جامعة آل البيت
دائرة ضمان الجودة والتخطيط

بسم الله الرحمن الرحيم

جامعة آل البيت

College of Science
Department of Mathematics
Course syllabus: Special Functions and Fourier Transform
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:

Periodic functions, Fourier series , Complex form of Fourier series, Fourier Transform, Gamma, Beta, and Error Functions, Sterling's formula, Laplace Transform, Convolution; Parseval's Theorem, Inverse Laplace Transform.

3. Course Information:

Course number: 401272	Course Title: Special Functions and Fourier Transform	Level : Second year
Course Nature: Theoretical	Prerequisite: 401203	Lecture time: Mon. Wed. 9:30 – 11:00
Academic year: 2019 – 2020	Semester: First	Credit Hours: 3

4. Course Objectives:

1. Learn the general concept of periodic functions.
2. Learn to compute the Fourier series (Real and complex) of a periodic function.
3. Understand and apply basic properties of Fourier Series.
4. Apply Dirichlet's condition and Parseval's theorem.
5. Learn the general forms of Gamma, Beta, and Error Functions.
6. Use the properties of the Gamma and Beta functions to evaluate some important integrals.
7. Learn the relation between Gamma and Beta functions.
8. Apply Sterling's formula.
9. Study the Laplace Transform and use it's properties.
10. Apply the Laplace Transform to solve some Ordinary differential equations.
11. Apply the Convolution theorem to find some difficult integrals.
12. Study the Inverse Laplace Transform and use it's properties.

5. Intended Student Learning Outcomes:

Successful completion of the course should lead to the following outcomes:

1. **Knowledge and Understanding Skills:** Student is expected to
   - 1.1. Deal with periodic functions.
   - 1.2. Find the Fourier series (Real and complex) of a periodic function.
   - 1.3. Evaluate some integrals using special functions.
   - 1.4. Prove some properties of the special functions.
   - 1.5. Prove some recurrence relations.
   - 1.6. List some properties of some special functions.
   - 1.7. Memorize some recurrence relations.
   - 1.8. Recognize some types of differential equations.
2. **Intellectual Analytical and Cognitive Skills:** Student is expected to
   - 2.1. Solve some differential equations using special functions.
   - 2.2. Evaluate some integrals using special functions.
3. **Subject- Specific Skills:** Student is expected to
   - 3.1. Prove some recurrence relations.
   - 3.2. Prove some orthogonal properties.
4. **Creativity /Transferable Key Skills/Evaluation:** Student is expected to

4.1. Think independently, set tasks and solve some problems. 4.2. Solve some particular problems.

6. Course Content:

Week	Chapter	Subject	Pages
1 – 6	Chapter 7 Fourier Series and Transforms	1.1 Introduction 1.4 Average Value of a Function 1.5 Fourier Coefficients 1.6 Dirichlet Conditions 1.7 Complex Form of Fourier Series 1.8 Other Intervals 1.9 Even and Odd Functions 1.11 Parseval's Theorem 1.12 Fourier Transforms	340 – 385
7 – 12	Chapter 8 Ordinary Differential Equations	8.8 The Laplace Transform 8.9 Solution of Differential Equations by Laplace Transforms 8.10 Convolution 8.11 The Dirac Delta Function	437 – 460
13 – 16	Chapter 11 Special Functions	11.1 Introduction 11.2 The Factorial Function 11.3 Definition of the Gamma Function; Recursion Relation 11.4 The Gamma Function of Negative Numbers 11.5 Some Important Formulas Involving Gamma Functions 11.6 Beta Functions 11.7 Beta Functions in Terms of Gamma Functions 11.9 The Error Function 11.10 Asymptotic Series 11.11 Stirling's Formula	537 – 552

7. Assessment:

Assessment	Grade Proportion	Week/Dates
Class Work (Quizzes, Homework and Attendance of the lecture)	**6 %**	
First exam	**22 %**	**الاثنين 2019/11/4**
Second exam	**22 %**	**الأربعاء 2019/12/11**
Final exam	**50 %**	**End of Semester**
Total	**100 %**	

8. Text Book:

The main reference	Mathematical Methods in the Physical Sciences
Author(s)	Mary L. Boas
Publisher	JOHN WILEY & SONS, INC.
Year	2006
The edition	3rd edition

9. References and additional resources:

1)	Chu W. Wong, Introduction to mathematical physics, methods and concepts
2)	G. B. Arfken & H. J. Weber, Mathematical methods for physicists
3)	Kreszing E. , Advanced Engineering mathematics
4)	K. F. Riley , M. P. Hobson and S. J. Bence , Mathematical Methods for Physics and Engineering