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Roll No

MCADD-302

M.C.A. (Integrated), III Semester

Examination, November 2023

Computer Oriented Numerical Methods

Time : Three Hours

Maximum Marks : 70

Note: i) Attempt any five questions.

ii) All questions carry equal marks.

1. a) Explain transcendental equation. What are its characteristics?
- b) Derive the Newton-Raphson iterative formula

$$X_{n+1} = X_n - \frac{f(x_n)}{f'(x_n)} \text{ for solving } f(x) = 0.$$

2. a) Explain Romberg integration. How does it improve the accuracy of integration?
- b) Estimate $\int_0^1 \frac{dx}{1+x^2}$ correct to five decimal places by using
 - i) Trapezoidal rule with $n = 4$
 - ii) Simpson's method with $n = 4$

3. a) Explain the basic concepts used in the Gauss elimination approach.
- b) Solve the following system of equations using simple elimination process:

$$x + y + z = 6$$

$$2x - y + 3z = 4$$

$$4x + 5y - 10z = 13$$

4. a) Find the binomial distribution of getting a six in three tosses of an unbiased dice.
 b) Telephone calls arrive at an exchange according to the Poisson process at a rate $\lambda=2/\text{min}$. Calculate the probability that exactly two calls will be received during each of the first 5 minutes of the hour.
5. a) What are the main steps to developing a scientific theory?
 b) Find the t-test value for the following two sets of values: 7, 2, 9, 8 and 1, 2, 3, 4.
6. a) Estimate the maximum error in evaluating the expression $x^3 - 2.5x^2 + 3.1x - 1.5$ at $x=1.25$
 b) A deck of cards contains 20 cards: 6 red cards and 14 black cards. 5 cards are drawn randomly without replacement. What is the probability that exactly 4 red cards are drawn?
7. a) Prove that the bisection method is linearly convergent.
 b) The data given below is about the number of passengers on 35 different cabs. The sample mean and the sample standard deviation of the data are 7.9 and 4.33, respectively. The data follow a uniform distribution where all values between and including zero and 14 are equally likely. Identify the values of x and y . Calculate the theoretical mean and standard deviation.
8. Find a root of each of the following equations using the bisection method.
 - a) $e^x - x - 2 = 0$
 - b) $\sin x - 2x + 1 = 0$
 - c) $\log x - \cos x = 0$
 - d) $x \tan x - 1 = 0$
