هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	**Mathematical Methods**
Course Code:	2023201-4
Program:	Bachelor in Mathematics
Department:	Mathematics and Statistics Department
College:	**Faculty of Sciences**
Institution:	**Taif University**
Version:	1
Last Revision Date:	20/05/2023

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: 4(4,0,0)

2. Course type

A.	☐University	☐College	☒ Department	☐ Track	☐Others
B.	☒ Required		☐Elective		

3. Level/year at which this course is offered: Level 8 / Third Year

4. Course general 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 2p, 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.

5. Pre-requirements for this course (if any):

Differential equation (2023103-4)

6. Co-requirements for this course (if any):

None

7. Course Main Objective(s):

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.**

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	**4Hr /Week**	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	60
2.	**Laboratory/Studio**	NA
3.	**Field**	NA
4.	**Tutorial**	NA
5.	**Others (specify)**	NA
Total		**60**

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with program	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.	K2	• 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	K2	• Lectures • Group discussions	• Exams • Assignments

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	the Fourier transforms.			
2.0	**Skills**			
2.1	Explain the Strum- Liouville problem and the properties of eigenvalues and eigen functions.	S4	• Interactive classes • Group discussions	• Quizzes • Assignments
2.2	Calculate the Fourier series for functions.	S4	• Lectures • Group discussions	• Exams • Quizzes
2.3	Apply the partial differential equations in some problems in applied sciences and mathematical physics.	S4	• Lectures • Self-learning through the website	• Exams • Quizzes • Assignments
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate responsibility and ethically in conducting their work	V3	• Interactive classes • Give students tasks of duties	• Assessment of design projects that have elements of interpersonal skills

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction and general review.	4
2.	Investigate Strum- Liouville problem (ordinary and singular). Knowledge the properties of Eigen function and Eigen values. Orthonormal set of function	4
3.	Fourier coefficients, Odd and even function and their properties, Fourier coefficient for odd and even functions.	4
4.	The Half – Range Series, Half rang sine series and half rang cosine series. the series containing only odd harmonics or even harmonics.	4
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	4
6.	Review session on one, two and three chapters and discussion of projects and exercises distributed during the semester	4
7.	**First Midterm exam**	4
8.	Definition of gamma and beta functions- Some integral using gamma and beta functions-	4
9.	The relation between gamma and beta functions	4

10.	The hyper geometric functions and convergence test- properties of hyper geometric functions	4
11.	The integral formulation for the hyper geometric functions – Properties of hyper geometric function	4
12	Bessel function and its properties- Some conformity for Bessel functions- orthogonal and normalized to the Bessel functions	4
13.	**Second Midterm exam**	4
14.	Recursion relation to the Bessel functions.	4
15	Hermite function and its properties- Some conformity for Hermite functions- orthogonal and normalized to the Hermite functions. Recursion relation to the Hermite functions.	4
Total		60

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quizzes	Continuous Evaluation	10 %
2.	Assignments, report	Continuous Evaluation	10 %
3.	Midterm 1 Exam	8-9	15%
4.	Midterm 2 Exam	12-13	15%
5.	Final Exam	15-16	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	Mathai, A.M. and Haubold, H.J., 2008. Special functions for applied scientists (Vol. 4). New York: Springer.
Supportive 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 فوريه، مطابع جامعه الملك سعود، 1433هـ.
Electronic Materials	https://oiipdf.com/special-functions-for-applied-scientists

Other Learning Materials	Matlab tutorial.

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms, which can accommodate up to 50 students and equipped with e-podiums, and internet access.
Technology equipment (Projector, smart board, software)	Laptop, smart board, and projector.
Other equipment (Depending on the nature of the specialty)	Wi-Fi internet connections

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Indirect
Effectiveness of students assessment	Faculty, Program Leader	Direct
Quality of learning resources	Peer Reviewer, Students	Direct, Indirect
The extent to which CLOs have been achieved	Peer Reviewer, Students	Direct. Indirect
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	Department Council
REFERENCE NO.	4
DATE	October 2023

قسم الرياضيات والإحصاء
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