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Code No: 124DD

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year II Semester Examinations, May - 2017

MATHEMATICS – II

(Common to ME, MCT, MIE, MSNT)

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) Show that $\nabla r^n = nr^{n-2}\vec{r}$, where $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ and $r = |\vec{r}|$. [2]

b) Find the values of a, b, c so that $\vec{F} = (x+2y+az)\hat{i} + (bx-3y-z)\hat{j} + (4x+cy+2z)\hat{k}$ is irrotational. [3]

c) What are Dirichlet's conditions for the existence of Fourier series? [2]

d) Find the Fourier transform of $f(x) = e^{-|x|}$. [3]

e) Construct the forward difference table from the following data: [2]

x:	0	10	20	30
y:	0	0.174	0.347	0.518

f) Obtain the normal equations for fitting a straight line $y = ax + b$ to the data (x_i, y_i), $i = 1, 2, \ldots\ldots\ldots n$. [3]

g) If the first two approximations x_3 and x_4 for the root of $x^3 - 3x - 4 = 0$ are 2.125 and -3 respectively, find x_5 by the method of false position. [2]

h) Find the LU decomposition for the matrix $A = \begin{pmatrix} 2 & 3 \\ 1 & 2 \end{pmatrix}$. [3]

i) Approximate $\int_0^{\pi} \sin x\, dx$ using the 2-point Gauss-Legendre formula. [2]

j) Evaluate $\int_0^1 \frac{dx}{x}$ using Simpson's $\frac{1}{3}$ rule with $h = \frac{1}{4}$. [3]

PART-B

(50 Marks)

2.a) Find the values of a and b so that the surfaces $ax^2 - byz = (a+2)x$ and $4x^2y + z^3 = 4$ intersect orthogonally at the point (1,-1,2).

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

OR

3.a) Find the work done by the force $\overline{F} = (3x^2 - 6yz)\hat{i} + (2y + 3xz)\hat{j} + (1 - 4xyz^2)\hat{k}$ in moving a particle from (0, 0, 0) to (1, 1, 1) along the curve $C: x = t, y = t^2, z = t^3$.

b) Use Green's theorem to evaluate $\oint_c (2xy - x^2)dx + (x^2 + y^2)dy$, where c is the boundary of the region enclosed by $y = x^2$ and $y^2 = x$. [5+5]

4. Find the Fourier series expansion of the function
$f(x) = \begin{cases} 2 + x, & -2 \le x \le 0 \\ 2 - x, & 0 < x \le 2 \end{cases}$, $f(x+4) = f(x)$. Hence show that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots\ldots = \frac{\pi^2}{8}$. [10]

OR

5.a) Find the Fourier integral representation of $f(x) = \begin{cases} x, & |x| < 1 \\ 0, & |x| > 1 \end{cases}$.

b) Find the inverse Fourier sine transform of $\frac{e^{-as}}{s}$. [5+5]

6.a) If $y_{20} = 24$, $y_{24} = 32$, $y_{28} = 35$, $y_{32} = 40$, find y_{25} using Gauss forward difference formula.

b) Use Lagrange's interpolation formula to find a polynomial of least degree which suits the following data: [5+5]

x:	0	1	3	4
y:	5	6	50	105

OR

7.a) Fit a polynomial of second degree to the following data by the method of least squares:

x:	0	1	2
y:	1	6	17

b) Fit a curve of the form $y = ae^{bx}$ for the following data: [5+5]

x:	1	2	3	4
y:	1.65	2.70	4.50	7.35

8.a) Find a root of the equation $e^x - x = 2$ using bisection method correct to 3 decimal Places.

b) Compute $\sqrt{10}$ using Newton-Raphson method correct to 3 decimal places. [5+5]

OR

9. Solve the system of equations $10x + y + z = 12, 2x + 10y + z = 13, 2x + 2y + 10z = 14$ by Jacobi's iteration method and Gauss-Seidel iteration method. [10]

10.a) Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Trapezoidal rule with $h = \frac{1}{6}$.

b) Apply shooting method to solve the boundary value problem
$y'' - 6y^2 = 0,\ y(0) = 1,\ y(0.5) = 0.44$. [5+5]

OR

11.a) Given that $\frac{dy}{dx} = 2 + \sqrt{xy},\ y(1) = 1$. Find approximate value of y at $x = 2$ using Euler's modified method.

b) Find the largest eigen vector and the corresponding Eigen value of the matrix $A = \begin{pmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{pmatrix}$ by power method. [5+5]

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