

Solve the following questions

Question 1

Write an algorithm to explain the use of the *Adomian decomposition method* to solve the *nonlinear integral equation*

$$\lambda x(s) - \int_0^1 \sin(st) (x(t))^2 dt = e^s, \quad 0 \leq s \leq 1.$$

Question 2

- a) Explain the main idea of the *collocation method*?
- b) Using $\phi_i(s) = s^i$, $i = 0, 1, \dots, n$ as a basic functions, write an algorithm to explain the use of the *collocation method* to solve the following *integro Fredholm* integral equation

$$\lambda x'(s) - \int_0^b k(s,t)x(t)dt = y(s), \quad 0 \leq s \leq b.$$

Question 3

The *Nystrom method* is one of the important techniques used to solve the integral equation, write an algorithm to explain the use of this technique to solve the *mixed integral equation*:

$$\lambda x(s) - \int_0^s k(s,t)x(t)dt - \int_0^b k(s,t)x(t)dt = y(s), \quad 0 \leq s \leq b.$$

Question 4

- a) Reduce the following Volterra equation of the 1st kind to an equation of the 2nd

kind
$$\sin x - \int_0^x e^{x-t} u(t) dt.$$

- b) Write Matlab program to explain the use of a suitable numerical method to solve this equation.