Code No: 121AL **R15**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech I Year Examinations, May/June - 2017

MATHEMATICAL METHODS

(Common to EEE, ECE, CSE, EIE, IT, ETM)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART- A (25 Marks)

1.a) Define any 4 difference operators. [2]

b) Prove that $\frac{\Delta}{\nabla} - \frac{\nabla}{\Delta} = \Delta + \nabla$ [3]

c) Write the iterative formula for finding the approximate solution of the initial value problem $\frac{dy}{dx} = f(x, y); y(x_0) = y_0$. [2]

d) Find the positive square root of 12 up to 4 decimal places. [3]

e) If $x = \sum_{n=1}^{\infty} \frac{2b_n}{\pi} \sin nx,\ 0 \le x \le \pi$, find b_n. [2]

f) Does the Fourier series expansion of f(x) = 1, 0 < x < 4, f(x+4) = f(x) exist? If so, find the constant term, coefficients of $\cos \pi x$ and $\sin \pi x$. [3]

g) Solve $\frac{\partial z}{\partial x} + \frac{\partial z}{\partial y} = 1$ [2]

h) Write all possible solutions of the equation $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$ [3]

i) State Gauss divergence theorem. [2]

j) If $\nabla \times \bar{A} = \bar{0}, \nabla \times \bar{B} = \bar{0}$ then find the value of $Div(\bar{A} \times \bar{B})$. [3]

PART-B (50 Marks)

2.a) Using Gauss's backward interpolation formula find the population for the year 1936 given that,

Year x	1901	1911	1921	1931	1941	1951
Population y	12	15	20	27	39	52

b) Prove that $(E^{\frac{1}{2}} + E^{-\frac{1}{2}})(1+\Delta)^{\frac{1}{2}} = 2 + \Delta$ [5+5]

OR

3.a) Using the following table, find f(2.75) using Forward difference formula.

x	2.5	3	3.5	4	4.5	5
Y=f(x)	21.145	22.043	20.225	18.644	17.262	16.047

b) Using the following table fit a curve of the form $y = ax^b$ using method of least squares. [5+5]

x	1	2	3	4	5	6
y	1200	900	600	200	110	50

4.a) Find a root of the equation $x^3 - 9x + 1 = 0$ correct to 4 decimal places by bisection method.

b) Solve the following system of equations by using Gauss –Seidal iterative method (give the solution correct to 3 decimal places) 8x-3y+2z=20; 4x+11y-z=33; 6x+3y+12z=35.

[5+5]

OR

5.a) By applying 4th order Runge-Kutta method obtain the values of y at x=0.1 and at 0.2 for the differential equation $\frac{dy}{dx} = -y$, given that $y(0) = 1$.

b) Apply Simpson's rule to find the value of $\int_0^2 \frac{1}{1+x^3} dx$ by taking 10 points in [0, 2]. [5+5]

6.a) Obtain the Fourier series of $f(x) = f(x+2\pi)$ and $f(x) = \frac{\pi - x^2}{4}, 0 < x < 2\pi.$

b) Find the half range cosine series of $f(x) = x(2-x)\, in\ 0 \le x \le 2.$

[5+5]

OR

7.a) Find the half range cosine series for the function $f(x) = \begin{cases} x^2, & 0 \le x < 1 \\ 1, & 1 \le x \le 2 \end{cases}$

b) Is the function defined as $f(x) = \begin{cases} x+\pi, & 0 \le x \le \pi \\ x-\pi, & -\pi \le x \le 0 \end{cases}$ even or odd? If $f(x+2\pi) = f(x)$, find its Fourier series expansion. [5+5]

8.a) Using the method of separation of variables, solve $\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u$, where $u(x,0) = 6e^{-3x}$.

b) Solve $z = p^2 x + q^2 y$, using Charpit's method. [5+5]

OR

9.a) An insulated rod of length l has its ends A and B maintained at 0^0C and 100^0C respectively until steady state conditions prevail. If B is suddenly reduced to 0^0C and maintained at 0^0C, find the temperature at a distance x from A at time t.

b) Solve $(x^2 - yz)p + (y^2 - xz)q = (z^2 - yx)$

[5+5]

10.a) Find the directional derivative of $\phi = x^2yz + 4xz^2$ at the point (1,-2,-1) in the direction of the vector $2\bar{i} - \bar{j} - 2\bar{k}$

b) Prove that $\nabla \times \nabla \times \bar{F} = \nabla(\nabla.\bar{F}) - \nabla^2 \bar{F}$ [5+5]

OR

11. Verify Stoke's Theorem for $\bar{A} = (2x-y)\bar{i} - yz^2\bar{j} - y^2z\bar{k}$ over upper half of the surface of the sphere of unit radius. [10]

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