Menoufia University
Faculty of Engineering, Shebien El-kom
Basic Eng. Science Department
First Semester Examination, 2013-2014
Date of Exam: 13 / 1/ 2014

Subject: Integral Equations
Code : BES625
Year: Post Graduate
Time Allowed : 3 hours
Total Marks: 100 Marks

Answer the following questions

Question 1(10 marks)

(a). **(4 marks)** Classify each of the following integral equations as: Volterra or Fredholm integral equation, linear or nonlinear, and homogeneous or non-homogeneous:

i). $u(x)=x+\int_0^1 (x-t)^2 u(t)\,dt$

ii). $u(x)=e^x+\int_0^x t^2 u^2(t)\,dt$

(b). **(4 marks)** Classify each of the following integro-differential equations as: Volterra integro-differential equations or Fredholm integro-differential equations. Also determine whether the equation is linear or nonlinear.

i). $u'(x)=1+\int_0^x e^{-2t}u^3(t)\,dt$ and $u(0)=0$

ii). $u''(x)=\frac{x^2}{2}-\int_0^x (x-t)u^2(t)\,dt$

(c) **(2 marks)**Write the homogeneous and non-homogeneous Volterra integral equation of the second kind, describing its terms.

Question 2(20 marks)

Solve the following Volterra integral equation of the second kind of the convolution type using (a) the Laplace transform method and (b) successive approximation method

$$u(x)=f(x)+\lambda\int_0^x e^{(x-t)}u(t)\,dt$$

Question 3(25 marks)

(a) **(5 marks)** Write Volterra integral equations of the first and how can be reduces to Volterra equation of the second kind

(b) **(20 marks)** Obtain the solution of the following Volterra equation using the series method

$$u(x) = 1 + 2\sin x - \int_0^x u(t)\,dt .$$

Question 4(45 marks)

(a) **(5 marks)** Write different forms Fredholm integral equations.

(b) **(20 marks)** Solve the following Fredholm integral equation by using the successive approximation method

$$u(x) = 1 + \int_0^1 x\,u(t)\,dt$$

(c) **(20 marks)** Use the successive approximation to solve the following Fredholm integral equation.

$$u(x) = \sin x + \int_0^{\pi/2} \sin x \cos t\; u(t)\,dt$$

With our best wishes

This exam measures the following ILOs														
Question Number	Q1-a	Q3-a				Q1-b	Q1-c	Q4-b			Q3-b	Q4-c	Q2		
Skills	a2-2	a5-1				b2-1	b5-1	b2-2			c4-2	c5-1	c7-2		
	Knowledge& Understanding Skills					Intellectual Skills					Professional Skills				