15. a. Solve $\nabla^2 u = -10(x^2+y^2+10)$ over the square mesh with sides $x = 0, y = 0, x = 3, y = 3$ with $u = 0$ on the boundary and mesh length 1 unit.

**(OR)**

b. Using Crank Nicholson's scheme, solve

$16\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$, $0 < x < 1, t > 0$

given $u(x,0) = 0$, $u(0,t) = 0$, $u(1,t) = 100t$ by computing '$t$' for two time steps in t direction, taking $h = 0.25$.

* * * *

| Reg. No. | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|

**B.Tech. DEGREE EXAMINATION, NOVEMBER 2012**
Fourth Semester

MA0202 – NUMERICAL METHODS
*(For the candidates admitted from the year 2007-2008 onwards)*

Time: Three hours Max. Marks: 100

Answer **ALL** Questions

**PART – A (10 × 2 = 20 Marks)**

1. Transform $y = ax^b$ into linear form.
2. State the condition of convergence for iterative methods of solving simultaneous linear equation.
3. Prove that $\Delta = \mu\delta + \frac{\delta^2}{2}$ with usual notations.
4. State Lagrange's inverse interpolation formula.
5. State the formulas for $\frac{dy}{dx}$ *at* $x = x_o$ *and* $\frac{d^2y}{dx^2}$ *at* $x = x_n$.
6. What are the order of errors in Trapezoidal rule and Simpson's 1/3 rule?
7. State modified Euler's iterative formula for solving $y' = f(x,y)$ *with* $y(x_0) = y_0$.
8. Give Milne's predictor corrector formula.
9. Classify PDE $u_{xx} - 2u_{xy} + 4u_{yy} = 0$.
10. Give Crank Nicholson difference scheme for solving a parabolic equation.

## PART – B (5 × 16 = 80 Marks)

11.a.i Fit a parabola $y = ax^2+bx+c$ to the data given below.

| $x$ | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| $y$ | 12 | 9 | 6 | 2 | 11 | 5 |

ii. Find the root of $3x-\cos x-1=0$ using Newton Raphson method.

**(OR)**

b. i. Solve by using Gauss Seidal method

$8x-3y+2z = 20,\ 2x+y+4z = 12,\ 4x+11y-z = 33$

ii. Find the inverse of the matrix $A=\begin{pmatrix} 2 & 1 & -1 \\ 0 & 2 & 1 \\ 5 & 2 & -3 \end{pmatrix}$ by Gauss elimination method.

12. a. Find the values of f(x) at x = 1.85 and x = 2.25 from the table given below using Newton's interpolation formula.

| $x$ | 1.7 | 1.8 | 1.9 | 2.0 | 2.1 | 2.2 | 2.3 |
|---|---|---|---|---|---|---|---|
| $f(x)$ | 5.4739 | 6.0496 | 6.6859 | 7.3891 | 8.1662 | 9.0250 | 9.9742 |

**(OR)**

b. i. Using Newton's divided difference formula, find the values of f(2), f(8) and f(15) given the following table.

| $x$ | 4 | 5 | 7 | 10 | 11 | 13 |
|---|---|---|---|---|---|---|
| $f(x)$ | 48 | 100 | 294 | 900 | 1210 | 2028 |

ii. Given the data, find $y(x)$ as a polynomial of degree 2 using Lagrange's interpolation formula.

| $x$ | 1 | 2 | 4 |
|---|---|---|---|
| $y(x)$ | 3 | –5 | 4 |

13.a.i The following table gives the population of a city in lakhs.

| Year | 1951 | 1961 | 1971 | 1981 | 1991 |
|---|---|---|---|---|---|
| Population | 40.62 | 60.80 | 79.95 | 103.56 | 132.65 |

Find the rate of change of growth of population in 1951 and 1991.

ii. Obtain the second derivative of y at x = 0.96 from the data.

| $x$ | 0.96 | 0.98 | 1.0 | 1.02 | 1.04 |
|---|---|---|---|---|---|
| $f(x)$ | 0.7825 | 0.7739 | 0.7651 | 0.7563 | 0.7473 |

**(OR)**

b. i. Evaluate $\int_0^1 \frac{dx}{1+x^2}$ by dividing the range into 8 equal parts using Simpson's rule and hence estimate the value of $\pi$.

ii. The table below gives the velocity $V$ of a moving particle at time $t$ seconds. Find the distance covered by the particle in 12 seconds using Simpson's 3/8 rule.

| $t$ | 0 | 2 | 4 | 6 | 8 | 10 | 12 |
|---|---|---|---|---|---|---|---|
| $V$ | 4 | 6 | 16 | 34 | 60 | 94 | 136 |

14.a. Compute y(0.1) and y(0.2) given that $y' = \frac{y-x}{y+x},\ y(0)=1$ using 4th order Runge Kutta method.

**(OR)**

b. Find y(2) from

$\frac{dy}{dx} = \frac{x+y}{2},\ y(0)=2,\ y(0.5)=2.636,\ y(1.0)=3.595,$

$y(1.5)=4.968$ using Adam Bashforth predictor corrector formula.