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Term End Examination 2025-2026
Programme – M.Sc.(MATH)-2025
Course Name – Numerical Analysis with Computer Programming
Course Code - MSM17501 (T)
(Semester I)

Full Marks : 40 **Time : 2:0 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question) 1 x 10=10

1. *Choose the correct alternative from the following :*

(i) Select the correct output of the following codes:

```
int i=65;

printf("%c", i);
```

a) 65 b) i
c) A d) 97

(ii) Identify the correct one. _______ is not a function from math.h library file.

a) printf() b) sqrt()
c) pow() d) sin()

(iii) Identify the correct option. The Jacobi's method is a method of solving a matrix equation on a matrix that has no zeroes along ______

a) Leading diagonal b) Last column
c) Last row d) Non-leading diagonal

(iv) Select the correct number of assumptions are used in Jacobi's method.

a) 2 b) 3
c) 4 d) 5

(v) Select the correct option. Consider the initial value problem

$y' = x(y + x) - 2, y(0) = 2$. Use Euler's method with step sizes $h = 0.3$ to compute approximations to $y(0.6)$ is equals to

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a) 0.953
b) 0.0953
c) 0.909
d) -0.953

(vi) Choose the correct error in modified Euler's method .

a) $0\ (h^2)$
b) $0\ (h^3)$
c) $0\ (h^4)$
d) $0\ (h^5)$

(vii) Select the two major types of boundary conditions.

a) Wall and symmetry
b) Inlet and outlet
c) Dirichlet and Neumann
d) Initial and physical

(viii) Initial conditions are used for ___________ problems. Write the correct option.

a) time-dependent problems
b) boundary value problems
c) control volume problems
d) finite difference problems

(ix) Choose the correct problems so that the Crank-Nicolson scheme unconditionally stable.

a) Compressible flows
b) Advection problems
c) Diffusion problems
d) Convection-Diffusion problems

(x) Classify the condition $\frac{\partial y}{\partial n} = f$.

a) Neumann boundary condition
b) Dirichlet boundary condition
c) Cauchy boundary condition
d) Robin boundary condition

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Explain diagonal five-point formula for solving elliptic equations. (3)

3. Describe Jacobi's method to compute the eigenvalues of the following matrix $\begin{pmatrix} 1 & 2 \\ 2 & 1 \end{pmatrix}$. (3)

4. Explain predictor-corrector method for solving ordinary differential equation. (3)

5. Describe the MATLAB code for adding the matrices $A = \begin{pmatrix} 56 & 23 \\ 0 & 62 \end{pmatrix}$ and $B = \begin{pmatrix} 12 & 20 \\ 60 & 2 \end{pmatrix}$. (3)

6. Solve the boundary value problem $u_t = u_{xx}$ under the conditions $u(0,t) = u(1,t) = 0$ and $u(x,0) = sin\,\pi x$, 0, $0 \le x \le 1$ using the Schmidt method (Take $h = 0.2$ and $r = \frac{1}{2}$). (3)

OR

Write the solution of the PDE $y_{tt} = y_{xx}$ up to $t = 0.1$ with a spacing of 0.1 subject to $y(0,t) = 0, y(1,t) = 0, y_t\,(x,0) = 0$ and $y(x,0) = 10 + x(1-x)$. (3)

Group-C

(Long Answer Type Questions) 5 x 3=15

7. Discuss various types of array in C. (5)

8. Apply Milne's method and evaluate $y(1)$ by solving the differential equation $y' = x - y^2$ in the range $0 \le x \le 1$ given: (5)

$y(0.2) = 0.020,\ y(0.4) = 0.0795, y(0.6) = 0.1762, y(0.8) = 0.3046.$

9. Evaluate the solution of the equation $\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2}$ with the boundary conditions $u = 0$ at $x = 0$ and 1, $t > 0$ and the initial conditions $u = \frac{1}{2}\sin \pi x, \frac{\partial u}{\partial t} = 0$, (5)

when $t = 0, 0 \le x \le 1$, for x=0.2 and $t = 0.1$.

OR

Estimate the first approximate values at the interior mesh points of the following Dirichlet's problem (5)

$u_{xx} + u_{yy} = 0, u(x,0) = 0, u(0,y) = 0,$

$u(x,1) = 10x, u(1,y) = 20y.$

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