جامعة آل البيت
دائرة ضمان الجودة والتخطيط

بسم الله الرحمن الرحيم

جامعة آل البيت

College of Science
Department of Mathematics
Course syllabus: Advanced Mathematical Methods
First semester 2019/2020

1. Instructor Information:

Instructor Name	Safwan Al-Shara'		
Office Hours	Tuesday	10:00 – 11:00 12:00 – 1:00	
	Monday, Wednesday	12:30 – 2:00	
Office Number and Telephone Extension	2201		
Email	safwan_alshara973@yahoo.com		

2. Course Description:

Integral Transforms: Definition of Laplace Transforms and its Inverse Transforms, Transforms of special functions, Theorems and applications, Fourier Transforms and its inverse, applications, Hankel Transform and applications, Mellin Transforms, some applications. Integral equations: Definition and method of solutions, some applications.

3. Course Information:

Course number: 401771	Course Title: Advanced Mathematical Methods	Level : Master degree
Course Nature: Theoretical	Prerequisite: None	Lecture time: Wed. 2:00 – 5:00
Academic year: 2019 – 2020	Semester: First	Credit Hours: 3

4. Course Objectives:

1. Study Integral equation with separable kernel.
2. Apply the method of successive approximations to solve I.E.
3. Study the Mellin Transform, it's properties and applications.
4. Study the Hankel Transform, it's properties and applications.
5. Study the Laplace Transform, it's properties and applications.
6. Study the Inverse Laplace Transform, it's properties and applications.

5. Course Content:

Integral equations and boundary value problems	
* Introduction	* Classical Fredholm theory
* Integral equations with separable kernels	* Applications to ordinary differential equations
* Method of successive approximations	
The Mellin Transform	
* The Mellin transform. Definition	* Mellin transforms of derivatives
* Linearity property of Mellin transforms	* Mellin transform of Integrals
* Elementary properties of the Mellin transform	* Inverse Mellin transform. Definition
Hankel Transforms	
* The Bessel function	* Inversion formula for the Hankel transformation
* The Hankel Transforms	* Applications of the Hankel transform to boundary value problems
* Linearity property	
* Hankel Transform of the derivatives of a function	
Laplace Transform	
* Integral Transform. Definition	* Second translation theorem
* Definition of Laplace Transform	* Laplace Transforms of derivatives
* Sufficient conditions for the existence of Laplace Transform	* Laplace Transforms of integrals
* Linearity property for Laplace Transform	* Initial and final theorems
* Laplace Transform for elementary functions	* Laplace Transform of periodic functions

* First translation theorem * Unit step function	* Evaluation of integrals by using Laplace Transforms * Laplace Transforms of some Special functions
Inverse Laplace Transform	
* Definition of Inverse Laplace Transform * Inverse Laplace Transform for elementary functions * Linearity property of Inverse Laplace Transform * Use of Partial fractions	* First and Second translation theorem * Inverse Laplace Transforms of derivatives * Inverse Laplace Transforms of integrals * The Convolution Theorem
Applications of Laplace Transforms	
* Solution of ordinary differential equations with constant coefficients * Solution of ordinary differential equations with variable coefficients	* Solution of simultaneous ordinary differential equations * Solution of partial differential equations subject to boundary conditions * Integral equations of convolution type
Fourier Transforms	
* Dirichlet's conditions * Fourier Integral formula * Fourier Sine and Cosine Transforms * Linearity property of Fourier Transforms	* Relation between the Fourier Transforms of the derivatives of a function * Applications of Fourier Transform to boundary value problems
Finite Fourier Transform	
* Fourier Series * The Finite Fourier sine Transform * The Finite Fourier cosine Transform	* Relation between the Finite Fourier Transforms of the derivatives of a function * Applications of Finite Fourier Transform to boundary value problems

6. Assessment:

Assessment	Grade Proportion	Week/Dates
First exam	**30 %**	**الأربعاء 2019/11/13**
Second exam	**30 %**	**الأربعاء 2019/12/18**
Final exam	**40 %**	**End of Semester**
Total	**100 %**	

7. Text Book:

The main reference	1) Integral Equations and Boundary value problems 2) Integral Transforms
Author(s)	1,2) M. D. Raisinghania
Publisher	1,2) S. Chand & Company Ltd.
Year	1)2000 2)1995
The edition	1,2) 2nd edition

8. References and additional resources:

1)	Ram P. Kanwal , Linear Integral Equations, Theory and Technique
2)	Lokenath Debnath & Dambaru Bhatta, Integral transforms and their applications
3)	Mary Boas, Mathematical Methods in the Physical Sciences