



**NATIONAL OPEN UNIVERSITY OF NIGERIA**  
Plot 91, Cadastral Zone, NnamdiAzikwe Expressway, Jabi, Abuja.

**FACULTY OF SCIENCES**  
**April/May Examination 2019**

**Course Code:** MTH423  
**Course Title:** Integral Equations  
**Credit Unit:** 3  
**Time allowed:** 3 HOURS  
**Total:** 70 Marks  
**Instruction:** ATTEMPT NUMBER ONE (1) AND ANY OTHER (4) QUESTIONS

1. (a) State the Volterra integral Equation (2 marks)  
(b) Enumerate three classes of Volterra Integral equations (6 marks)  
(c) Solve the integral equation  $Q(x) = 3 \int_0^x \cos(x-y) Q(y) dy + e^x$  (8 marks)  
(d) Solve the equation  $A(x) = x + 1 + \int_0^x (1 + 2(x-y)) d(y) dy$  (6 marks)
2. (a) State completeness in an orthogonal system of integral equation (3 marks)  
(b) Use Laplace transform to solve  
$$f(x) - \int_0^x K(x-y) f(y) dy = g(x)$$
 (9 marks)
3. (a) Solve  $Q(x) = x^3 + \int_0^x e^{3(x-y)} Q(y) dy$  (5 marks)  
(b) Solve the integral equation  $A''(x) + \int_0^x e^{2(x-y)} A'(y) dy = 1$ ,  
where  $A(0) = 0$  and  $A'(0) = 0$ . (7 marks)
4. (a) State Fredholm equation (3 marks)  
(b) Find the Eigenvalue and Eigen function of the system defined by:  
$$\phi(x) = \lambda \int_0^1 (1 + xt) \phi(t) dt, \quad 0 \leq x \leq 1.$$
 (9 marks)
5. (a) Solve the equation  $y'' + 5y' + 6y = e^{-t}$ ,  $t \geq 0$ , where  $y(0) = 2, y'(0) = 1$  (9 marks)

(b) Write three (3) properties of Eigen value and Eigen function, corresponding to kernel K of an integral equation. (3 marks)

6. (a) State Convergence Theorem (2 marks)

(b) Form an integral equation corresponding to

$$y'' + 2xy' + y = 0, \quad y(0) = 1, \quad y'(0) = 0. \quad (4 \text{ marks})$$

(c) State Fourier's coefficient and transform  $\frac{d^2y}{dx^2} + \lambda y = 0$ , when  $y = 0$  at  $x = 0$  and  $y' = 0$  at  $x = 1$  into integral equation form. (6 marks)