

Code No: 114DD

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year II Semester Examinations, November/December - 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)

- Find grad ϕ when ϕ is given by $\phi = 3xyz^3 - yz$. [2M]
- Find curl $(xi + yj + zk)$. [3M]
- Write the Dirichlet's conditions for a valid Fourier expansion of a function. [2M]
- Find the finite Fourier sine transforms of $f(x) = 1$. [3M]
- Solve the difference equation: $(E^2 + 6E + 9)y_n = 0$. [2M]
- Given that

X	1	2	3	4	5
Y	2	5	10	17	26

- Find the value of $\Delta^2 y_5$. [3M]
- Find two values for $x \sin x - \cos x = 0$ between which the root lies. [2M]
- If $A = LU$ Find L where $A = \begin{bmatrix} 1 & 2 & 0 \\ 1 & -3 & -1 \\ 0 & 4 & 3 \end{bmatrix}$. [3M]
- Write the Taylor series formula to find $y_1 = y(x_1)$ given $y(x_0)$. [2M]
- Using Picard's method find $y^{(1)}(x)$ for the initial value problem $dy/dx = x+y$, $y(0)=1$. [3M]

PART-B

(50 Marks)

- If $\nabla\phi = 2xyz\bar{i} + x^2z\bar{j} + x^2y\bar{k}$, find the scalar potential ϕ .
 - Evaluate $\nabla^2 f(r)$ where $\bar{r} = xi + yj + zk$. [5+5]
- OR
- Verify the Gauss divergence theorem for $\bar{F} = y\bar{i} + x\bar{j} + z\bar{k}$ over the cylindrical region Bounded by $x^2 + y^2 = 9$, $z = 0$ and $z = 2$. [10]
- Show the Fourier cosine transform of $f(x) = e^{-x^2}$ is $\frac{1}{\sqrt{2}} e^{-s^2/4}$. [10]

OR

5.a) Find the half-range cosine series for the function $f(x) = (x-1)^2$ in the interval $0 < x < 1$. Hence show that $\frac{\pi^2}{24} = \sum_{n=1}^{\infty} \frac{1}{(2n-1)^2}$.

b) Find the Fourier transform of $f(x) = x e^{-x}$, $0 \leq x < \infty$. [5+5]

6.a) Prove that If $f(x)$ is a Polynomial of degree n and the values of x are equally spaced then $\Delta^n f(x)$ is a constant.

b) Using Lagrange formula, Calculate $f(4)$ from the following table. [5+5]

X	0	1	2	3	5	7
Y	0	12	13	15	2	3

OR

7.a) Using Gauss forward interpolation formula find the value of $\log 337.5$ from the following table.

X	310	320	330	340	350	360
$Y_x = \log x$	2.4914	2.5051	2.5185	2.5315	2.5441	2.5563

b) Fit a curve of the form $y = ab^x$ to the data. [5+5]

X	0	1	2	3
Y	1.05	2.10	3.85	8.30

8.a) Solve the system of equations $5x-y+z=10$, $2x+4y=12$, $x+y+5z=-1$ by Gauss Seidel method.

b) Show that the system of equations $5x-y+z=10$, $2x+4y=12$, $x+y+5z=-1$ are consistent and solve them by LU decomposition. [5+5]

OR

9.a) Find the root of the equation $x \log_{10}(x) = 1.2$ by using Newton Raphson method.

b) Find the root of $x \tan x + 1 = 0$ by Regula Falsi method. [5+5]

10.a) Integrate numerically $\int_0^{\pi/2} \sqrt{\cos \theta} d\theta$ by Trapezoidal rule taking $h = \frac{\pi}{10}$.

b) Solve the initial value problem by Modified Euler's method $y' = x+y$, $y(0)=1$, $h=0.1$, to find $y(0.2)$. [5+5]

OR

11.a) Find an approximate value of $\log_5 5$ by calculating to 4 decimal places, by

Simpson's 1/3 rule, $\int_0^5 \frac{dx}{4x+5}$, dividing the range into 10 equal parts.

b) Given $y' = x+y$, $y(0)=0$, $h=0.2$, compute $y(0.2)$ using R-K Method. [5+5]

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