Model Question Paper (Theory)
B.A/B.Sc. III Year Examination, March/April 2011
MATHEMATICS PAPER IV(a)
NUMERICAL ANALYSIS

Time: 3Hrs **Maximum Marks: 100**

NOTE: Answer 6 questions from Section –A and 4 questions from Section –B choosing at least one from each unit. Each question in Section –A carries 6 marks and each question in Section-B carries 16 marks.

SECTION-A (6×6=36)

Unit I

1) Define Absolute, Relative and Percentage errors. Find the relative and percentage error in $u = 6v^5 - 3v^4$ at $v = 1.5 \pm 0.0025$.
2) Using Newton-Raphson method find root of the equation $x^3 - 5x + 3 = 0$ Correct to three decimal places.

Unit II

3) Find the missing term in the following table:

x	0	1	2	3	4
y	1	3	9	-	81

4) Determine the values of Δy_{-1}, $\Delta^3 y_{-2}$, $\Delta^5 y_{-3}$ in terms of y_0 by using definition of forward difference.

Unit III

5) Derive normal equations for fitting a straight line $y = a + bx$.
6) Find the value of $\int_3^7 x^2 log x \, dx$ by taking 8 strips using Boole's rule.

Unit IV

7) Explain ill conditioned and well-conditioned linear systems.
8) Derive Taylors series solution of $\frac{dy}{dx} = f(x, y)$, $y(x_0) = y_0$.

SECTION-B (4× 16=64)

Unit I

9) a) Define multiplicity of a root of $f(x) = 0$.Explain Newtons generalized formula for approximation of a multiple root with multiplicity p for $f(x) = 0$.

b) Find the smallest root of the equation $y(x) = x^3 - 6x^2 + 11x - 6 = 0$ by Ramanujan's method.

10) a) Explain the method of false position with its geometric significance.

b) Find the root of the equation $y(x) = x^3 - 2x - 5 = 0$ which lies between 2 & 3 by Muller's method.

Unit II

11) a) Derive Newton's forward interpolation formula.

b) From the following table , find the value of $e^{1.17}$ using Gauss forward formula:

x	1.00	1.05	1.10	1.15	1.20	1.25	1.30
e^x	2.7183	2.8577	3.0042	3.1582	3.3201	3.4903	3.6693

12) a) Derive Langrange's interpolation and estimate error in Langrange's interpolation formula.

b) If $f(x) = \frac{1}{x^2}$ find the divided differences in [a,b] and [a,b,c].

Unit III

13) a) Determine the constants a and b by the least squares method such that $y = ae^{bx}$, fits the following data:

x	1.0	1.2	1.4	1.6
y	40.170	73.196	133.372	243.02

b) From the following table of values of x and y find $\frac{dy}{dx}$, $\frac{d^2y}{dx^2}$ when $x = 6$.

x	0	1	2	3	4	5	6
y	6.9897	7.4036	7.7815	8.1291	8.4510	8.7506	9.0309

14) a) Derive Simpson's $\frac{3^{th}}{8}$ rule and find error in it.

b) Using Trapezoidal rule find the value of $\int_0^{\frac{\pi}{2}} \sqrt{cos\theta}\, d\theta$ by dividing integral into 6 parts.

Unit IV

15) a) Explain the method of solving system of equations by Gauss –Siedal iterative method.

b) Solve the equations by the method of Factorization:

$2x + 3y + z = 9, \quad x + 2y + 3z = 6, \quad 3x + y + 2z = 8.$

16) a) Describe Euler's modified method of solving $\frac{dy}{dx} = f(x, y), \quad y(x_0) = y_0$.

b) Solve by Runge-Kutta method of fourth order, $10\frac{dy}{dx} = x^2 + y^2, y(0) = 1$ with $h = 0.1$ and obtain $y(0.2)$.