Code No: 121AL **R15**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech I Year Examinations, August/September - 2017
MATHEMATICAL METHODS
(Common to EEE, ECE, CSE, EIE, IT, ETM)

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) Write the formula to find an interpolate value for unequally spaced data (x_1, y_1), (x_2, y_2) and (x_3, y_3). [2]

b) Derive the normal equations for best fit of a straight line $y = a + bx$. [3]

c) Find the slope of the tangent to the curve at $x = 0$ which passes through the points $(0,3)$, $(2,6)$ and $(4,8)$. [2]

d) Find an approximate value of $\sqrt{18}$ using Newton's Raphson method. [3]

e) Find the average value of $f(x) = x^2$ in the interval $(-\pi, \pi)$ using Fourier series. [2]

f) Find the Fourier transform of $f(x) = \begin{cases} 1, |x| \geq a \\ 0, |x| < a \end{cases}$. [3]

g) Solve the non linear partial differential equation $pq = 1$. [2]

h) Form the Partial difference equation form $z = f\left(\frac{x}{y}\right)$ by eliminating arbitrary function f. [3]

i) State stokes theorem. [2]

j) Apply Gauss divergence theorem to evaluate $\iint x\,dydz + y\,dzdx + z\,dxdy$ over the surface of the sphere of radius a units. [3]

PART-B

(50 Marks)

2.a) Find the missing value from the following data

x	0	5	10	15	20	25
y	6	10	-	17	-	31

b) Find the best fit of the curve $y = a(b^x)$ to the following data

x	2	6	5	8
y	1	5	7	9

[5+5]

OR

3.a) Find an interpolate polynomial from the following data

X	0	1	2	4
$f(x)$	1	1	2	5

b) The values of a function $f(x)$ are given below for certain values of x. Find the value of f(10).

X	5	6	9	11
$f(x)$	12	13	14	16

[5+5]

4.a) Find a negative real root of $x^3 - x - 11$ using Iterative method correct to three decimal places.

b) Solve by Gauss-Seidel method of the system of equations:

$10x - 2y - 2z = 6$; $-x + 10y - 2z = 7$ and $-x - y + 10z = 8$ [5+5]

OR

5.a) The velocity v of a particle with respect to time t as given below

t	0	10	20	30	40
v	45	60	65	54	42

Find the acceleration of a particle at the time $t = 40$ min.

b) Solve numerically $\frac{dy}{dx} = x - y$, $y(0) = 1$ for $x = 0.2, 0.4$ by modified Euler's method.

[5+5]

6.a) Define Fourier Series of even and odd functions on $(-l, l)$

b) Obtain the Fourier series expansion of f(x) = |x| in (- π, π) and hence deduce that

$\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots\ldots\ldots$ [5+5]

OR

7.a) Let $\bar{f}_s(p)$ and $\bar{f}_c(p)$ are Fourier sine and cosine transform of $f(x)$, prove that $F_c\{xf(x)\} = \frac{d}{dp}\bar{f}_s(p)$ and $F_s\{xf(x)\} = -\frac{d}{dp}\bar{f}_c(p)$.

b) Find the Fourier cosine transform of $f(x) = e^{-x^2}$ on $(0, \infty)$. [5+5]

8.a) Solve the partial differential equation $(mz - ny)p + (nx - lz)q = ly - mx$ where l, m, n are constants.

b) Solve $(p^2 + q^2)y = qz$. [5+5]

OR

9.a) Solve the heat conduction equation in a thin rod: $\frac{\partial U}{\partial t} = c^2 \frac{\partial^2 U}{\partial x^2}$ by method of separation of variables.

b) Find the solution of the one dimensional heat equation $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$ under the boundary conditions $u(0,t) = 0$, $u(l,t) = 0$ and $u(x,0) = x$, $0 < x < l$, l being the length of the rod.

[5+5]

10.a) Find the Directional derivative of $\phi = x^4 + y^4 + z^4$ at the point A(1,-2,1) in the direction of AB where B is (2,6,-1).

b) Verify stokes theorem for a vector field defined by $\bar{F} = -y^3\bar{i} + x^3\bar{j}$ in the region $x^2 + y^2 \le 1,\ z = 0$. [5+5]

OR

11.a) Using Greens theorem, Evaluate $\oint_C (y - \sin x)dx + \cos x dy$ where C is the triangle enclosed by the lines $y = 0, x = \frac{\pi}{2}$ and $\pi y = 2x$.

b) If the vector field $\bar{F} = (2xyz^2)i + (x^2z^2 + z\cos yz)\bar{j} + (2x^2yz + y\cos yz)\bar{k}$ is conservative then find its scalar potential function. [5+5]

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