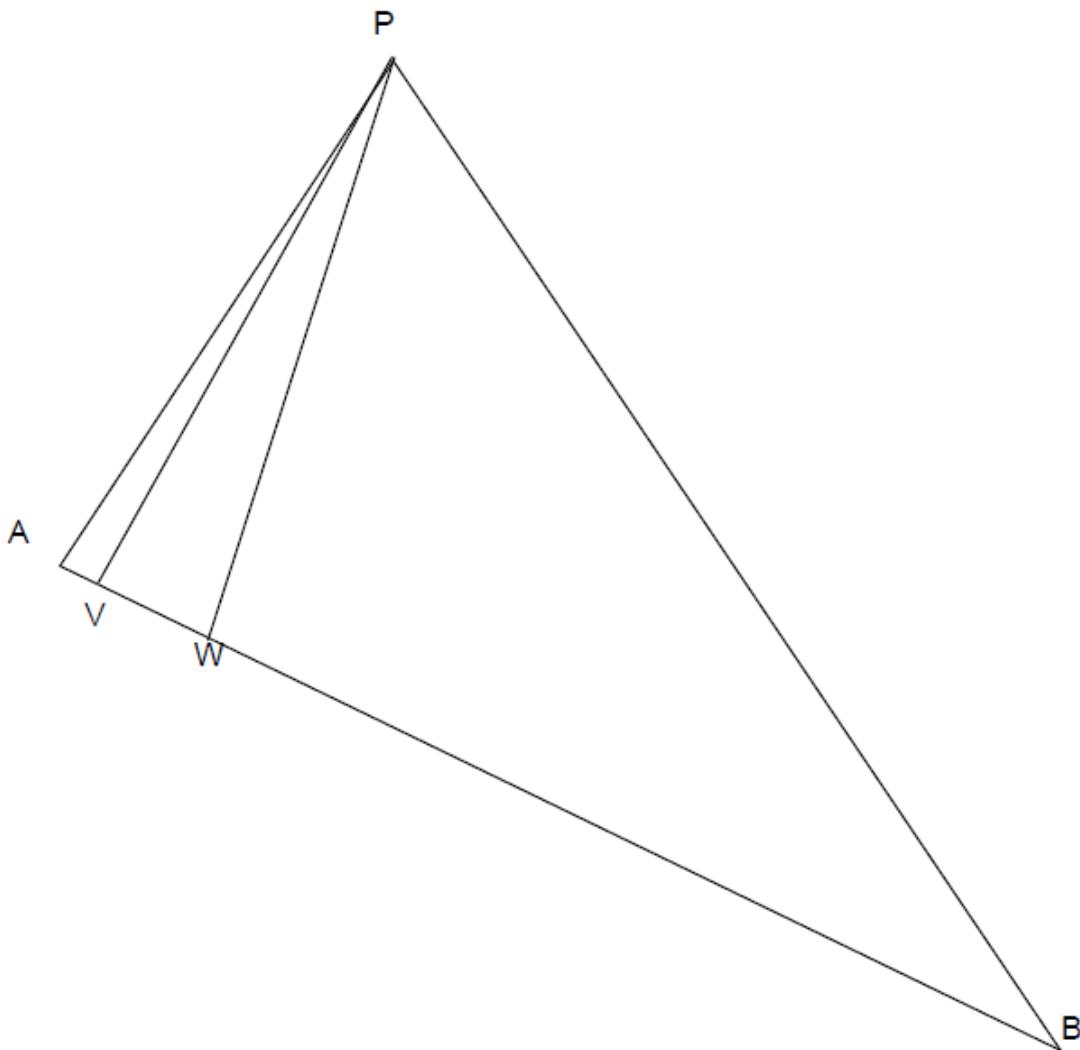
A = tan Lat A ÷ tan DLon = tan 32 48 ÷ tan 063 33 = 0.320… S
B = tan Lat B ÷ sin DLon = tan 18 03 ÷ sin 063 33 = 0.363… N

