Biyani Girls college ,Jaipur

Model Paper-A (B.Sc. II)

Subject: Mathematics

Paper : Numerical Analysis

Max Marks: 32 **Max Time: 2:30 hrs**

Attempt any five questions in all selecting atleast one question from each unit.

Unit 1

Q.1 Prove that

(i) $\mu\delta = \frac{1}{2}(\Delta + \nabla)$ (ii) $1 + \left(\frac{\delta^2}{2}\right) = \sqrt{1+\delta^2\mu^2}$

Given, log 100 = 2, log 101 = 2.0043, log 103 = 2.0128, log 104 = 2.0170. Find log 102.

Or

(i) Derive the Newton Forward Interpolation Formula.

(ii)

By means of Lagrange's formula, prove that

$$y_1 = y_3 - 0.3\,(y_5 - y_{-3}) + 0.2\,(y_{-3} - y_{-5}).$$

Unit 2

Q.2 (i)

The values of e^{-x} at x = 1.72 to x = 1.76 are given in the following table:

x:	1.72	1.73	1.74	1.75	1.76
e^{-x}:	0.17907	0.17728	0.17552	0.17377	0.17204

Find the value of $e^{-1.7425}$ using Gauss' forward difference formula.

(ii)

Find the value of y_{15}, using Bessel's formula, if

$$y_{10} = 2854,\quad y_{14} = 3162,\quad y_{18} = 3544,\quad y_{22} = 3992.$$

or

(i) Find the First Derivative and second Derivative of Newton Backward Interpolation.

Evaluate

$$\int_0^6 \frac{dx}{1+x^2} \text{ by using}$$

(i) *Simpson's one-third rule*

(ii) *Simpson's three-eighth rule*

(iii) *Trapezoidal rule*

Unit 3

Q.3 (i)

Approximate y and z by using Picard's method for the particular solution of $\frac{dy}{dx} = x + z$, $\frac{dz}{dx} = x - y^2$ *given that* $y = 2$, $z = 1$ *when* $x = 0$.

(i) By Runge Kutta method

Given $\frac{dy}{dx} = y - x$, $y(0) = 2$. *Find* $y(0.1)$ *and* $y(0.2)$ *correct to f*

decimal places

Or

Given that $\frac{dy}{dx} = log_{10}(x + y)$ *with the initial condition that* $y = 1$ *when* $x = 0$. *Find y for* $x = 0.2$ *and* $x = 0.5$ *using Euler's modified formula.*

Unit 4

Q.4. A necessary and sufficient condition that a vector $\overrightarrow{F(t)}$ to be constant direction only is $\vec{F} \times \frac{\overrightarrow{dF}}{dt}$

(b) Find the directional derivative of $\phi = 4xz^3 - 3x^2y^2z$ at the point (2, -1,2) in the direction 2i-sj+6k.

or

Verify Stokes Theorem for the function F=zi+xj+yk where C is the unit circle in the x-y plane bounding the hemisphere z=$\sqrt{1 - x^2 - y^2}$

Verify divergence theorem for F=xyi+$z^2j + 2yzk$on the tetrahedron x = y = z =0, x + y + z =1

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Model Paper-B (B.Sc. II)

Subject: Mathematics

Paper : Numerical Analysis

Max Marks: 32 **Max Time: 2:30 hrs**

Unit 1

Q.1

Express $y = 2x^3 - 3x^2 + 3x - 10$ *in factorial notation and hence show that* $\Delta^3 y = 12$.

b)

Estimate the production for 1964 and 1966 from the following data:

or

Prove that the Lagrange's formula can be put in the form

$$P_n(x) = \sum_{r=0}^{n} \frac{\phi(x)\, f(x_r)}{(x - x_r)\, \phi'(x_r)}$$

where $$\phi(x) = \prod_{r=0}^{n} (x - x_r)$$

Unit 2

Q.2 (i) *From the following table, find the value of* $e^{0.24}$

Where x= 0.1, 0.2, 0.3, 0.4 , 0.5

(ii)

Using Bessel's formula, find f '(7.5) from the following table:

x:	7.47	7.48	7.49	7.5	7.51	7.52	7.53
f(x):	0.193	0.195	0.198	0.201	0.203	0.206	0.208.

or

(a) Use Gauss's forward interpolation formula to find f(32) from the given table

X:	25	30	35	40
F(x):	0.2707	0.3027	0.3386	0.3794

(b)

If third differences are constant, prove that

$$y_{x+\frac{1}{2}} = \frac{1}{2}(y_x + y_{x+1}) - \frac{1}{16}(\Delta^2 y_{x-1} + \Delta^2 y_x)$$

Unit 3

Q.3 **Solve the following system of equations :**

$$10x_1 + 2x_2 + x_3 = 9$$

$$2x_1 + 20x_2 - 2x_3 = -44$$

$$-2x_1 + 3x_2 + 10x_3 = 22$$

Use Gauss Jordan Method.

(b) Solve the following system of equation by Jacobi Method.

$83x_1 + 11x_2 - 4x_3 = 95$

$7x_1 + 52x_2 + 13x_3 = 104$

$3x_1 + 8x_2 + 29x_3 = 71$

Or

(a) *Given the differential eqn.* $\frac{dy}{dx} = \frac{x^2}{y^2+1}$

with the initial condition $y = 0$ *when* $x = 0$. *Use Picard's method to obtain y for* $x = 0.25$, 0.5 *and* 1.0 *correct to three decimal places.*

(b) Using Euler's modified method, obtain a solution of the equation $\frac{dy}{dx} = x + |\sqrt{y}|$ **with initial conditions y = 1 at x = 0 for the range** $0 \le x \le 0.6$ **in the step of 0.2. Correct upto four place of decimals.**

Unit 4

Q.4(a) If $\vec{r}$ x $\overrightarrow{dr}$ = 0 then show that r is a constant vector.

Prove that curl(u$\vec{a}$) = (grad u)x $\vec{a}$ + u curl $\vec{a}$

If $\frac{d^2r}{dt^2}$=-n^2r *, then find the value of* $\left|\frac{\overrightarrow{dr}}{dt}\right|$

Or

Verify Gauss divergence theorem for the function F=4xzi-y^2j + yzk taken over the cube bounded by x=0, x= 1 y=0, y=1 z=0 z=1.

Use Green's theorem to evaluate :

$$\int\{(y - sinx)dx + cosxdy\}$$

Where c is a triangle enclosed by the lines y=0, x=$\pi/2$ and y=$2x/\pi$