

NUMERICAL METHODS AND STATISTICS
M(IT)302

TIME ALLOTTED: 3 HOURS

FULL MARKS: 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable

GROUP – A
(Multiple Choice Type Questions)

1. Answer any **ten** from the following, choosing the correct alternative of each question: **10×1=10**

SL. NO.	Question	Marks	CO No.
(i)	The percentage error in approximated $4/3$ to 1.3333 is a) 0.0025% b) 25% c) 0.000025% d) 0.25%	1	1
(ii)	The degree of precession of Trapezoidal rule a) 1 b) 2 c) 3 d) 4	1	2
(iii)	The standard deviation of the data 49,63,46,59,65,52,60,54 is a) 636 b) 639 c) 632 d) 649	1	5
(iv)	The mean deviation about the arithmetic mean of the numbers 31,35,29,63,55,72,37 is a) 13.9 b) 14.5 c) 15.2 d) 14.9	1	2
(v)	Newton Raphson's method is also known as method a)normal b)tangent c)parallel d)none	1	2
(vi)	Runge-Kutta formula has a truncation error, which is of the order of a) h^2 b) h^4 c) h^5	1	3

NARULA INSTITUTE OF TECHNOLOGY
An Autonomous Institute under MAKAUT

- | | | | | | |
|--------|---|---|---|--|--|
| | d) h^3 | | | | |
| (vii) | The number of significant figures in 0.00120036 is | 1 | 2 | | |
| | a) five | | | | |
| | b) six | | | | |
| | c) seven | | | | |
| | d) eight | | | | |
| | | | | | |
| (viii) | In Newton's divided difference interpolation formula $f(x_0, x_1)$ is equal to | 1 | 3 | | |
| | a) $\frac{f(x_0) - f(x_1)}{x_0 - x_1}$ | | | | |
| | b) $\frac{f(x_1) - f(x_0)}{x_1 - x_0}$ | | | | |
| | c) Both (a) and (b) | | | | |
| | d) None of these | | | | |
| | | | | | |
| (ix) | Which of the following is not true (the notations have their usual meanings)? | 1 | 1 | | |
| | a) $\Delta = E - 1$ | | | | |
| | b) $\Delta \cdot \nabla = \Delta - \nabla$ | | | | |
| | c) $\frac{\Delta}{\nabla} = \Delta + \nabla$ | | | | |
| | d) $\nabla = 1 - E^{-1}$ | | | | |
| | | | | | |
| (x) | In LU- factorization method, the given system of equation represented by $AX=B$ is Converted to another system $LUX=B$, where U is | 1 | 2 | | |
| | a) Lower triangular matrix | | | | |
| | b) Upper triangular matrix | | | | |
| | c) Identity matrix | | | | |
| | d) Null matrix | | | | |
| | | | | | |
| (xi) | In Simpson's 1/3 rd rule of finding $\int_a^b f(x) dx$, $f(x)$ is approximated by | 1 | 4 | | |
| | a) Line segment | | | | |
| | b) parabola | | | | |
| | c) circular sector | | | | |
| | d) part of ellipse | | | | |
| | | | | | |
| (xii) | A normal population has a mean 0.1 and s.d 2.1. The mean of the sampling distribution of the sample mean with sample size 900 is | 1 | 2 | | |
| | a) 1 | | | | |

NARULA INSTITUTE OF TECHNOLOGY
An Autonomous Institute under MAKAUT

- b) 0.1
c) 0.001
d) none of these

GROUP – B
(Short Answer Type Questions)
(Answer any three of the following) 3 x 5 = 15

SL. NO.		Mark s	CO No.														
2.	Find the missing term in the following table: <table border="1"><tr><td>x</td><td>0</td><td>5</td><td>10</td><td>15</td><td>20</td><td>25</td></tr><tr><td>f(x)</td><td>6</td><td>10</td><td>-</td><td>17</td><td></td><td>31</td></tr></table>	x	0	5	10	15	20	25	f(x)	6	10	-	17		31	5	2
x	0	5	10	15	20	25											
f(x)	6	10	-	17		31											
3.	Find a real root of the equation $x^x + 2x - 2 = 0$ using Bisection Method correct up to two decimal places.	5	2														
4.	Find the relative percentage error in the computation of $x - y$ for $x = 12.05$ and $y = 8.02$ having absolute error $\Delta x = 0.005, \Delta y = 0.001$.	5	3														
5.	Evaluate $\int_0^1 \frac{1}{1+x^2} dx$ by Simpson's one-third rule, taking $n = 6$. Hence find the value of π .	5	4														
6.	If T is an unbiased estimator of θ , show that \sqrt{T} is biased estimate of $\sqrt{\theta}$.	5	5														

