Code: 9A14501 R09

B.Tech III Year I Semester (R09) Supplementary Examinations, May 2013

NUMERICAL METHODS

(Mechatronics)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

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1 (a) Find a root of the equation $2x = \cos x + 3$ correct to three decimal places by iteration method.

(b) Find a root of the equation $x^2 - 4x - 10 = 0$ by using bisection method.

2 (a) Apply Jacobi – iteration method to solve the equations:

$$3x_1 - 2x_2 = 5;$$
$$-x_1 + 2x_2 - x_3 = 0$$
$$-2x_2 + x_3 = -1$$

(b) Apply Gauss – Jordan method to solve the equations:

$$x + y + z = 9;$$
$$2x - 3y + 4z = 13$$
$$3x + 4y + 5z = 40$$

3 (a) Show that:

(i) $\delta = E^{1/2} - E^{-1/2}$

(ii) $\Delta - \nabla = \Delta\nabla = \delta^2$

(iii) $hD = \log(1 + \Delta) = -\log(1 - \Delta) = \sin h^{-1}(\mu\delta)$.

(b) Use Lagrange's formula to find the form of $f(x)$, given

x:	0	2	3	6
$f(x)$:	648	704	729	792

4 (a) Fit a straight line of the form $y = a + bx$ to the data:

x	1	2	3	4	6	8
y	2.4	3.1	3.5	4.2	5.0	6.0

(b) Give the data points:

x_1	5	4	3	2	1
x_2	3	-2	-1	4	0
y	15	-8	-1	26	8

Obtain a regression plane to fit the data.

5 (a) Find the first and second derivatives of $f(x)$ at $x = 1.5$ for the following data.

x:	1.5	2.0	2.5	3.0	3.5	4.0
$f(x)$:	3.375	7	13.625	24	38.875	59

(b) Evaluate $\int_0^{\pi/2} \sqrt{\sin\theta}\, d\theta$, using Simpson's rule with $h = \pi/12$.

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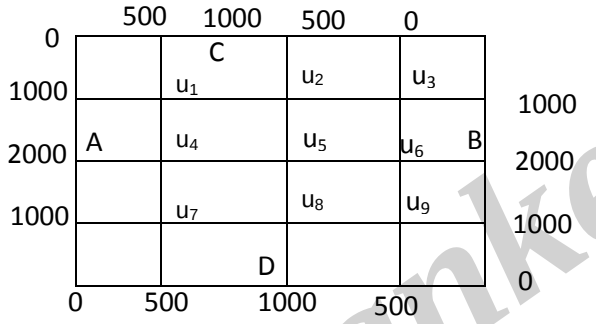
6 (a) Employ Taylor's series method to obtain approximate value of 'y' at $x = 0.1$ and 0.2 for the differential equation $\frac{dy}{dx} = x - y^2,\ y(0) = 1.$

(b) Use Adams – Bashforth method to find y (4, 4), given $5xy^1 + y^2 - 2 = 0,\ y(4) = 1,$ $y(4.1) = 1.0049,\ y(4.2) = 1.0097,\ y(4.3) = 1.0143.$

7 (a) Find the largest Eigen value and corresponding Eigen vector of the matrix.
$\begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$ by power method.

(b) Given the equation $\frac{d^2y}{dx^2} = e^{x^2}$ with $y(0) = 0,\ y(1) = 0.$ Estimate the values of $y(x)$ at $x = 0.25$ and $x = 0.5$ by finite – difference method.

8 Solve the elliptic equation $u_{xx} + u_{yy} = 0$ for the following square mesh with boundary values as shown in the figure.



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