Code No: 124DD **R15**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech II Year II Semester Examinations, February - 2024

MATHEMATICS -II

(Common to ME, MIE)

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

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART - A

(25 Marks)

1.a) Find the gradient of φ where $\varphi = 3x^2y - y^3z^2$ at (1,-2,1). [2]

b) Find the directional derivative of $\varphi = xyz$ in the direction of the outer normal to the surface $z = xy$ at the point $(3, 1, 3)$. [3]

c) Find the Fourier sine transform of $\frac{1}{x}$. [2]

d) Find the half range sine series for e^x in $0 < x < 1$. [3]

e) Write Newton's forward and backward interpolation formulae. [2]

f) Find the missing value of the data [3]

x	1	1.4	1.8	2.2
y	3.49	4.82	-	6.5

g) What is diagonally dominant of the given system of linear equations? [2]

h) Find the Lower Triangular matrix L in the LU decomposition of the matrix

$$A = \begin{bmatrix} 1 & 2 & 1 \\ 0 & 3 & 1 \\ 2 & 5 & 0 \end{bmatrix}.$$ [3]

i) Write the iterative formulae used in Euler's, Modified Euler's method to find y_n. [2]

j) Find $y(1.1)$ given $\frac{dy}{dx} = x + y$ and y(1) = 0 using Taylor's series. [3]

PART - B

(50 Marks)

2. Verify Stoke's theorem in a plane for $\vec{F} = (y - z + 2)\vec{i} - (yz + 4)\vec{j} - xz\vec{k}$, where S is the open surface of the cube formed by the planes $x = 0, x = 2, y = 0, y = 2, z = 0,\ z = 2$ above the xy-plane. [10]

OR

3. Verify the Gauss Divergence theorem for $\vec{F} = (x^2 - yz)\vec{i} + (y^2 - xz)\vec{j} + (z^2 - xy)\vec{k}$ over the rectangular parallelepiped bounded by $x = 0, x = a, y = 0, y = b, z = 0,\ z = c$. [10]

4. Obtain Fourier series expansion of $f(x) = (\pi - x)^2$ in $0 < x < 2\pi$ and deduce the value of $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \cdots \ldots = \frac{\pi^2}{6}$. [10]

OR

5.a) Find the Fourier cosine transform of $e^{-ax} sinax$

b) Using Fourier integral show that $e^{-ax} - e^{-bx} = \frac{2(b^2-a^2)}{\pi}\int_0^{\infty} \frac{\lambda sin\lambda x}{(\lambda^2+a^2)(\lambda^2+b^2)} d\lambda,\ a > 0,\ b > 0$ [5+5]

6.a) Find the second difference of the polynomial $x^4 - 12x^3 + 42x^2 - 30x + 9$ with the interval of differencing h=2.

b) Using Gauss's forward formula, find $f(22)$ from the following table.

x	20	25	30	35	40	45
f(x)	354	332	291	260	231	204

[5+5]

OR

7. Fit a curve of the form $y = ab^x$ for the following data.

x	2	3	4	5	6
y	8.3	5.3	33.1	65.2	127.4

[10]

8.a) Find a real root of the equation $x \log_{10} x = 1.2$ which lies between 2 and 3 by bisection method.

b) Find the positive root of $3x - cosx - 1 = 0$ using Newton-Raphson method. [5+5]

OR

9. Obtain the solution of the following system using Gauss-Seidel iteration method correct to 3 decimal places. $10x - 5y - 2z = 3; 4x - 10y + 3z = -3; x + 6y + 10z = -3.$ [10]

10.a) Evaluate $\int_0^6 \frac{dx}{1+x}$ by using (i) Trapezoidal Rule (ii) Simpson's 1/3rd Rule (iii) Simpson's 3/8th Rule. Verify your results by actual Integration.

b) Find y(0.1) using Runge-Kutta 4th order formula given that $y' = x^2 - y$ and y(0) =1. [6+4]

OR

11. Find the dominant eigen value and the corresponding eigen vector of $A = \begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ using power method. Find the least latent root and hence the third eigen value also. [10]

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