

INDIAN MARITIME UNIVERSITY
(A Central University, Government of India)
END SEMESTER EXAMINATION-DECEMBER 2019
B.Sc(Nautical Science)
Semester – II
Nautical Mathematics - II
(UG21T2203)

Date: 09.12.2019

Max Marks: 70

Time: 3 Hrs

Pass Marks : 35

7 questions out of 9. All questions carry equal marks.

1. The length of a ship's water plane is 100 meters. The lengths of the half-ordinates commencing from forward are as follows. 0, 3.6, 6.0, 7.3, 7.7, 7.6, 4.8 and 0.6 meters respectively. Midway between the last two half ordinates is one whose length is 2.8 metres. Find the area of the water plane.

(10 marks)

2. A ship 150 meters long has semi-ordinates commencing from forward as follows:
0, 5, 9, 9, 9, 7 and 0 meters respectively.
Find the distance of the centre of flotation from forward.

(10 marks)

3. 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)	x	0	1	2	3	4	5	6
Area of WP (Sq. m)	y	5000	5600	6020	6025	6025	6025	6025

Find the ship's KB at this draft.

(10 marks)

4. The areas of a ship's water planes are as follows:

Draft (m)	0	1	2	3	4
Area of WP (Sq.m)	650	660	662	661	660

Calculate the ship's displacement in tones when floating in salt water at 4 meters draft. Also, if the ship's load draft is 4 meters, find the FWA.

(10 marks)

5. A ship's water plane is 18 meters long. The half-ordinates at equal distances from forward are as follows:

0, 1.2, 1.5, 1.8, 1.8, 1.5 and 1.2 meters respectively. Find the second moment of the water plane area about the center line.

(10 marks)

6. Expand $f(x) = \sqrt{(1 - \cos x)}$, $0 < x < 2\pi$ in a Fourier series. Hence

$$\text{evaluate } \frac{1}{1.3} + \frac{1}{3.5} + \frac{1}{5.7} + \dots$$

(10 marks)

7. Obtain the Fourier series for the function

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

$$\text{Deduce that } \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots \infty = \frac{\pi^2}{8}$$

(10 marks)

8. Obtain Fourier series for the function $f(x)$ given by

$$f(x) = 1 + \frac{2x}{\pi}, \quad -\pi \leq x \leq 0,$$

$$= 1 - \frac{2x}{\pi}, \quad 0 \leq x \leq \pi$$

Deduce that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots = \frac{\pi^2}{8}$

(10 marks)

9. Obtain the Fourier expansion of $x \sin x$ as a cosine series in $(0, \pi)$.

Hence show that, $\frac{1}{1.3} + \frac{1}{3.5} + \frac{1}{5.7} - \dots \infty = \frac{\pi-2}{4}$

(10 marks)