GROUP – C
(Long Answer Type Questions)
(Answer any three of the following) 3 x 15 = 45

SL. NO.			Marks	CO No.														
7.	(i)	Compute $y(0.4)$ by Milne's predictor-corrector method from the equation $\frac{dy}{dx} = xy + y^2$, given that $y(0)=1, y(0.1)=1.1169$ $y(0.2)=1.2773$ $y(0.3)=1.5040$	7	2														
	(ii)	Using approximate formula find $f(0.29)$ from the following table <table border="1"><tr><td>X</td><td>0.20</td><td>0.22</td><td>0.24</td><td>0.26</td><td>0.28</td><td>0.30</td></tr><tr><td>f(x)</td><td>1.6596</td><td>1.6698</td><td>1.6804</td><td>1.6912</td><td>1.7024</td><td>1.7139</td></tr></table>	X	0.20	0.22	0.24	0.26	0.28	0.30	f(x)	1.6596	1.6698	1.6804	1.6912	1.7024	1.7139	8	3
X	0.20	0.22	0.24	0.26	0.28	0.30												
f(x)	1.6596	1.6698	1.6804	1.6912	1.7024	1.7139												
8.	(i)	Evaluate the integral $\int_0^{\pi/2} \sqrt{1 - 0.162 \sin^2 \theta} d\theta$ using i) Trapezoidal rule ii) Simpson's 1/3 rule Correct upto 4 decimal place, taking $n=6$	8	4														

- (ii) Compute $y(0.2)$ by Runge Kutta method of fourth order for the differential equation $\frac{dy}{dx} = xy + y^2$, $y(0) = 1$. taking step length $h = 0.1$ 7 3
9. (i) The table given below the diastolic pressure of 250 men. The reading were made to the nearest millimeter and distribution is given as: 4 4
- | | | | | | | | | |
|---|-------|-------|-------|-------|-------|-------|-------|-------|
| x | 58-62 | 63-67 | 68-72 | 73-77 | 78-82 | 83-87 | 88-92 | 93-97 |
| y | 4 | 5 | 31 | 39 | 114 | 30 | 25 | 2 |
- Calculate the mean and median from the given data.
- (ii) A random sample of 100 articles taken from a batch of 2000 articles with s.d 0.048 shows that the average diameter of the articles is 0.354. Find 95% confidence interval for the average diameter of this batch of 2000 articles. [Given area under the normal curve between $z = 0$ and $z = 1.96$ is 0.475] 7 4
- (iii) Find the equation of the line of regression of x on y for the following data: 4 2
- | | | | | | | | |
|---|-----|-----|-----|-----|-----|-----|-----|
| x | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 |
| y | 5.3 | 5.7 | 6.3 | 7.2 | 8.2 | 8.7 | 8.4 |
10. (i) Determine the equation of a straight line which best fits the following data: 5 3
- | | | | | | | | |
|---|----|----|----|----|----|----|----|
| x | 10 | 12 | 13 | 16 | 17 | 20 | 25 |
| y | 19 | 22 | 24 | 27 | 29 | 33 | 37 |
- (ii) Prove that the correlation coefficient r lies between -1 and +1. 5 4
- (iii) Find the equation of the line of regression of x on y for the following data: 5 4
- | | | | | | | | |
|---|-----|-----|-----|-----|-----|-----|-----|
| x | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 |
| y | 5.3 | 5.7 | 6.3 | 7.2 | 8.2 | 8.7 | 8.4 |
11. (i) Find a root of the equation $x^3 - 2x - 5 = 0$ using Regula-Falsi Method correct up to four decimal places. 7 1
- (ii) Find the value of $y(0.4)$ using Runge-Kutta method of fourth order with $h=0.2$, given that $\frac{dy}{dx} = \sqrt{x^2 + y}$, $y(0)=0.8$ 8 2