B.Tech. 3rd Semester (G-Scheme)
(Mechanical & Automation) Examination,
December–2023
NUMERICAL ANALYSIS & PROGRAMMING
Paper–BSC-MA-201-G

Time allowed : 3 hours] *[Maximum marks : 75*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : *Attempt **five** questions in all, selecting **one** question from each unit. **Question No. 1 is compulsory.** All questions carry equal marks.*

1. (a) Define condition for the convergence of iterative method. 6×2½=15

(b) Prove that $(1+\Delta)(1-\nabla) = 1$

(c) Write Gauss's forward and backward interpolation formula.

(d) Using Euler's method find y (0. 2) for given first order differential equations $\frac{dy}{dx} = y - x^2 + 1$ and $y(0) = 0.5$

(e) Evaluate $\int_4^{5.2} \log_e x \, dx$ by trapezoidal rule by taking $h = 0.2$.

(f) Write a C ++ program which prints all odd positive integers less than 100, omitting these integers divisible by 7.

Unit–I

2. (a) Find the real root of the equation $x^3 - 2x - 5 = 0$ by the method of false position correct to three decimal places.

(b) Find the root of the equation $x \sin x + \cos x = 0$ using Newton - Raphson method. 15

3. (a) Using Gauss - Jacobi method, solve the following system of equations :

$$x + 17y - 2z = 48$$

$$30x - 2y + 3z = 75$$

$$2x + 2y + 18z = 30$$

(b) Represent the following functions in factorial polynomial and their successive forward differences, taking $h = 1$.

(i) $x^4 - 12x^3 + 42x^2 - 30x + 9$

(ii) $x^4 + 3x^3 - 5x^2 + 6x - 7$ 15

Unit–II

4. (a) From the following data, find y at $x = 43$ and $x = 84$.

x :	40	50	60	70	80	90
y :	184	204	226	250	276	304

Also express y in terms of x using Newton's interpolation formula.

(b) Use Lagrange's interpolation formula to find the value of f(x) corresponding to x = 27 from the following data :

x :	14	17	31	35
y :	68.7	64.0	44.0	39.0

15

5. (a) Find the value of f' (0.5) using Sterling formula from the following data :

x :	0.35	0.40	0.50	0.55	0.60	0.65
y :	1.521	1.506	1.488	1.467	1.444	1.389

(b) Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by using Simpson's $\frac{1}{3}$rd and Simpson's $\frac{3}{8}$th rule and compare result with its actual value. 15

Unit–III

6. Consider the initial value problem $\frac{dy}{dx} = y - x^2 + 1$, $y(0) = 0.5$ Find y (0.4) and y(0.6) using fourth order Runge-Kutta method. 15

7. Solve numerically $\frac{dy}{dx} = x^2 + y^2 - 2$ using Milne's predictor – corrector method for x = 0.3 given the initial value x = 0, y = 1. The value of y for x = – 0.1, 0.1, 0.2 should be computed by Taylor series expansion. 15

Unit–IV

8. Write an algorithm for Newton-Raphson method to solve the equation $f(x) = 0$. Apply the same to solve $\cos x - xe^x = 0$ near $x = 0.5$ correct to three decimal point. 15

9. Write a C++ program to solve the following equations by Gauss-Seidal method : 15

$$83x + 11y - 4z = 0;$$

$$7x + 52y + 13z = 104;$$

$$3x + 8y + 29z = 71.$$