اعتماد
NCAAA

T4

2020

Course Specifications

Course Title:	**Mathematical Method**
Course Code:	**2023201-4**
Program:	**Bachelor in Mathematics.**
Department:	**Mathematics and Statistics Department**
College:	**Faculty of Sciences**
Institution:	**Taif University**

Table of Contents

A. Course Identification

1. Credit hours: 4 Hours	

2. Course type

a. University ☐ College ☐ Department ☑ Others ☐

b. Required ☑ Elective ☐

3. Level/year at which this course is offered: 8ᵗʰ level / 3ʳᵈ year

4. Pre-requisites for this course (if any)**:**
    Differential equation (2023103-4)

5. Co-requisites for this course (if any)**:**
    None

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	5Hr /Week	100
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	50
2	Laboratory/Studio	
3	Tutorial	
4	**Others** (specify) E-Learning There are many items of this course including answered examples and exercises the student should log on his blackboard to get understanding and then solve the exercises.	
	Total	**50**

B. Course Objectives and Learning Outcomes

1. Course Description

In this course we explain the Strum- Liouville problem (ordinary and singular), properties of Eigen function, Eigen values and orthonormal set of function. Analyze Fourier series for functions of periodic 2π, Fourier coefficients, odd and even function and their properties, the Half – Range Series, sine, cosine series, the series containing only odd harmonics or even harmonics. Demonstrate Fourier transforms, their properties, and the solution of the initial boundary value problems for PDEs using Fourier transforms. Study gamma and beta functions, relation between gamma and beta functions, hyper geometric functions and it's properties, Bessel functions, the recursion relation, orthogonal and normalized of the Bessel functions, Analyze Hermite functions and it's properties, the recursion relation of the Hermit functions.

2. Course Main Objective

The student will be taught as follows:

1. **Introducing Strum- Liouville problem and properties of Eigen values and Eigen functions**

2. **Analyzing Fourier series for functions, Fourier transforms and their properties.**

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding:**	
1.1	**Define Strum- Liouville problem (ordinary and singular), properties of Eigen values, Eigen function and orthonormal set of function.**	**K2**
1.2	**Recognize the Fourier series for functions, the Fourier transforms, their properties, and the solution of the initial boundary value problems for PDEs using the Fourier transforms.**	**K2**
2	**Skills:**	
2.1	**Explain the Strum- Liouville problem and the properties of eigenvalues and eigen functions.**	**S4**
2.2	**Calculate the Fourier series for functions.**	**S4**
2.3	**Apply the partial differential equations in some problems in applied scie mathematical physics.**	**S4**
3	**Values:**	
3.1	**Demonstrate responsibility and ethically in conducting their work**	**V3**

C. Course Content

No	List of Topics	Contact Hours
1	Introduction and general review**.**	5
2	Investigate Strum- Liouville problem (ordinary and singular). Knowledge the properties of Eigen function and Eigen values. Orthonormal set of function.	5
3	Fourier series for functions of periodic 2π, Fourier coefficients, Odd and even function and their properties, Fourier coefficient for odd and even functions.	5
4	The Half – Range Series, Half rang sine series and half rang cosine series. the series containing only odd harmonics or even harmonics.	5
5	Fourier transforms and their properties. Using the Fourier transforms, Fourier sine and Fourier cosine to find the solution of the initial boundary value problems for PDEs	5
6	**Midterm exam.** Review session on one, two and three chapters and discussion of projects and exercises distributed during the semester**,**	5
7	Definition of gamma and beta functions- Some integral using gamma and beta functions- The relation between gamma and beta functions-	5
8	The hyper geometric functions and convergence test- properties of hyper geometric functions- The integral formulation for the hyper geometric functions – Properties of hyper geometric function	5
9	Bessel function and its properties- Some conformity for Bessel functions- orthogonal and normalized to the Bessel functions. Recursion relation to the Bessel functions.	5
10	Hermite function and its properties- Some conformity for Hermite functions- orthogonal and normalized to the Hermite functions. Recursion relation to the Hermite functions.	5
Total		**50**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding:**		
1.1	**Define Strum- Liouville problem (ordinary and singular), properties of Eigen values, Eigen function and orthonormal set of function.**	• Lectures • Group discussions	• Quizzes Assignments
1.2	**Recognize the Fourier series for functions, the Fourier transforms, their properties, and the solution of the initial boundary value problems for PDEs using the Fourier transforms.**	• Lectures • Group discussions	• Exams • Assignments
2.0	**Skills:**		
2.1	**Explain the Strum- Liouville problem and the properties of eigenvalues and eigen functions.**	• Interactive classes Group discussions	• Quizzes Assignments
2.2	**Calculate the Fourier series for functions**	• Lectures • Group discussions	• Exams • Quizzes
2.3	**Apply the partial differential equations in some problems in applied sciences and mathematical physics.**	• Lectures Self-learning through the website	• Exams • Quizzes Assignments
3.0	**Values:**		
3.1	**Demonstrate responsibility and ethically in conducting their work**	Interactive classes. Give students tasks of duties.	Assessment of design projects that have elements of interpersonal skills.

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Quizzes + Home works**	**Continues**	**10 %**
2	**Midterm exam**	**5th-6th**	**30 %**
3	**Class Work (Homework- report- class test….)**	**8th**	**10 %**
4	**Final exam**	**11th**	**50 %**

*Assessment task (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:
6 hours per week (as defined in the teaching schedule of the faculty member) for academic advice and consultations.
Teaching staff is also available using Blackboard web site and Taif University "Edugate" System.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	**English reference**: Rukmangadachari, Mathematical methods, Pearson India, 2009. **Arabic references:** 1- السيد محمد أبودهب خضيري، ناهد سيد محمود حسين، عبد المعطي محمد، طرق رياضية للعلميين والمهندسين، كنوز المعرفة، الطبعة الأولى، 1440هـ. 2- محمد بن عبد الرحمن القويز، الطرائق الرياضية في تحليل فورييه، مطابع جامعة الملك سعود، 1433هـ.
Essential References Materials	Mathai, A.M. and Haubold, H.J., 2008. Special functions for applied scientists (Vol. 4). New York: Springer.
Electronic Materials	https://oiipdf.com/special-functions-for-applied-scientists
Other Learning Materials	Matlab tutorial.

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	**Lecture halls, containing white boards, and electronic monitors - The seats fit the number of students - Laboratories equipped with suitable numbers of computers**
Technology Resources (AV, data show, Smart Board, software, etc.)	**Laptop and projector**.
Other Resources (Specify, e.g., if specific laboratory equipment is required, list requirements or attach a list)	**Wi-Fi internet connections**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment	Students	Indirect
Quality of learning resources	Peer Reviewer	Direct
	Students	Indirect
Extent of achieving the course learning outcomes	Peer Reviewer	Direct
	Students	Indirect

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	Department of Mathematics and Statistics
Reference No.	11
Date	12-7-1443 H

قسم الرياضيات والإحصاء
Mathematics and Statistics
Department

جامعة الطائف
TAIF UNIVERSITY