

Indian Maritime University
(A Central University, Government of India)
December 2022 End Semester Examination
B.S. (Nautical Science)
Semester - II
Applied Mathematics
(UG21T5201)

Date: 25.11.2022

Time : 3 Hours

Maximum Marks: 70

Pass Marks: 35

Note : Question no. 1 and 2 are compulsory.

Answer any 5 from remaining 7 questions (each of 10 marks).

Scientific Calculator is permitted, if required.

Part A

Q.1 Choose correct option from the given options.

(i) $L(e^t) =$

- a) $1/(s-1)$
- b) $1/(s+1)$
- c) $1/s$
- d) s

(ii) $L^{-1}\left(\frac{1}{s^n}\right)$ is

- a) $\frac{t^{n+1}}{(n+1)!}$
- b) $\frac{t^{n-1}}{(n-1)!}$
- c) $\frac{t^n}{(n)!}$
- d) none of these

(iii) The relation between operators E and Δ is

- a) $\Delta = E + 1$
- b) $\Delta = E$
- c) $\Delta = E - 1$
- d) $\Delta = E^2$

(iv) For equally spaced data the interpolation formula to be used is

- a) Newton's forward interpolation formula
- b) Newton's backward interpolation formula
- c) Stirling's formula
- d) All of these

(v) The regression line of y on x is

- a) $(y + \bar{y}) = b_{yx}(x - \bar{x})$
- b) $(y - \bar{y}) = b_{yx}(x - \bar{x})$
- c) $(y - \bar{y}) = b_{yx}(x + \bar{x})$
- d) $(y - \bar{y}) = b_{xy}(x - \bar{x})$

(vi) $b_{yx} * b_{xy} =$

- a) r
- b) $\frac{1}{r}$
- c) r^2
- d) r^3

(vii) If A,B,C and D are four chemicals costing Rs.15, Rs.12, Rs.8 and Rs.5 per 100gm. Respectively and are contained in a given compound in the ratio of 1,2,3 and 4 parts respectively , then what should be the price of the resultant compound.

- a) Rs.8.30
- b) Rs.9
- c) Rs. 8
- d) Rs. 10

(viii) In a fourier series the constants a_0, a_n and b_n are called

- a) Fourier constants
- b) Euler's formulae
- c) Dirichlet's constants

d) None of these

(ix) Lagrange's interpolation method is used for

- a) equally spaced data
- b) unequally spaced data
- c) both a) and b)
- d) none of these

(x) In a data set the value of the observation that occurs most frequently is called

- a) Mean
- b) Median
- c) Mode
- d) Deviation

Q.2 (i) Find the Laplace transform of $4t^2 + \sin 3t + e^{2t}$

(ii) Find the a_0 term in the Fourier series to represent $f(x) = x^2$ in $(0, 2\pi)$

(iii) Prove that $\nabla = 1 - E^{-1}$

(iv) Construct forward difference table for following data. (1,.1), (2,4.2), (3,9.3), (4,16.4).

(v) Define Range and Mode

(5X2=10 Marks)

Part B

Q.3 a) Find the Laplace transform of $\frac{1}{t}(1 - \cos t)$

b) Find the Laplace transform of $\int_0^t \sin 2u \, du$

(5 + 5 Marks)

Q.4 a) Using Newton's forward difference interpolation formula find $\sin 52^\circ$ from the following table:

x	$\sin 45^\circ$	$\sin 50^\circ$	$\sin 55^\circ$	$\sin 60^\circ$
$f(x)$	0.7071	0.7660	0.8192	0.8660

b) The area of circle of diameter d is given by

x	80	85	90	95	100
y	5026	5674	6361	7088	7854

Find area of circle of diameter 98 using Newton's backward interpolation formula.

(5 + 5 Marks)

Q.5 a) Find coefficient of correlation from the following data:

x	2	5	9	8	4
y	5	7	8	9	10

b) A sample of 6 persons was selected the value of their age (x variable) and their weight is demonstrated in the following table. Find the regression equation and what is the predicted weight when age is 8.5 years.

(5 + 5 Marks)

Q.6 a) A company is planning to improve plant safety. For this accident data for last 50 weeks was compiled. These data are grouped into the frequency distribution. Calculate the arithmetic mean by step deviation method. The compiled data is:

Number of accidents	0-4	5-9	10-14	15-19	20-24
Number of weeks	5	22	13	8	2

b) A survey was conducted to determine the age (in years) of 150 autos. The result of such a survey is given. What is the median age of the autos? The data is given in the following table.

Age of auto	0-4	4-8	8-12	12-16	16-20
Number of autos	13	31	46	20	10

(5 + 5 Marks)

Q.7 a) Express $f(x) = \frac{x}{2}$ as a Fourier series in the interval $-\pi < x < \pi$

b) Expand $f(x) = e^x$ as a Fourier series in the interval $(-l, l)$

(5 + 5 Marks)

Q. 8 a) Find the value of $f(9)$ from the following data using Lagrange's method of interpolation.

X:	5	7	11	13	17
Y:	150	392	1452	2366	5202

b) Use the Trapezoidal Rule to estimate the integral $\int_0^2 e^{x^2} dx$ taking 10 intervals.

