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MCSE–004

MASTER OF COMPUTER APPLICATIONS (MCA)

Term-End Examination

June, 2025

MCSE-004 : NUMERICAL AND STATISTICAL COMPUTING

Time : 3 Hours *Maximum Marks : 100*

***Note** : (i) Question No. **1** is compulsory.*

*(ii) Attempt any **three** questions from the rest.*

(iii) Use of calculator is allowed.

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1. (a) Let $a = \cdot 41$, $b = \cdot 36$ and $c = \cdot 70$. Prove that : 5

$$\frac{a-b}{c} \neq \frac{a}{c} - \frac{b}{c}$$

(b) Consider the number $\frac{2}{3}$. Its floating point representation rounded to 5 decimal places is .66667. Find out to how many decimal places the approximate value of $\frac{2}{3}$ is accurate. 5

(c) Obtain the positive root of the equation $x^2 - 1 = 0$ by Regula-Falsi method. 5

(d) Find the smallest root of $x^7 + 9x^5 - 13x - 17 = 0$ using Newton-Raphson methods. 5

(e) Evaluate the missing term in the following using backward differences of Interpolation : 5

x	$f(x) = \log x$
100	2.000
101	2.0043

102	?
103	2.0128
104	2.0170

(f) Given $f(x) = \sin x$, $f(0.1) = 0.09983$, $f(0.2) = 0.19867$, use the method of linear interpolation to find $f(0.16)$. Find the error in $f(0.16)$. 5

(g) Calls at a particular call center occur at an average rate of 8 calls per 10 minutes. Suppose that the operator leaves his position for a 5 minutes coffee break. What is the chance that exactly one call comes in while the operator is away ? 5

(h) Solve the initial value problem to calculate approximation for $y(0.1), y(0.2)$ using Euler's method with $h = 0.1$. 5

2. (a) Compute the square root of a, using Newton's method. How does the error behave ? 10

(b) Solve the following linear system of equations : 10

$$x_1 + x_2 + x_3 = 3$$

$$4x_1 + 3x_2 + 4x_3 = 8$$

$$9x_1 + 3x_2 + 4x_3 = 7$$

using Gauss Elimination method.

3. (a) Find the interpolating polynomial that fits the following data : 10

x_k	f_k
6	2
1	3
2	12
5	147

using the Lagrange's interpolation formula.

(b) Calculate the value of the integral : 10

$$\int_4^{5.2} \log x \, dx$$

by :

(i) Trapezoidal rule

(ii) Simpson's $\frac{1}{3}$ rule

4. (a) Using Runge-Kutta method of fourth order, compute $y(0.2)$ and $y(0.4)$ for $10y' = x^2 + y^2$, $y(0) = 1$, taking $h = 0.1$. 10

(b) By means of Lagrange's formula, prove that : 10

$$y_1 = y_3 - 0.3(y_5 - y_{-3}) + 0.2(y_{-3} - y_{-5})$$

where $y_i = y(i)$.

5. Write short notes on any *four* from the following : 4×5=20

(a) Exponential Random Variables

(b) Chi-square Distribution

(c) Acceptance-Rejection method

(d) Goodness of fit

(e) Uniform Random Number Generators

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