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08MTP/MAU/MFD11

First Semester M.Tech. Degree Examination, Dec.09/Jan.10
Applied Mathematics

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

1 a. Find the binary form of the number 193. **(06 Marks)**

b. The number 3.1415927 is approximated as 3.1416. Find the following:
i) error ii) relative error and iii) number of significant digits of the approximation. **(04 Marks)**

c. If $A = \begin{bmatrix} 2 & 3 & 4 \\ 1 & -5 & 6 \end{bmatrix}$, $B = \begin{bmatrix} 8 & 0 \\ 2 & 7 \\ -1 & 4 \end{bmatrix}$, write Fortran program for the multiplication of the matrices A & B. **(10 Marks)**

2 a. Find the L_1, L_2, L_∞ and L_e norms of the matrix $A = \begin{bmatrix} 4 & 3 \\ 7 & 6 \end{bmatrix}$ **(06 Marks)**

b. Find the solution of the following set of equations using the Gauss elimination method:
$2x_1 - x_2 + x_3 = 4$, $4x_1 + 3x_2 - x_3 = 6$ and $3x_1 + 2x_2 + 2x_3 = 15$ **(06 Marks)**

c. Find the inverse of the matrix $A = \begin{bmatrix} 4 & -1 & 1 \\ -1 & 6 & -4 \\ 1 & -4 & 5 \end{bmatrix}$ using the relation $[A]^{-1} = [U]^{-1}([U]^{-1})^T$. **(08 Marks)**

3 a. Convert the eigen value problem

$$\begin{bmatrix} 15000 & -5000 \\ -5000 & 5000 \end{bmatrix}\begin{Bmatrix} x_1 \\ x_2 \end{Bmatrix} = \lambda\begin{bmatrix} 20 & 0 \\ 0 & 5 \end{bmatrix}\begin{Bmatrix} x_1 \\ x_2 \end{Bmatrix}$$

to a standard eigen value problem. **(08 Marks)**

b. Find the Eigen values and the Eigen vectors of the matrix

$$A = \begin{bmatrix} 12 & 6 & -6 \\ 6 & 16 & 2 \\ -6 & 2 & 16 \end{bmatrix}$$ by using Jacobi method. **(04 Marks)**

c. Generates the functions $f_i(\lambda)$, $i = 0, 1, 2, 3$ and 4 for the tridiagonal matrix

$$A = \begin{bmatrix} 3 & -2 & 0 & 0 \\ -2 & 5 & -3 & 0 \\ 0 & -3 & 7 & -4 \\ 0 & 0 & -4 & 9 \end{bmatrix}$$ **(08 Marks)**

4 a. Evaluate the mixed partial derivative $\frac{\partial^4 f}{\partial x^2 \partial y^2}$ of the function $f(x, y) = 2x^4x^3$ using central differences at $x = 1$ and $y = 1$ with a step size $\Delta x = \Delta y = 0.1$ **(12 Marks)**

b. Find the first three derivatives of $f(x) = x^2e^{-4x}$ and express Taylor's series expansion of f(x) at $x = 1$. **(08 Marks)** termine the value of the integral $I = \int_a^b f(x)dx$, where

$$f(x) = 0.84885406 + 31.51924706x - 137.66731262x^2 + 240.55831238x^3 - 171.45245361x^4 + 41.95066071x^5$$

m a = 0.0 and b = 1.5 using Simpson's 1/3 rule with different step sizes. **(08 Marks)**

aluate the integral $I = \int_0^2 ye^{2y}dy$ using the Gauss-Legendre quadrature. **(04 Marks)**

aluate the integral $I = \int_{z=0}^{2}\int_{y=1}^{4}\int_{x=-1}^{3} 5xy^3z^2\,dx\,dy\,dz$ using the two-point Gauss-Legendre quadrature rule. **(08 Marks)**

nd the solution of the initial value problem $y' = y + 2x - 1$; $y(0) = 1$ in the interval $x \le 1$ using Adams – Bashforth open formulas of order 2 through 6. **(10 Marks)**

nd the solution of the initial value problem.

$-1 + 2x + y$; $y(0) = 1$, at $x = 0.4$ using the fourth order Adams predictor-corrector method with $h = 0.1$. **(10 Marks)**

he differential equation governing the transverse deflection of a beam w(x) subjected to a distributed load, p(x) as shown in the Fig.7(a), is given as

$$\frac{d^2}{dx^2}\left(EI\frac{d^2w}{dx^2}\right) = p(x)$$

here E = Young's modulus and I = area moment of inertia of the beam.

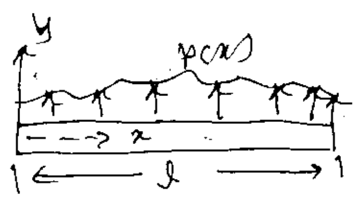

Fig.7(a)

rmulate the boundary value problem for a uniform beam i) fixed at the both ends and ii) mply supported at both ends. **(08 Marks)**

plain the shooting methods. **(12 Marks)**

metal rod of length 1 m is initially at 70°C. The steady-state temperature of the left and ht ends of the rod are given as 50°C and 20°C respectively. Using $\alpha^2 = 0.1\ m^2/min$, 0.2m and $\Delta t = 0.3$ min, determine the temperature distribution in the rod for $0 \le t \le 0$, ng Crank-Nicholson method. **(10 Marks)**

aluminium plate of size 0.3m×0.3m is initially at the temperature 30°C. If the adjacent es of the plate are suddenly brought to 120°C and maintained at the temperature, derive equations necessary for the determination of the time variation of temperature in the ate using the alternating direction implicit method.

a K = 236W/m-k, C = 900 J/kg-K, $\rho = 2700\ kg/m^3$, $\Delta x = \Delta y = 0.1$ m. **(10 Marks)**

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