Code No: 113AA

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year I Semester Examinations, November - 2015
MATHEMATICS – II
(Common to CE, CHEM, MMT, AE, PTE, CEE)

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 ϕ satisfies Laplacian equation, show that $\Delta\phi$ is both solenoidal. [2M]

b) Find curl $x^2i + yi + zk$. [3M]

c) Write the Dirichlet's conditions for the existence of Fourier series of a function $f(x)$ in the interval $(\alpha, \alpha + 2\pi)$. [2M]

d) State and prove linearity property of Fourier transforms. [3M]

e) State interpolation. [2M]

f) If the interval of difference is unity, Find $\Delta(x^2 + 2x)$. [3M]

g) Under what conditions Gauss-Seidal method is applicable. [2M]

h) Derive an iteration formula to find square root of a number n by Newton Raphson method. [3M]

i) State merits and demerits of Runge-Kutta method. [2M]

j)

x	0	1	2	3
y	1	0.5	0.3333	0.25

Evaluate $\int_0^3 \frac{dx}{1+x}$ by Trapezoidal rule. [3M]

PART-B **(50 Marks)**

2. State and verify Stokes theorem for the function $\bar{f} = x^2i + xyj$ integrated round the square in the plane z = 0 whose sides are along the lines x = 0 = y, x = a = y. [10]

OR

3. Find the work done in moving in a particle in the force field $\bar{f} = 3x^2i + (2zx - y)j + zk$, along the curve defined by $x^2 = 4y, 3x^3 = 8z$ from x = 0 to x = 2. [10]

4.a) Expand the Fourier series expansion of the function
$f(x) = 0, -\pi \le x \le 0$
$= \sin x, 0 \le x \le \pi$
and deduce $\frac{1}{1.3} - \frac{1}{3.5} + \frac{1}{5.7} + \ldots = \frac{\pi - 2}{4}$.

b) Obtain the half range cosine series for the function $f(x) = x^2$ when $0 < x < \pi$ and find the sum of the series $\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \ldots$ [5+5]

OR

5.a) State and prove Change of scale property of Fourier transforms.

b) Find Fourier sine transform of $f(x) = \frac{1}{x(x^2+a^2)}$ and hence deduce cosine transform of $\frac{1}{x^2+a^2}$. [5+5]

6.a) Find the missing term in the following data:

x	0	1	2	3	4
y	1	3	9	-	81

Why this value is not equal to 3^3. Explain.

b) Fit a straight line to the following data by the method of least square. [5+5]

x	0	1	2	3	4
y	1	1.8	3.3	4.5	6.5

OR

7.a) Given $\sin 45^0 = 0.7071, \sin 50^0 = 0.7660, \sin 55^0 = 0.8192$ and $\sin 60^0 = 0.8660$. Find $\sin 52^0$ using Newton's interpolation formula.

b) A curve passes through the points (0, 18), (1, 10), (3, -18) and (6, 90). Find the slope of the curve at x = 2. [5+5]

8. Find the inverse of the matrix $\begin{bmatrix} 2 & 3 & 1 \\ 1 & 2 & 3 \\ 3 & 2 & 1 \end{bmatrix}$ using LU decomposition method. [10]

OR

9.a) Find the root of $2x - \log x = 7$, correct to three places of decimal using iteration method.

b) Find the root of the equation $x\log_{10}(x) = 1.2$ using False position method. [5+5]

10. Find the successive approximate solution of the differential equation $y' = y$, $y(0) = 1$ by Picard's method and compare it with exact solution. [10]

OR

11. Determine the largest Eigen value and the corresponding eigenvector of the matrix $\begin{bmatrix} 4 & 1 & 0 \\ 1 & 20 & 1 \\ 0 & 1 & 4 \end{bmatrix}$ to 3 correct decimal places using the power method. [10]

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