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10MTP11

First Semester M.Tech. Degree Examination, December 2011
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. Define absolute, relative, percentage, inherent, round – off and truncation errors. Suppose, in a certain computational work 4.0001 is used as an approximate value of 4. Find the error, the absolute error and the percentage error. **(10 Marks)**

b. Slove: $2x - y + z = 4$
$4x + 3y - z = 6$
$3x + 2y + 2z = 15$, by Gauss – Jordhan method. **(10 Marks)**

2 a. Solve the following system of equations by using the LV decomposition method.
$2x_1 + x_2 + 4x_3 = 12$
$4x_1 + 11x_2 - x_3 = 33$
$8x_1 - 3x_2 + 2x_3 = 20$ **(10 Marks)**

b. Write an algorithm for Gauss – Seidal method for solving a system of linear algebraic equations. **(10 Marks)**

3 a. Using the Jacobi's method, find all the Eigen values and the corresponding Eigen vectors of the matrix. $A = \begin{bmatrix} 1 & \sqrt{2} & 4 \\ \sqrt{2} & 3 & \sqrt{2} \\ 4 & \sqrt{2} & 1 \end{bmatrix}$. **(10 Marks)**

b. By employing the Given's method, reduce the matrix, $A = \begin{bmatrix} 2 & 1 & -2 \\ 1 & 2 & -2 \\ -2 & -2 & 3 \end{bmatrix}$, to tridiagonal form and hence find its largest eigen value. **(10 Marks)**

4 a. A rod is rotating in a plane. The following table gives the angle θ(in radians) the rod has turned through, for various values of time t (in seconds).

t :	0	0.2	0.4	0.6	0.8	1.0	1.2
θ :	0	0.12	0.49	1.12	2.02	3.20	4.67.

Calculate the angular velocity and angular acceleration of the rod at t = 0.4 seconds. **(10 Marks)**

b. Evaluate the mixed partial derivative $\frac{\partial^4 f}{\partial x^2 \partial y^2}$ of the function $f(x.y) = 2x^4 y^3$, using central differences at $x = 1$ abd $y = 1$, with a step size $\Delta x = \Delta y = 0.1$. **(10 Marks)**

5 a. Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Romberg's method, correct to four decimal places. Hence deduce an approximate value of π. **(10 Marks)**

b. Evaluate the integral, $I = \int_1^2 \int_1^2 \frac{dx\ dy}{x+y}$, using the trapezoidal rule with h = k = 0.5 and h = k = 0.25. **(10 Marks)**

6 a. Compute y(0.1) and y(0.2) by Runge – Kutta method of 4^{th} order for the differential equation, $\frac{dy}{dx} = xy + y^2,\ y = (0)\ 1.$ **(10 Marks)**

b. Using Adams – Bashforth method, determine y(1.4) given that $\frac{dy}{dx} - x^2y = x^2,\ y(1) = 1.$ Obtain the starting values from Euler's method. (with, h = 0.1) **(10 Marks)**

7 a. Find the deflection of the uniform fixed – fixed beam, shown in Fig. 7(a), using the finite – difference method. **(10 Marks)**

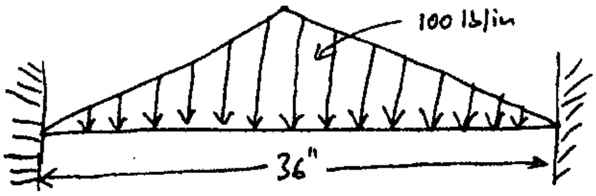

Fig. 7(a).

The data are h = 9", E = 30 x 10^6 psi, l = 36" and I = 2 in^4.

b. Derive the eigen value problem, corresponding to the free longitudinal vibration of a fixed – free bar using central differences. **(10 Marks)**

8 a. Derive the equation governing the free vibration of a beam. **(10 Marks)**

b. Find the solution of the equation:

$$\frac{\partial^2\phi}{\partial x^2} = \frac{\partial^2\phi}{\partial t^2}, 0 \le x \le 1$$

subject to the boundary conditions,

$$\phi(0, t) = 0, t > 0$$
$$\phi(1, t) = 0, t > 0$$

and the initial conditions

$$\phi(x, 0) = \sin \pi x, 0 \le x \le 1$$

and $\frac{\partial \phi}{\partial t}(x, 0) = 0, 0 \le x \le 1.$ **(10 Marks)**

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