

INDIAN MARITIME UNIVERSITY
(A Central University, Government of India)

May/June 2016 End Semester Examinations
B.Sc. (Nautical Science) - Second Semester (2013 batch onwards)

NAUTICAL MATHEMATICS – II (T 2203)

Date : 13.06.2016

Maximum Marks: 70

Time: 3 Hrs

Pass Marks : 35

NOTE: Attempt any SEVEN questions. All questions carry equal marks. Non-programmable calculator is permitted.

1. a) A ship's load water plane is 60 metres long. The lengths of the half ordinates commencing from forward are as follows:

0.1, 3.5, 4.6, 5.1, 5.2, 5.1, 4.9, 4.3 and 0.1 metres respectively.

Calculate the area of the water plane.

- b) A ship 150 metres long has semi-ordinates commencing from forward as follows: 0, 5, 9, 9, 9, 7 and 0 metres respectively. Find the distance of the centre of flotation from forward. (5+5 marks)

2. a) The areas of a ship's water-planes, commencing from the load draft of 24 metres, and taken at equal distances apart, are:

2000, 1950, 1800, 1400, 800, 400, and 100 sq. m. respectively. The lower area is that of the ship's outer bottom. Find the displacement in salt water, and the Fresh water allowance.

- b) A ship is floating upright on an even keel at 6.0 metres draft F and A. The areas of the water-planes are as follows:

Draft (m)	0	1	2	3	4	5	6
Area (Sq.m)	5000	5600	6020	6025	6025	6020	6000

Find the ship's KB at this draft. (5+5 marks)

3. a) A ship's breadth, at 9 metres intervals commencing from forward are as follows:

0, 7.6, 8.7, 9.2, 9.5, 9.4, and 8.5 metres respectively. Aft the last ordinate is an appendage of 50 sq. m. Find the total area of the water plane.

- b) A ship's water plane is 36 metres long. The half ordinates, at equidistant intervals commencing from forward, are as follows : 0, 4, 5, 6, 6, 5 and 4, metres respectively. Calculate the second moment of the water plane area about the centre line. (5+5 marks)

4. Calculate a area of a ship's water plane between last two ordinates. The ordinates are given as follows and the common interval is of 20 Metres:-

10, 25, 8 Metres respectively. Also find out the centroid for the specified areas. (10 Marks)

5. a) Expand $f(x) = x \sin x$ as a Fourier series in the interval $0 < x < 2\pi$.

- b) Find the Fourier series expansion for $f(x)$ if

$$f(x) = -\pi, \quad -\pi < x < 0$$

$$x, \quad 0 < x < \pi.$$

(5+5 marks)

6. a) If $f(x) = |\cos x|$, expand $f(x)$ as a Fourier series in the interval $(-\pi, \pi)$.

- b) Expand $f(x) = \frac{1}{4} - x$, if $0 < x < \frac{1}{2}$
 $= x - \frac{3}{4}$, if $\frac{1}{2} < x < 1$
as the Fourier series of sine terms.

(5+5 marks)

- 7 a) Obtain Fourier series for the function,

$$f(x) = \begin{cases} \pi x, & 0 \leq x \leq 1 \\ \pi(2-x), & 1 \leq x \leq 2 \end{cases}$$

- b) Find the Fourier series for, $f(x) = \begin{cases} \pi x, & 0 \leq x \leq 1 \\ 0, & x = 1 \\ \pi(x-2), & 1 \leq x \leq 2 \end{cases}$

(5+5 marks)

- 8 a) The turning moment T is given for a series of values of the crank angle $\theta^\circ = 75^\circ$.

θ° :-	0	30	60	90	120	150	180
T :-	0	5224	8097	7850	5499	2626	0

Obtain the first four terms in a series of sines to represent T and calculate T for $\theta = 75$

10 Marks

9. The following table gives the variations of periodic current over a period,

t sec :	0	T/6	T/3	T/2	2T/3	5T/6	T
A amp:	1.98	1.30	1.05	1.30	-0.88	-0.25	1.98

Show that there is a direct current part of 0.75 amp in the variable current and obtain the amplitude of the first harmonic.

(10 marks)