

INDIAN MARITIME UNIVERSITY
(A Central University, Government of India)
END SEMESTER EXAMINATIONS- JUNE/JULY 2019
B. SC. (NAUTICAL SCIENCE)
SEMESTER-II
NAUTICAL MATHEMATICS II
(UG21T2203)

Date: 28-06-2019
Time: 3Hrs

Max Marks: 70
Pass Marks: 35
Marks: 7 x 10 =70

Answer any SEVEN questions. All questions carry equal marks.

1. a. Find a Fourier series to represent $x - x^2$ from $x = -\pi$ to π
b. Find a_n in the expansion of $f(x) = x \sin x$ as a Fourier series in the interval $0 < x < 2\pi$

(5+5 marks)

2. a. Find the Fourier series for the functions

$$\begin{aligned} f(x) &= -1 \text{ for } -\pi < x < -\frac{\pi}{2} \\ &= 0 \text{ for } -\frac{\pi}{2} < x < \frac{\pi}{2} \\ &= 1 \text{ for } \frac{\pi}{2} < x < \pi \end{aligned}$$

- b. Find b_n in the expansion of

$$\begin{aligned} f(x) &= 0 \quad \text{for } -\pi \leq x \leq 0 \\ &= \sin x \quad \text{for } 0 \leq x \leq \pi \end{aligned}$$

As a Fourier series.

(5+5 marks)

3. Find the Fourier series expression of $f(x) = 2x - x^2$ in $(0,3)$ and hence deduce that

$$\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} \dots - \infty = -\frac{\pi^2}{12}$$

(10 marks)

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

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

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

(10 marks)

5. a. Express $f(x) = x$ as a half range cosine series in $0 < x < 2$

b. Obtain the first 3 coefficients in the Fourier cosine series for y , where y is given in the following table:

x	0	1	2	3	4	5
y	4	8	15	7	6	2

(5 + 5 marks)

6. a. A ship 120 meters long at the water line has equidistantly spaced half ordinates commencing from forward as follows.

0, 3.7, 5.9, 7.6, 7.5, 4.6, 0.1 meters respectively.

Find the area of the water plane and the TPC at this draft.

Water density = 1.025 t/m³.

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

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

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

(5+5 marks)

7. a. The length of a ships 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, 2.8, 0.6 meters
 Midway between the last 2 half ordinates in one whose length is 2.8 meters. Find the area of the water plane.
- b. A ships breadths at 9 m intervals commencing from forward are as follows. 0, 7.6, 8.7, 9.2, 9.4, 8.5 meters
 About the last ordinate is an appendage of 50 square meters. Find the total area of the water plane.

(5+5 marks)

8. a. A ship 150 meters long has half-ordinate commencing from aft as follows: 0, 5, 9, 9, 9, 7 and 0 meters
 Find the distance of the center of flotation from forward.

(10 marks)

9. a. A Ship is floating upright in S.W. on an even keel at 7m draft F and A . The TPC's are as follows.

Draft (m)	1	2	3	4	5	6	7
TPC (Tones)	60	60.3	60.5	60.5	60.5	60.5	60.5

The volume between the outer bottom and 1 m draft is 3044 cubic meters, and its center of gravity is 0.5 m above the keel. Find the ship KB.

(10 marks)
