R09

Code No: C1504

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.TECH I - SEMESTER EXAMINATIONS, APRIL/MAY-2012
COMPUTATIONAL METHODS IN ENGINEERING
(MACHINE DESIGN)

Time: 3hours **Max. Marks: 60**

Answer any five questions
All questions carry equal marks
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1. Use any matrix iterative method to solve the following system of equations:
$4X_1 + X_2 - X_3 = 3$;
$2X_1 + 7\,X_2 + X_3 = 19$;
$X_1 - 3\,X_2 + 12\,X_3 = 31$.

2.a) Derive Simpson's 1⁄3 rule from Newton–Cotes formulas.
b) The velocities of a car running on a straight road at intervals of 2 minutes are given below. Apply Simpson's rule to find the distance covered by the car.

Time in Minutes	0	2	4	6	8	10	12
Velocity in km/hr	0	22	30	27	18	7	0

3. Determine the smallest distance from the point (5, 8) to the curve $xy = 5$ using constrained optimization technique.

4. Develop a functional for the boundary value problem $\frac{d^2u}{dx^2} = x$, $0 < x < 1$ with u (0) = 0 and u (1) = 0. Use the same functional to solve the boundary value problem by Rayleigh – Ritz method using an approximating function $u = kx(1-x)$ where k is a constant.

5. Write down the finite difference analogue of the Laplace's equation $u_{xx} + u_{yy} = 0$ and solve it for the region bounded by the square $0 \le x \le 4$ and $0 \le y \le 4$, the boundary conditions being $u = 0$ at $x = 0$, $u = 8+2y$ at $x = 4$, $u = 0.5x^2$ at $y = 0$ and $u = x^2$ when $y = 4$.Consider grid spacing in each direction as 1.

6. Solve the heat conduction equation, $u_{xx} - u_t = 0$, subject to boundary conditions $u(0,t) = u(1,t) = 0$ and $u(x,0) = x - x^2$. Take $h = 0.25$ and $k = 0.025$.

7. Construct a least square quadratic approximation to the function $y(x) = \sin x$ on $[0, \pi/2]$ with respect to the weight function $W(x) = 1$.

8. Use the finite difference method to solve the wave equation $u_{tt} = 4\,u_{xx}$ over the rectangle $R = \{(x, t): 0 \le x \le 1, 0 \le t \le 1\}$. The string at rest has length L =1. Assume that the initial position is $u(x, 0) = \sin(\pi x)+\sin(2\pi x)$.

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