Part - II M.Sc II

Paper / Subject Code: 93624 / Mathematics : Paper IV Or V - Numerical Analysis.

Q. P. Code: 50899 Sem V

External (Scheme A) (3 Hours) [Total Marks:100
Internal (Scheme B) (2 Hours) [Total Marks:40

Note:

(1) **External (Scheme A) students answer any five questions.**

(2) **Internal (Scheme B) students answer any three questions.**

(3) **All questions carry equal marks. Scientific calculator can be used.**

(4) **Write on top of your answer book the scheme under which you are appearing.**

Que. 1 (a) Explain the terms: Inherent error, Round-off error and Truncation error. Find the truncation error for e^x at $x = \frac{1}{5}$ and $x = \frac{1}{9}$ if the first three terms are retained in the expansion.

(b) Convert the hexadecimal number $(1F5.B)_{16}$ to the binary form and then convert to the decimal form.

Que. 2 (a) Define the term rate of convergence of iterative method and also find the rate of convergence of the Chebyshev method.

(b) Perform two iterations of the Bairstow method to extract a quadratic factor $x^2 + px + q$ from the equation $x^4 + x^3 + 2x^2 + x + 1 = 0$. Use initial approximations $p_0 = 0.5$, $q_0 = 0.5$.

Que. 3 (a) Describe the Jacobi's method to obtain eigen values and eigen vectors of a real symmetric matrix $A = [a_{ij}]$ of order $n \times n$.

(b) Solve the following system of linear equations using Gauss-Seidel iteration method. $6x + 15y + 2z = 72$; $x + y + 54z = 110$; $27x + 6y - z = 85$. (Take 5 iterations.)

Que. 4 (a) Define interpolating polynomial and estimate the error in the interpolating polynomial.

(b) Find the cubic Lagrange's interpolating polynomial from the following data:

x:	0	1	2	5
f(x):	2	3	12	147

Que. 5 (a) Derive Newton-Cotes quadrature formula and use it to derive Trapezoidal rule for numerical integration.

(b) Evaluate $\int_0^{1.5}\int_0^1 e^{x+y}\,dxdy$ using Simpson's three eight rule with $h = k = \frac{1}{2}$.

Que. 6 (a) Using the least-squares method, obtain the normal equations to find the values of a, b, c and d when the curve $y = d + cx^2 + bx^3 + ax^4$ is to be fitted for the data points $(x_i, y_i), i = 1, 2, 3......., n$.

(b) Using the Chebyshev polynomials, obtain the least squares approximation of second degree for $f(x) = 3x^4 - 5x^3 + 11x + 22$ on $[-1, 1]$ with respect to the weight function $w(x) = \frac{1}{\sqrt{1-x^2}}$.

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Mathematics
Paper IV
Block No 01
Room No 08
01

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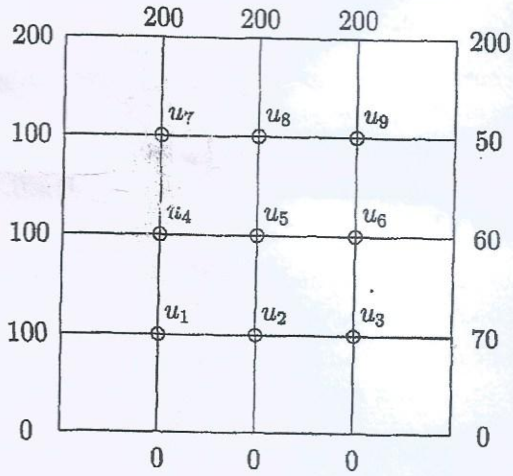
Que. 7 (a) Derive the Milne's predictor-corrector formula to solve the differential equation $\frac{dy}{dx} = f(x, y)$ with $y(x_0) = y_0$.

(b) Using Euler's modified formula, find an approximate value of $y(0.05)$ and $y(0.1)$, given that $\frac{dy}{dx} = x^2 + y$ with $y(0) = 1$. [Take $h = 0.05$].

Que. 8 (a) Derive a numerical method to find the numerical solution of one dimensional wave equation with initial and boundary conditions.

(b) Use Liebmann's method to solve the Laplace equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ at the interior mesh points of the square region with boundary values given in the following figure.



[Take 2 iterations and obtain result correct upto three decimal places.]

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