

2024**M.Sc. 2nd Semester Examination****APPLIED MATHEMATICS****PAPER : MTM-204(CBCS)****(Statistical and Numerical Methods)***Full Marks : 40**Time : 2 hours**The figures in the right-hand margin indicate marks.***A.** Answer any **four** questions : 2×4=8

1. Define the terms inherent error and truncation error.
2. If $f(x) = 3\tan x - 7x$, find the percentage error in $f(x)$ at $x = \frac{\pi}{4}$ if the error in x is 0.04.
3. Find the position of a real root of $2x - 3\sin x - 5 = 0$.
4. What do you mean by measures of central tendency? Give different measures.

(2)

5. Define the term 'correlation' between variables. When the variables are said to be positively correlated, negatively correlated and uncorrelated?
6. Point out the mistake or ambiguity in the following statement:
"A person goes from X to Y on cycle at 8 kilometers per hour and returns at 10 kilometers per hour. His average speed was 9 kilometers per hour".

B. Answer any **four** questions : 4×4=16

7. Evaluate $\int_0^1 \frac{x dx}{1+x^2}$ by Simpson's 1/3 rule, taking 6 equal subintervals.

8. Solve by Gauss-elimination method, correct up to two significant figures :

$$5x + 7y + 9z = 3$$

$$2x + 3y - 6z = 7$$

$$10x - 5y + 3z = 9$$

9. Find $y(0.02)$, from the equation

$\frac{dy}{dx} = 2x^3 + 3y$, $y(0) = 1$, taking step length $h = 0.01$, by Euler's method, correct up to four decimal places.

(5)

- (iii) Let the lines of regression concerning two variables x and y be given by $y = 32 - x$ and $x = 13 - 0.25y$. Obtain the values of the means and the correlation coefficient. 2+3+3

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(3)

10. Define geometric and harmonic mean of a group of n -observations. Also, define the weighted geometric and harmonic mean of a group of n -observations.

11. Prove that, $AM \geq GM \geq HM$, where AM, GM and HM represent arithmetic, geometric and harmonic means, respectively.

12. Define the median and the median class of the data given below :

Class boundaries: 15-25 25-35 35-45 45-55 55-65 65-75

Frequency : 4 11 19 14 0 2

C. Answer *any two* questions : $8 \times 2 = 16$

13. Describe Newton-Raphson method to find a real root of the equation $f(x) = 0$, where $f(x)$ is continuous function of x . Give geometrical interpretation of this method. Write down the convergence criteria of this method. $5+2+1$

14. Compute $y(0.6)$, from the equation $\frac{dy}{dx} = xy$, $y(0) = 2$, taking step length $h = 0.2$, by fourth order Runge-Kutta method, correct up to five decimal places. 8

(4)

15. (i) Define covariance and correlation coefficient of a set of n -pair observations.

(ii) Write the important properties of correlation coefficients.

(iii) While calculating the coefficient of correlation between two variables x and y , the following results were obtained:

$n = 25$, $\sum x = 125$, $\sum y = 100$, $\sum x^2 = 650$, $\sum y^2 = 460$, $\sum xy = 508$. It was however later discovered at the time of checking that two pairs of observations (x, y) were $(18, 12)$ and $(6, 8)$, respectively. Determine the correct value of the coefficient of correlation. $2+3+3$

16. (i) What is regression? Define regression curve.

(ii) Write three important properties of linear regression line.