Registration No.: | | | | | | | | | | |

Total number of printed pages - 2

M.Tech.
MDPE105

First semester Regular/ Back Examination - 2015-16

Numerical Analysis

QUESTION CODE : T1199

Full Marks - 70
Time : 3 Hours

Answer Question No. 1 which is compulsory and any five from the rest. The figures in the right-hand margin indicate marks.

1. Answer all the questions precisely. [2×10]

   (a) Verify $\Delta = E - 1$.

   (b) Find the cube root of 12.

   (c) What is the order of convergence of fixed point method?

   (d) What is the error in trapezoidal integration?

   (e) What is diagonally dominated matrix?

   (f) What is ill-condition?

   (g) What is the value of $(\Delta - \nabla)(x^2)$

   (h) What is the difference between precision and accuracy.

   (i) If $\int_a^b f(x)\mathrm{d}x = \alpha f(a) + \beta f(b)$ correct up to first degree polynomial, then find α and β.

   (j) What is the difference between single-step and multi-step method.

2. Answer according to the instruction.

   (a) Find the root of the equation $x^2 + 2x - 3 = 0$ in the interval [0, 2] using fixed point method correct up to 4-decimal places. [5]

   (b) Compute the real root of $f(x) = 2^x - 3x = 0$ in the interval $0 \le x \le 2$ using Newton's method. [5]

3. Answer precisely.

   (a) Solve the system of equations $x + 2y + 3z = 5$, $2x + y + z = 4$ and $3x + y + 3z = 7$ using Gauss-Seidel method. [5]

   (b) Compute the largest eigenvalue and corresponding eigenvector of the matrix whose row are $(7, 6, -3)$, $(-12, -20, 24)$ and $(-6, -12, 16)$ [5]

4. Give precise answer.

   (a) Construct the Lagrange interpolating polynomial using the data points $(-1, 10)$, $(0, 7)$, $(2, 7)$ and $(5, 22)$. [5]

   (b) If $P_3(x) = 2H_0(x) + 2H_1(x) + 5H_2(x) + 4H_3(x)$ is the Hermite interpolating polynomial corresponding to the data $(1, 2, 2)$ and $(2, 5, 4)$, then find cubic polynomials $H_i(x)$ for $0 \le i \le 4$. [5]

5. Answer in detail.

   (a) Evaluate the integration $\int_0^1 \frac{dx}{\sqrt{1+x^2}}$ using one third Simpson's rule with $h = \frac{1}{4}$. [5]

   (b) Evaluate the integration $\int_1^2 \frac{dx}{1+x^3}$ using 3-point Gauss-Legendre quadrature formula. [5]

6. Give the detail derivation.

   (a) Use the Runge-Kutta method to obtain the numerical solution $y(0.5)$ up to 4-decimal places of the initial value problem $y' = x^2 + y^2$, $y(0) = 1$, by taking $h = 0.1$. [5]

   (b) Solve the boundary value problem given by $y''(x) = y^2$ for $0 \leq x \leq 1$ with $y(0) = 1$ and $y'(1) = 0.5$. [5]

7. Give details of the answer.

   (a) Derive the alternating direction implicity procedure for solving Poission equation. [5]

   (b) Solve the elliptic partial differential equation in a domain whose boundaries $0 \leq x, y \leq 1$ are kept at 10 degree temperature using 3 grid point. [5]

8. Answer in detail.

   (a) Use the Adams-Bashforth method to obtain the numerical solution $y(0.5)$ of the initial value problem $y' = 1 + y^2$, $y(0) = 0$ which is correct up to 4-decimal place by taking $h = 0.1$. Approximate $y(0.1)$, $y(0.2)$ and $y(0.3)$ by Runge-Kutta method [5]

   (b) Find the solution of the differential equation $y''(x) = x$ with $y(0) = 0$ and $y'(1) = -\frac{1}{2}$. [5]

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