

9. Learning Outcomes, Teaching, Learning and Assessment Method

A- Cognitive goals.

1. Students will enhance their logical thinking and problem structuring abilities, and will further develop their understanding of the concept of proof.
2. Enable students to obtain knowledge and understanding of the basic principles of applied mathematics.
3. Empower students to obtain knowledge and understanding the power series method and Fourier Series Analysis in applied mathematics.
4. Enable students to gain knowledge and understanding of how laws are linked.
5. Support students to identify the most important applications in mathematics such as solving some complicated equations with complex roots and how to make a mathematical analysis using Fourier series.

B. The skills goals special to the course.

1. The student will be able to use power series method to solve 2nd or even 3rd order linear homogenous ODEs.
2. Studying and finding the analytical solutions for different special functions/equations.
3. Fourier series will be discussed and studying intensively.

Teaching and Learning Methods

1. Giving theoretical lectures.
2. Giving descriptive homework.
3. Direct questions to students to test their understanding of the topic.
4. Assigning students homework.
5. Solving problem sheets and past examination papers.

Assessment methods

1. Monthly exams and daily quizzes.
2. Programmed mid-term exams.
3. Homeworks.
4. Direct oral questions.

C. Affective and value goals

1. Enabling students to solve second and third order linear homogenous ODEs.
2. Enabling students to solve problems related to the derivations of laws and their equations.
3. Enabling students to solve mathematical problems using the simplest means.

Teaching and Learning Methods

Assessment methods

Assessment weighting used for 2-3 attempts.

Weighting:

Homeworks and quizzes 15%
Exams 85%

D. General and rehabilitative transferred skills (other skills relevant to employability and personal development)

1. The ability to self-research to solve applied mathematical problems.
2. Handling various type of differential equation using efficient methods and its benefits and use in mathematics.

10. Course Structure

Week	Hours	ILOs	Unit/Module or Topic Title	Teaching Method	Assessment Method
1	4		Introduction to Linear Equations and Power Series. Studying the convergence of power series.		
2	4		Ordinary Points and Singular Points. Regular Singular Points, The Indicial Equation.		
3	4		Form and Validity of The Solution Near a Regular Singular Point. Indicial Equation with Difference of Roots Non-Integral.		
4	4		Differentiation of a Product of Equation. Indicial Equation with Equal Roots.		
5	4		Indicial Equation with Difference of Roots a Positive		

			Integer (Non Logarithmic Case, Logarithmic Case). Solution of Large x (Point at Infinity).		
6	4		Special Functions: The Gamma, Beta and Error Function.		
7	4		Bessel's Functions: Bessel's Equation, Repeated Relation, Integral Form for Bessel's Functions, Modified Bessel's Functions		
8	4		Legendre Equation, Legendre Polynomial.		
9	4		Generating Function for Legendre Polynomials, Orthogonality for Legendre Polynomials Associated Legendre Equation.		
10	4		Hypergeometric Equation and The Confluent Hypergeometric Equation.		
11	4		Laguerre Polynomials Hermite Polynomials		
12	4		Fourier Series: Orthogonality of a Set of Sine and Cosine.		
13	4		Fourier Series: An Expansion theorem. Examples of Fourier series: Even and odd Functions.		
14	4		Fourier Sine Series, Fourier Cosine Series. Change of Interval. Complex Form of Fourier Series. Differentiation and Integration of Fourier Series. Fourier Transform.		
15	4		Integral Transforms. Fourier Integrals. Fourier Transforms. Fourier Sine & Cosine Transform. Convolution Theory of Fourier Transform.		

11. Infrastructure

1. Books Required reading:

Elementary Differential Equations, by E. D. Rainville and P. E. Bedient

Fourier series and Boundary Value Problems (Brown and Churchill Series) 8th Edition.

2. Main references (sources)	Elementary Differential Equations, by E. D. Rainville and P. E. Bedeint
A- Recommended books and references (scientific journals, reports...).	<p>طرق في الرياضيات التطبيقية, تأليف د. باسل يعقوب يوسف</p> <p>Any website that specializes and reliable to study applied mathematics.</p>
B-Electronic references, Internet sites...	
12. The development of the curriculum plan	
Including new topics with applications and replacing some old topics at this module. Some of these subjects should be transferred back to level 2 especially ODEs module (Second year BSc)!	