C = A ± B = 0.320... - 0.363... = 0.043... N
ICo = tan$_{-1}$ (1 ÷ C ÷ cosLat A) = 87 54 43.26
sin mid = cosopp x cosopp
sin PV = cos (90 – A) x cos (90 – PA)
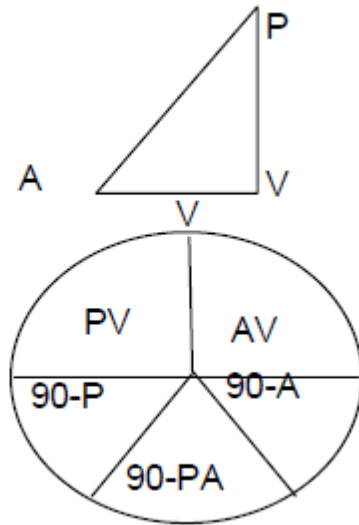
PV = sin$_{-1}$ (cos (90 – 87 54 43.26) x cos (90 – 57 12))
PV = 57 08 27.67 ~ 90
Lat V = 32 51.5 N
sin mid = tan adj x tan adj
sin (90 – PA) = tan (90 – P) x tan (90 – A)
P = 90 – tan$_{-1}$ (sin (90 – PA) ÷ tan (90 – A))
P = 90 – tan$_{-1}$ (sin (90 – 57 12) ÷ tan (90 – 87 54 43.26))
P = 003 51 01.24 E
Lon V = Lon A ± DLon AV = 079 51 W – 003 51 01.24 E = 075 59 58.76 W
Lon V = 076 00.0 W
c)

Ques 2)

a) i)
Transfers Intercepts TA - CA
Can (18:00 – 17:45) x 14.0 = 3.5 F -3.9 A
Arc (18:00 – 17:50) x 14.0 = 2.3 F -1.4 A
Alp (18:00 – 17:58) x 14.0 = 0.5 F +5.9 T
Ant (18:00 – 18:15) x 14.0 = 3.5 B -5.7 A

ii) CT 23:53 UT
ZN 06:00
CT 17:53 ZT
Tim Mag TB Alt
Can 17:45-0.9 142 42
Arc 17:500.2 270 54
CT 17:53
Alp 17:582.2 062 28
Ant 18:151.2 224 19
Canopus, Arcturus, and Alphard are the most suitable for determining the vessel's position.
They have been observed close to Civil Twilight.
They are of reasonable brightness.
They have a good range of bearings.
Their altitudes are reasonable.
Antares has been observed late, the horizon may be indistinct; and has a low altitude, more susceptible to abnormal refraction.

c)
DLat 7.3 N
Dep 0.8 E
AP Lat 28 42.0 S
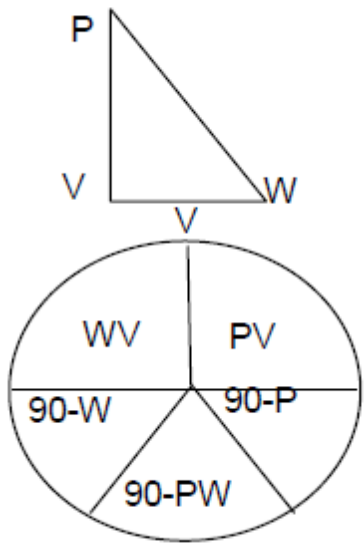DLat 00 07.3 N
Lat 28 34.7 S
MLat = 28 42.0 – 00 7.3 ÷ 2 = 28 38 21
DLon = Dep ÷ cosMLat = 0.8 ÷ cos 28 38 21 = 0.9 E
AP Lon 094 36.0 W
DLon 000 00.9 E
Lon 094 35.1 W

P = Lon V ± Lon W = 075 59 58.76 W – 064 48 W = 011 11 58.76 E
PW = 90 – 32 21 = 57 39
sin mid = tan adj x tan adj
sin (90 – P) = tan PV x tan (90 – PW)
PW = 90 – tan$_{-1}$ (sin (90 – 011 11 58.76) ÷ tan 57 08 27.67)
PW = 57 38 27.99
Lat W = 32 21 32.01
DLat = Lat W – Lat Be = 32 21 32.01 – 32 21 = 00 00 32.01
Vessel is 0.5 NM North of Island.