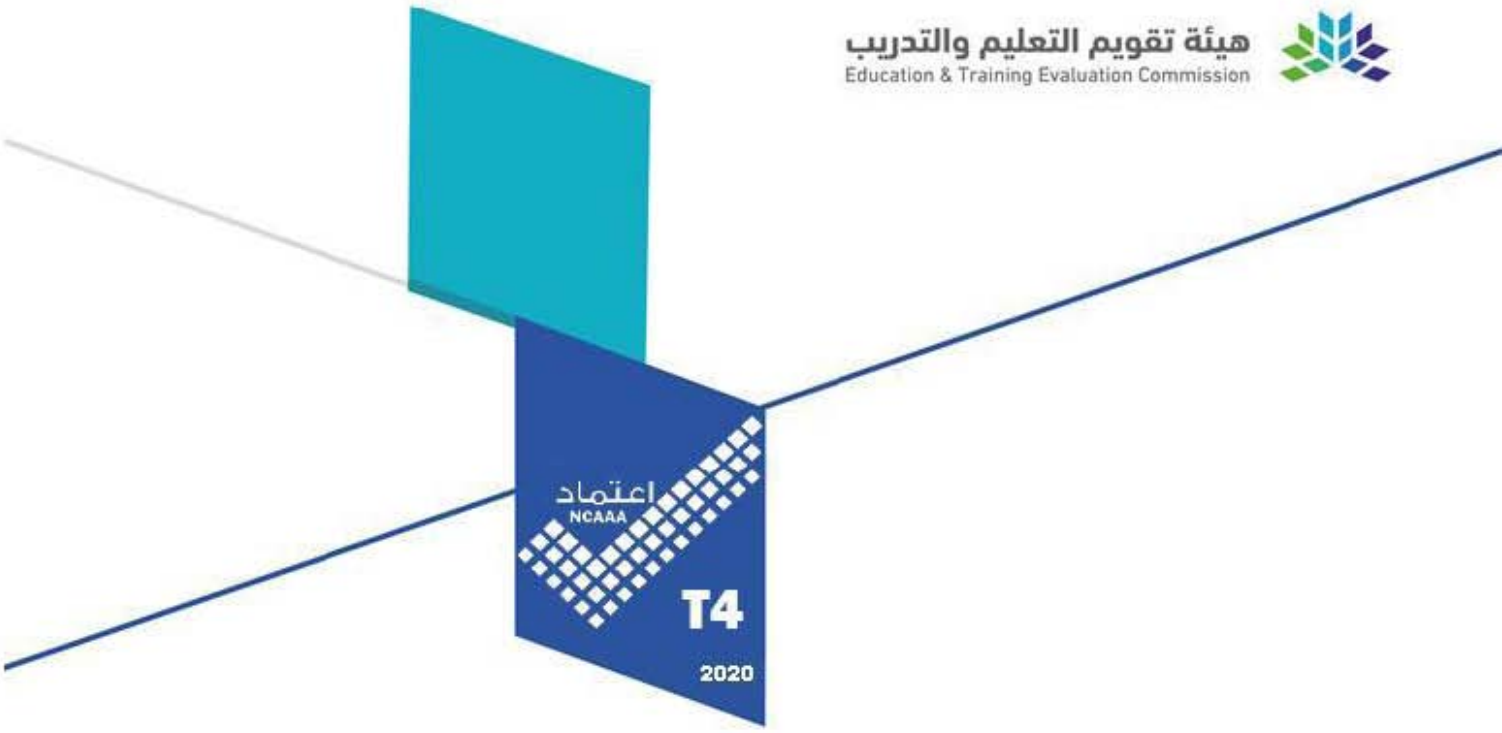
هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission



Course Specifications

Course Title:	**Theoretical Methods in Physics (2)**
Course Code:	**PHY2202**
Program:	**Physics**
Department:	**Physics**
College:	**Applied Sciences**
Institution:	**Umm Al-Qura University**

Table of Contents

A. Course Identification

1. Credit hours:	**4 hrs**
2. Course type	
a.	University ☐ College ☐ Department ☑ Others ☐
b.	Required ☑ Elective ☐
3. Level/year at which this course is offered:	**4/2nd year**
4. Pre-requisites for this course (if any):	**Theoretical Methods in Physics (1)**
5. Co-requisites for this course (if any):	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	40	100%
2	**Blended**		
3	**E-learning**		
4	**Distance learning**		
5	**Other**		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	40
2	**Laboratory/Studio**	-
3	**Tutorial**	-
4	**Others** (specify) Exams/ Quizzes	-
	Total	40

B. Course Objectives and Learning Outcomes

1. Course Description

This course is intended to introduce to Fourier series and Fourier Transforms as well as ordinary differential equations with their various physics applications. Topics cover the basic of Fourier series and Fourier Transforms and how to apply them to expand a function. In addition, the course includes methods to solve differential equations (various orders),, an introduction to systems of differential equations, the Laplace transform, and the Green functions. Applications of first-order linear differential equations and second-order linear differential equations with constant coefficients will be also studied.

