[Time: Three Hours] **[Marks:80]**

N.B.: (1) Question No 1 is compulsory

(2) Attempt any three questions out of the remaining five questions

(3) Non Programmable calculator is allowed

Q.1)

a) Find the value of the integral $\int_0^{1+i}(x-y+ix^2)dz$ along the straight line from z=0 to z=1+i . [5]

b) Find the Fourier Series representing by f(x)= $|x|$, $-\pi<x<\pi$. [5]

c) Find the Fourier transforms of f(x)=1, $|x|<k$; 0 for $|x|>k$ [5]

d)) Express $f(x)=x^4-8x^3+18x^2-10x$. Find also the function whose first difference is the given function. [5]

Q.2)

a) Expand f(x)= $lx-x^2$, , $0<x<l$ in a half range sine series [6]

b) Using the method of Lagrange's multipliers solve the following NLPP Optimize $z=6x_1+8x_2-x_1^2-x_2^2$ subject to $4x_1+3x_2=16$, $3x_1+5x_2=15$, $x_1,x_2 \geq 0$ [6]

c) Expand $f(x)=\frac{2}{(z-1)(z-2)}$ about z=0 indicating the region of convergence. [8]

Q.3)

a) If f(5)=12, f(6)=13,f(9)=14 and f(11)=16 , find f(10) using Lagrange's Interpolation formula [6]

b) Find the solution of the wave equation $\frac{\partial^2 y}{\partial t^2}=c^2\frac{\partial^2 y}{\partial x^2}$ such that $y=P_0\cos pt$,(P_0 is constant) when x=L and y=0 when x=0 [6]

c) Use the Kuhn Tucker conditions to solve the following NLPP [8]
Maximize $z=10x_1+10x_2-x_1^2-x_2^2$
subject to $x_1+x_2\leq 8$,
$-x_1+x_2\leq 5$, $x_1,x_2\geq 0$

Q4)

a) Find Half range cosine series for f(x)=x , 0<x<2 [6]

b) Evaluate the integral using Cauchy's Integral formula $\int_C \frac{e^{2z}}{(z-a)^4}dz$ where C is the circle $|z|=2$ [6]

c) A bar with insulated sides is initially at temperature 0° C throughout. The end x=0 is kept at 0° C and the heat is suddenly applied so that $\frac{\partial u}{\partial x}$=10 at x=L for all the time. Find the temperature function u(x,t). [8]

Q5)

a) Find f(4.4) for which f(0)=12, f(2)=7, f(4)=6, f(6)=7 , f(8)=13,f(10)=32,f(12)=77 [6]

b) Find the complex form of the Fourier series for $f(x) = e^{2x}$ in (0,2) [6]

c) The steady state temperature distribution in a thin plate bounded by the lines x=0,x=a,y=0 and y=∞ governed by the partial differential equation $U_{xx}+U_{yy}=0$. Obtain the steady state temperature distribution under the conditions:
U(0,y)=U(a,y)=U(x,∞)=0 and U(x,0)=x, $0 \le x \le \frac{a}{2}$, [8]
= a-x, $\frac{a}{2} \le x \le a$.

Q6)

a) solve $\frac{\partial z}{\partial x} - 2\frac{\partial z}{\partial y} = z$ *where* $z(x,0) = 3e^{-5x} + 2e^{-3x}$ using method of separation of variable [6]

b) Evaluate $\int_0^{2\pi} \frac{cos2\theta}{5+4cos\theta} d\theta$. [6]

c) Use Newton's Divided Difference formula to find the polynomial of the lowest degree which assumes the following values: Also find f'(2) and f''(2) [8]

x	-1	1	2	3
f(x)	-21	15	12	3

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