Indian Mar3itime University

(A Central University, Govt of India)

Sep/Oct'25 SE

Programme Name: B Sc (NS)

Semester: II

Subject Code: UG21T6201

Subject Name: NAUTICAL MATHEMATICS

Date: 01.09.2025	Max Marks: 70
Duration: 03 Hrs	Pass Marks: 35

General Instructions

(i) All Sections (A, B & C) are to be attempted.
(ii) Options, if any, are specified in respective section.
(iii) Use of nonprogrammable scientific calculator is allowed.
(iv) Use of logarithmic table is allowed.

Section A

Ten MCQs/Fill in the Blanks of 01 Mark each – Choose the correct answer as applicable.

1. In a spherical triangle, the sum of angles is always

a) 180°
b) Greater than 180°
c) Less than 180°
d) Exactly 200°

2. In a spherical triangle ABC, a = 49°08′, b = 58°23.0′ and C = 71°21′. Calculate c.

a) 52°10′
b) 68°25′
c) 56° 42′
d) 75°30′

3. The normal distribution is a proper probability distribution of a continuous random variable, the total area under the curve f(x) is

a) Equal to one
b) More than one
c) Less than one
d) Between –1 and 1

1|5

4. If $r = 0.8$, $b_{xy} = 0.32$, then what will be the value of b_{yx}?
a) 0.48
b) 0.52
c) 2
d) 1

5. The determinant of a singular matrix is always
a) 0
b) 1
c) -1
d) not defined

6. Eigenvalues of a matrix are found by solving which equation?
a) Characteristic Equation
b) Quadratic Equation
c) Linear Equation
d) Vector Equation

7. Let $A = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$. Then the number of subsets of A containing exactly two elements is
a) 20
b) 40
c) 45
d) 90

8. The Cardinality of a fuzzy set is:
a) 0
b) finite
c) infinite
d) not known

9. Identify the feasible region, given constraints are $x + y \leq 5$, $x \geq 0$, $y \geq 0$.
a) A triangle
b) A rectangle
c) A line
d) An unbounded region

10. In a transportation problem, the total supply must be
a) Greater than demand
b) Equal to demand
c) Less than demand
d) Independent of demand

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Section B

Five Questions of 02 Marks each

11. In a spherical triangle PQR, P = 57° 30.5′, Q = 95° 17′ and R = 70° 11′. Calculate p, q and r.

12. For the data:

x:	105	104	102	101	100	99	98	96	93	92
y:	101	103	100	98	95	96	104	92	97	94

Find the Coefficient of Correlation. What type of correlation does the data exhibit?

13. Using the properties of determinants show that

$$\begin{vmatrix} 29 & 1 & 4 \\ 33 & 5 & 4 \\ 17 & 3 & 2 \end{vmatrix}$$

Is zero

14. In a class of 60 students, 25 students play cricket and 20 students play tennis, and 10 students play both the games. Find the number of students who play neither?

15. Formulate and solve the following Linear Programming Problem (LPP):
Maximize: $Z = x_1 + x_2$,
subject to constraints $x_1 - x_2 \geq 0$,
$-3x_1 + x_2 \geq 3$
and $x_1 \geq 0$, $x_2 \geq 0$.

Section C

Seven Questions of 10 Marks each of which any 05 questions to be answered.

16. In spherical triangle ABC, A = 81°24.3′, B = 61°31.7′ AND C = 102°58′. Calculate a, b and c.

(10 Marks)

17.a) x is a normal variate with mean 30 and SD is 5. find the probabilities
1) $26 \leq x \leq 40$ 2) $x \geq 45$ 3) $|x-30| > 5$

(6 Marks)

b) If one vessel in every 10 is wrecked find the probability that out of 5 vessels at least 4 arrive safely.

(4 Marks)

18.a) In the following table recorded data showing the test scores made by salesmen on an intelligence test and their weekly sales

Salesman	1	2	3	4	5	6	7	8	9	10
Test scores	40	70	50	60	80	50	90	40	60	60
Sales	2.5	6.0	4.5	5.0	4.5	2	5.5	3	4.5	3

Calculate the regression line of sales on test scores and estimate the most probable weekly sales volume if a salesman score is 70.

(5 Marks)

b) Ten participants in a contest are ranked by two judges as follows. Calculate the Spearman's rank correlation coefficient.

x:	1	6	5	10	3	2	4	9	7	8
y:	6	4	9	8	1	2	3	10	5	7

(5 Marks)

19.a) State the Eigen Value theorem.

(2 Marks)

b) Reduce the following matrix into its normal form and hence find its rank

A =

$$\begin{bmatrix} 1 & 2 & -1 & 3 \\ 4 & 1 & 2 & 1 \\ 3 & -1 & 1 & 2 \\ 1 & 2 & 0 & 1 \end{bmatrix}$$

(8 Marks)

20.a) Let A = {1,2,3,4,5}, B = {3,4,5,6,7} and C = {1,4,7}

1) Find A ∪ B , A ∩ B and A- B

(3 Marks)

b) Consider the Boolean expression: A • (B+C) + A' • B

1) Simplify the Boolean expression using Boolean identities.

2) Draw the truth table for the simplified expression.

(4 Marks)

c) Let X = {1,2,3,4,5} be a universe of discourse. A fuzzy set A is defined as A = {(1,0.2), (2,0.6), (3,0.8), (4,0.5), (5,0.1)} where the second value represents the membership grade.

1) Find the compliment of the fuzzy set A.

(3 Marks)

21. Solve graphically:

Maximize $Z = 50x_1 + 60x_2$

Subject to constraints $2x_1 + 3x_2 \leq 1500$,

$3x_1 + 2x_2 \leq 1500$,
$x_1 \leq 400$,
$x_2 \leq 400$ and x1, $x_2 \geq 0$.

(10 Marks)

22. Obtain an initial basic feasible solution to the following transportation problem using matrix minima method.

	D1	D2	D3	D4	Supply
O1	6	4	1	5	14
O2	8	9	2	7	16
O3	4	3	6	2	5
Demand	6	10	15	4	35

(10 Marks)

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