2. Course Main Objective

This course is designed to supply students for a variety of mathematical methods that need for advanced undergraduate and beginning graduate study in physical science and to develop a solid background for those who will continue into the mathematics of advanced theoretical

physics

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and understanding:**	
1.1		K1(I)
1.2		K1(I), K2(I)
1.3	Apply Fourier series and Fourier transform to related physics applications.	K1(I), K2(I)
1.4	Recognize several types of first and second ordinary differential equations and the appropriate methods to solve them.	K1(I), K2(I)
1.5		
2	**Skills:**	
2.1	Explain the principles and properties of the discrete Fourier series and Fourier transform together with their applications.	S2(I)
2.2		S2(I)
2.3	Solve ordinary differential equations using standard methods like separation of variables, auxiliary equation, integral transforms etc.	S1(I)
2.4	Apply Laplace transforms to solve ordinary differential equations.	S1(I)
3	**Values:**	
3.1	Participate effectively in multidisciplinary and/or interdisciplinary teams.	V2(I)
3.2		V1(I), V2(I)
3.3		V1(I)
3.4		V1(I)

C. Course Content

No	List of Topics	Contact Hours
1	**Fourier series and transforms:** Periodic Functions, Average Value of a Function, Fourier Coefficients, Dirichlet Conditions, Complex Form of Fourier Series, Even and Odd Functions, Applications of Fourier Series, Parseval's Theorem, Fourier Transforms.	12
2	**First order ordinary differential equations:** Separable equations, linear 1st order equations, Bernoulli equation, Exact equations & integrating factors, Homogeneous equations, Change of variables.	8
3	**Second order ordinary differential equations:** Linear homogeneous equations, undamped & damped oscillator, Linear inhomogeneous equations, finding particular solutions, Forced vibrations, Resonance, General ordinary differential equations, Fourier series in Finding particular solutions.	12
4	**Solution of Differential Equations by Laplace Transforms:** The Laplace Transform, Convolution, The Dirac Delta Function, Introduction to Green Functions.	8
	Total	**40**

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	Be familiar with the concepts of Fourier series, Fourier transform as well as Laplace transforms.	1. Lectures. 2. Discussions 3. Slides and computer simulation software may be used by the teachers to clarify concepts. 4. Problems solving 5. Students may be asked to solve some problems on computer using MATLAB language.	1- Homework assignments. 2- Group Project assignment. 3- Question – answer session in class. 4- Exams: quizzes, Mid-term, and final exams
1.2	Recognize how to expand a function in a Fourier series, and under what conditions such an expansion is valid.		
1.3	Recognize and taste the physical meanings Fourier series, Fourier transform and the related applications.		
1.4	Recognize several types of first and second ordinary differential equations and the appropriate methods to solve them.		
2.0	**Skills**		
2.1	Explain the principles and properties of the discrete Fourier series and Fourier transform together with their applications.	1. Lectures. 2. Discussions. 3. Problems solving. 4. Encourage the student to look for the information in different references. 5. Ask the student to attend lectures for practice solving problem. 6. Define duties for each chapter	**1**- Homework assignments. **2**- Group Project assignment. **3**- Question – answer session in class. **4**- Exams: quizzes, Midterm, and final exams.
2.2	Justify the necessity of using Fourier series and Fourier transform in signal processing.		
2.3	Solve ordinary differential equations using standard methods like separation of variables, auxiliary equation, integral transforms etc.		
1.4	Apply Laplace transforms to solve ordinary differential equations.		
3.0	**Values**		
3.1	Participate effectively in multidisciplinary and/or interdisciplinary teams	**1.** Groupe assignments **2.** Clarify deadlines for delivery of assignments, reports, and exams	**1.** Evaluate the efforts of each student in preparing the report. **2.** Evaluate the work in teams. Evaluation of students' presentations.
3.2	Accepting different ideas and respecting other opinions.		
3.3	Manage a project (modelling or simulation) with due attention to time and resource management		
3.4	Take responsibility and take the course instructions seriously.		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Exercises and HomeWorks	All weeks	10%
2	Participation in activities and quizzes.	All weeks	10%
3	Midterm exam	6th week	30%
4	Final exam	End of the term	50%

*Assessment task (i.e., written test, oral test, oral presentation, group project, essay, etc.)
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E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

Students are supervised by academic advisers in physics Department and the timetables for academic advice were given to the student each semester (8hrs per week).

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Mary L. Boas, Mathematical methods in the Physical sciences, Third edition, John Wiley & Sons (2006). ISBN-13: 978-0471198260
Essential References Materials	**1.** Mathematical Methods for Physicists: A Comprehensive Guide 7th edition, by George B. Arfken, Hans J. Weber, Frank E. Harris, Academic Press is an imprint of Elsevier (2013), ISBN: 978-0-12-384654-9. **2.** Mathematical Methods for Physics and Engineering, by K. F. Riley, M. P. Hobson and S. J. Bence, Cambridge University Press; (2006), ISBN-13: 978-0521679718.
Electronic Materials	
Other Learning Materials	MATLAB

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, e).	Lecture room Labs
Technology Resources (AV, data show, Smart Board, software, etc.)	data show, software
Other Resources	None

Item	Resources
(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Student Feedback on Effectiveness of Teaching	Students	Direct
Evaluation of Teaching	Department	Indirect
Improvement of Teaching	Program leaders	Direct
Quality of learning resources	Faculty	Direct
Extent of achievement of course learning outcomes	Program leaders	Direct

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	Dr Atif Ismail, Dr. Walid Belhadj and Prof. Khaled Abdel-Waged
Reference No.	
Date	