Course Specification
(Bachelor)

Course Title:	**Mathematical Physics (2)**
Course Code:	**2033203-3**
Program:	**Bachelor in Physics**
Department:	**Department of Physics**
College:	**College of Science**
Institution:	**Taif University**
Version:	**2023**
Last Revision Date:	20/09/2023

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A. General information about the course:

1. Course Identification

1. Credit hours: (3)

2. Course type

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

3. Level/year at which this course is offered: (5th Level / 1nd Year)

4. Course general Description:

This course covers important parts for applied mathematics to some physical phenomena. Students will study Fourier series for periodic functions and its applications, partial differential equations and its resolution using separation of variables method, complex numbers and analytical functions, followed by some applications of the residue theorem to calculate some definite integrals. Finally, Parseval's theorem, the convolution product, as well as, Laplace and Fourier transforms and their applications for solving differential equations will be also studied.

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

Mathematical physics(1) / 2033102-3

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

None

7. Course Main Objective(s):

Use Fourier series to expand periodic functions. Solve partial differential equations using separation of variable method. Evaluation of definite integrals by using residue theorem. Find solution of differential equation by using the method of Laplace and Fourier Transform.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	3	100%
2	E-learning	0	0%
3	Hybrid Traditional classroom E-learning	0	0%
4	Distance learning	0	0%

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	45
2.	Laboratory/Studio	0
3.	Field	0
4.	Tutorial	0
5.	Others (specify)	0
Total		45

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	• State the basic concepts of Fourier series, Dirichlet condition, Parseval's Theorem, Partial differential equations and complex numbers.		• lecture	• Written exam
1.2	• Define separation of variables method and superposition theory and write Cauchy integral theorem, Fourier and Laplace transform.	K2	• Enhanced with lecture	• Written exam
…				
2.0	Skills			
2.1	• Expand the Periodic function by using Fourier series, deduce the value of an infinite sum of a numerical series, apply residue theorem, as well	S1	• Problem solving	• Written exam

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	as, properties of Fourier and Laplace Transform.			
2.2	• Solve differential equations by using separation of variables, Laplace and Fourier Transform.		• Problem solving	• Written exam
3.0	Values, autonomy, and responsibility			
3.1	• Show responsibility for working independently and interacting with staff to extract important information and identifying key issues to make progress	V1	• Groups discussion	• Homework
3.2	• Interacting, working in groups and having a willingness to take initiative.		•Groups discussion	• Homework Reports and research activities

C. Course Content

No	List of Topics	Contact Hours
1	**Unit 1: Fourier series** ▪ Periodic functions ▪ Applications of Fourier series ▪ Fourier coefficients ▪ Complex form of Fourier series ▪ Fourier series for odd and even functions ▪ Dirichlet conditions and Parseval's theorem	9
2	**Unit 2: Partial differential equations** ▪ The diffusion or thermal conduction equation ▪ Laplace's equation ▪ The wave equation - the vibrating string ▪ Steady state temperature in a cylinder and in a sphere	12

	▪ Vibration of a circular membrane ▪ Poisson' s equation	
3	**Unit 3: Functions of a complex variable** ▪ Analytic functions ▪ Contour integrals ▪ The residue theorem ▪ Methods of finding residue ▪ Evaluation of definite integrals by using residue theorem	**12**
4	**Unit 4: Integral transforms** ▪ Laplace transform and its inversion ▪ Solution of differential equation by using Laplace transform ▪ Fourier transforms and its inversion ▪ Solution of differential equation by using Fourier transform ▪ Convolution product, Parseval' s theorem	**12**
Total		**45**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Activities	Periodically	20%
2.	Midterm exam	8^{th}	15%
3.	Short exam	13^{th}	15%
4.	Final exam	16^{th}	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	▪ Mathematical methods in the physical sciences , M.L.Boas , John Wiley &sons ,2^{nd} edition ,1983

Supportive References	▪ Mathematics for Physics, Michael Stone and Paul Goldbart ▪ Mathematical Tools for Physics,by James Nearing Physics
Electronic Materials	▪ http : // hyperphysics ,phy-astr.gsu.edu / hbase / hframe.htm ▪ Wikipedia.org / Wiki / physics subjects ▪ http://www.physics.miami.edu/nearing/mathmethods/mathematical_methods-three.pdf
Other Learning Materials	• CD associated with the text books (when available). • Lecture notes and Power Points presentations prepared by the lecturer.

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Lecture room with max 60 seats • Lecture room with max 60 seats
Technology equipment (projector, smart board, software)	• Data show • Smart board
Other equipment (depending on the nature of the specialty)	• None

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	• Instructor • Program coordinator • Departmental council	Indirect
Effectiveness of Students assessment	• Students	Indirect
Quality of learning resources	• Students • Faculty	Indirect
The extent to which CLOs have been achieved	• Program leaders • Instructor	Direct
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	PHYSICS DEPARTMENT COUNCIL
REFERENCE NO.	NO. 4-45
DATE	27/09/2023 (12/03/1445)

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