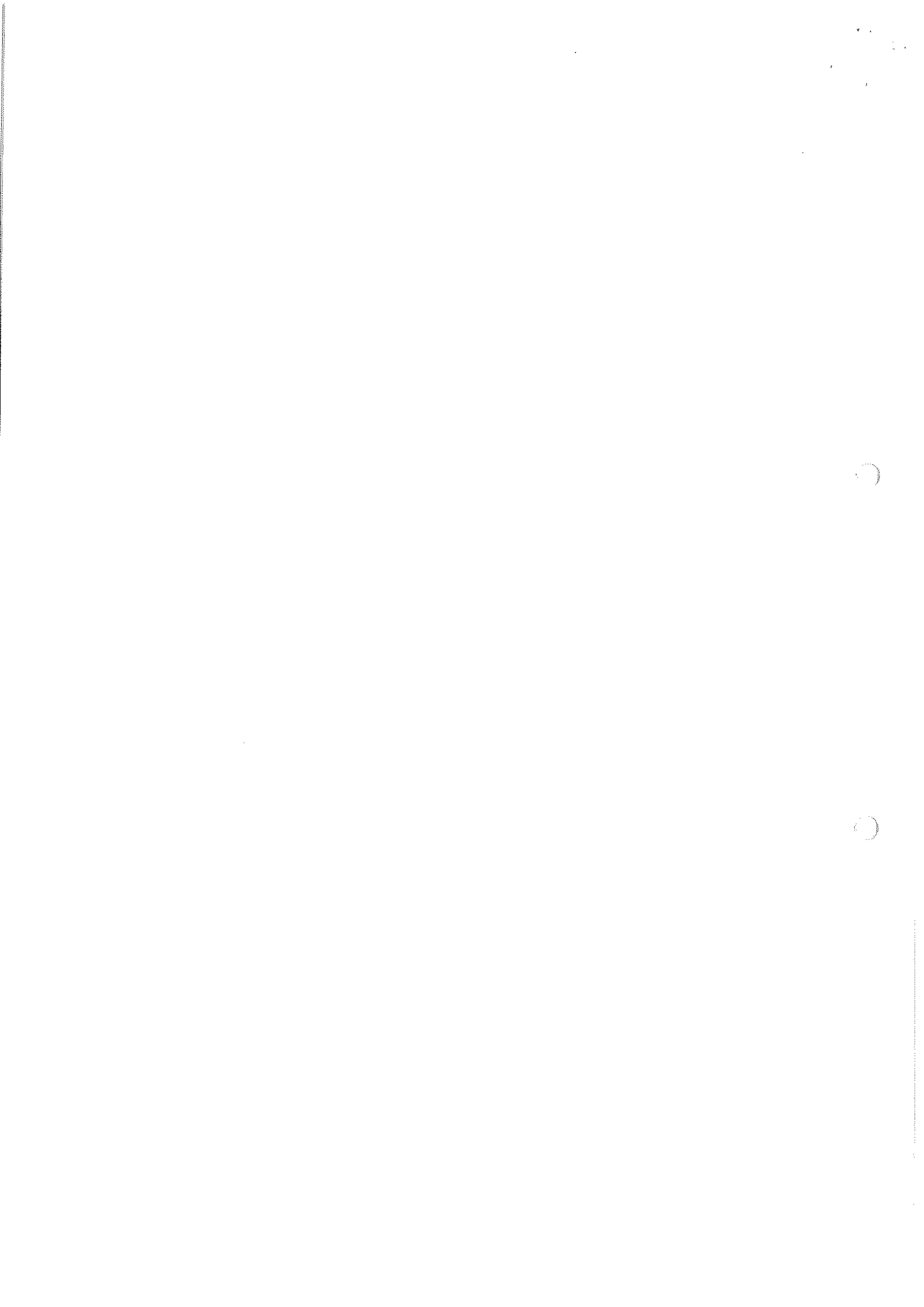
(5 + 5 Marks)

Q.9 a) Solve by the method of transforms the equation

$$y''' + 2y'' - y' - 2y = 0 \text{ given } y(0) = y'(0) = 0 \text{ and } y''(0) = 6$$

b) Find the inverse Laplace transform of $\log\left(\frac{(s+1)}{s-1}\right)$

(5 + 5 Marks)



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Section B

Q.5 b) A sample of 6 persons was selected the value of their age (x variable) and their weight is demonstrated in the following table. Find the regression equation and what is the predicted weight when age is 8.5 years.

Serial no.	Age (x)	Weight (y)
1	7	12
2	6	8
3	8	12
4	5	10
5	6	11
6	9	13

