Code No: G3501/R13

M. Tech. I Semester Supplementary Examinations, December-2016

COMPUTER AIDED NUMERICAL MATHEMATICS

(Computer Aided Structural Engineering)

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

Answer any FIVE Questions
All Questions Carry Equal Marks

1. a Find a real root of x *tanx +1=0* using Newton Raphson method.
   b Find a real root of the equation $x\log_{10} x = 1.2$ using bisection method.

2. a A solid of revolution is formed by rotating the area between the x-axis, the lines x = 0 and x = 1 and a curve through the points with the following coordinates

x	0	0.25	0.50	0.75
y	1	0.9896	0.9589	0.9089

   Estimate the volume of the solid given by $V = \pi\int_0^1 y^2 dx$ using Simpson's $1/3^{rd}$ rule.

   b Evaluate $\int_0^1 \frac{1}{1+x} dx$ correct to three decimal places with h = 0.5, h = 0.25 successively using Trapezoidal and Romberg integration.

3. a Solve the system of equations using LU decomposition method $27x + 6y - z = 85$, $6x + 15y + 2z = 72$, $x + y + 54z = 110$.
   b Perform three iterations of the Newton Raphson method to solve the system of equations $x^2 + xy + y^2 = 7$ and $x^3 + y^3 = 9$.

4. Using shooting method, solve the boundary value problem
$$u'' = u + 1, 0 < x < 1,\ u(0) = 0,\ u(1) = e - 1.$$

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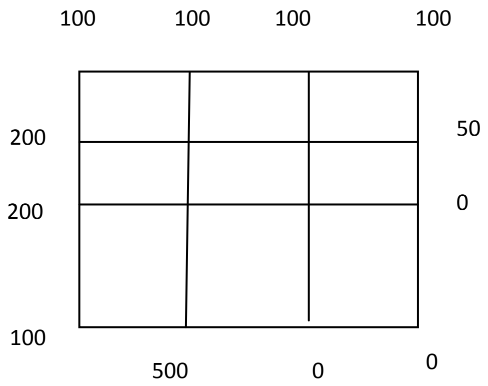
5. Given the values of u(x,y) on the boundary of the square in the figure, evaluate the u(x,y) satisfying the Laplace equation at the interior nodes of the grid using Gauss Seidel method.



6. a Solve the Laplace equation with h = 1/3 over the boundary of a square of unit length, with u(x,y) = 3xy on the boundary.

   b Write the Crank Nicholson scheme and then solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$, *u(x,0)=sinx*, $0 \le x \le \pi$, $u(0,t)=0=u(\pi,t)$ for $u(\pi/2, \pi^2/16)$.

7. a Solve the one dimensional heat equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$
   Subject to the conditions $u(x,0)=0=u(0,t)$, $u(1,t)=t$ using Bender Schmidt method.

   b Derive necessary and sufficient conditions for stability of the finite difference equation related to parabolic equation.

8. a Explain different steps involved in the implementation of finite element approach.

   b Solve the one dimensional Poisson equation $\frac{d^2T}{dx^2} = -20$ for a 100 cm rod with boundary conditions T(0,t)=15 and T(100,t)=30 using finite element approach.

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