

R13**Code No: 114DD****JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD****B.Tech II Year II Semester Examinations, May-2015****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) If $\vec{a} = a_1\vec{i} + a_2\vec{j} + a_3\vec{k}$ and $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$ then find $\nabla(\vec{r} \cdot \vec{a})$ [2M]
- b) State Stoke's Theorem. [3M]
- c) If $f(x) = \frac{1}{4}(\pi - x)^2$, $0 < x < 2\pi$ find a_0 . [2M]
- d) If finite fourier cosine transform of f is $\frac{1}{n^2}[(-1)^n - 1]$ and $F_c(0) = \frac{\pi^2}{2}$ find $f(x)$. [3M]
- e) Prove that $\Delta \nabla = \delta^2$. [2M]
- f) If $y(0) = 6$, $y(1) = 24$, $y(2) = 60$ and $y(3) = 120$, then find $\nabla^2 y_3$. [3M]
- g) Find an iteration formula to find the square root of a number by Newton Raphson method. [2M]
- h) Find the LU decomposition of $\begin{bmatrix} 2 & -3 & 1 \\ 3 & 4 & 2 \\ 2 & -3 & 4 \end{bmatrix}$. [3M]
- i) If $y_0 = 0$, $y_1 = 0.497$, $y_2 = 0.692$, $y_3 = 0.825$ $h = \frac{1}{4}$ then find $\int_0^{0.75} y dx$ by Simpsons $\frac{3}{8}$ th rule. [2M]
- j) If $y'' = 2y$, then find the recurrence relation among y_0, y_1, y_2 , when $h = 1$. [3M]

PART - B**(50 Marks)**

2. Prove that the function. $\vec{F} = (x^2 - yz)\vec{i} + (y^2 - zx)\vec{j} + (z^2 - xy)\vec{k}$ is irrotational and hence find scalar potential function corresponding to it. [10]
- OR**
3. Evaluate $\iint_S \vec{F} \cdot \vec{n} ds$ where $\vec{F} = (x + y^2)\vec{i} - 2x\vec{j} + 2yz\vec{k}$ and S is the surface of the plane $2x + y + 2z = 6$ in the first octant. [10]

4.a) Find the fourier series to represent the function $f(x) = |\sin x|$ in $-\pi < x < \pi$.

b) Find the Fourier Transform of

$$f(x) = \begin{cases} \cos x & 0 < x < a \\ 0 & x \geq a \end{cases} \quad [5+5]$$

OR

5.a) Obtain a cosine series for the function $f(x) = \begin{cases} x, 0 \leq x \leq \frac{\pi}{2} \\ \pi - x, \frac{\pi}{2} \leq x \leq \pi \end{cases}$

b) Find the Fourier transform of $f(x) = \begin{cases} 1 - |x|, & \text{if } |x| < 1 \\ 0 & \text{if } |x| > 1 \end{cases} \quad [5+5]$

6.a) Use Lagranges formula to obtain the value of t when A = 85 from the following table.

t	2	5	8	14
A	94.8	87.9	81.3	68.7

b) Fit the curve of the form $y = a + bx$ by the method of least squares. [5+5]

x	0	5	10	15	20	25
y	12	15	17	22	24	30

OR

7. Fit a curve of the form $y = ab^x$ by the method of least squares. [10]

x	2	3	4	5	6
y	144	172.8	207.4	248.8	298.5

8.a) Find a root of the equation $\sin x = 1 - x$ using Newton Raphson method.

b) Explain the Geometric interpretation of Regula Falsi method. [5+5]

OR

9. Solve the system of equations $x + y + z = 1$, $3x + y - 3z = 5$, $x - 2y - 5z = 10$ by writing the coefficient matrix as a product of a lower triangular and an upper triangular matrix. [10]

10. Find $y(0.1)$ and $y(0.2)$ using Runge Kutta method given that $y' = x^2 - y$, $y(0) = 1$ [10]

OR

11. Solve the boundary value problem $y'' = x + y$, with $h = 0.25$ given that $y(0) = 0$, $y(1) = 1$. [10]

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