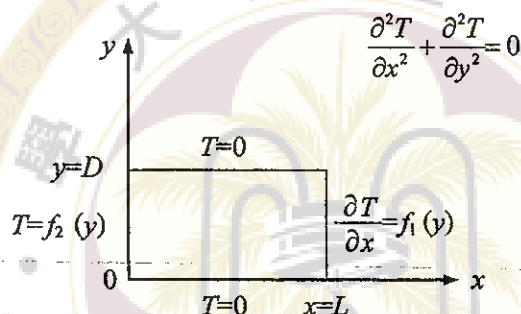


1. Solve the following ordinary differential equations: (20%)

(1)  $\frac{d^2x}{dt^2} + 2\frac{dx}{dt} + 2x = 5 \cos t$  ;  $x=0$  and  $\frac{dx}{dt}=0$  for  $t=0$

(2) Find the solution of  $x''+2x'+2x = g(t)$ ,  $x(0)=0$ ,  $x'(0)=0$  where  $g(t) = 1$   
for  $0 \leq t \leq 1$ ,  $g(t) = 0$  for  $t > 1$

2. (1) Can the method of Fourier Transform be used to solve the two-dimensional, steady-state problem with the conditions as indicated? Why? (10%)



(2) Can the above problem (1) be solved by Laplace Transform? Why? (10%)

3. Find the region of convergence and the sum of each of the following series. (20%)

(1)  $\frac{1}{2} \frac{z+1}{z-1} + \frac{1}{2^2} \left(\frac{z+1}{z-1}\right)^2 + \frac{1}{2^3} \left(\frac{z+1}{z-1}\right)^3 + \dots$

(2)  $\frac{1}{z(z+1)} + \frac{1}{(z+1)(z+2)} + \frac{1}{(z+2)(z+3)} + \frac{1}{(z+3)(z+4)} + \dots$

4. If  $\phi$  is functions of either  $(x,y)$  or  $(x,\eta)$ , and  $\eta = y - E(x)$ . Find the relation

between  $\left. \frac{\partial \phi}{\partial x} \right|_y$  and  $\left. \frac{\partial \phi}{\partial x} \right|_\eta$  (20%)

5. Find the Taylor series of the following functions about the point  $Z = a$  and determine the radius of convergence. (20%)

(1)  $\log Z$ ,  $a=1$

(2)  $\sin Z^2$ ,  $a=0$ .