هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

Course Specifications

Course Title:	MATHEMATICAL PHYSICS
Course Code:	**252 PHYS**
Program:	**Physics**
Department:	**Physics**
College:	**Science**
Institution:	**Jazan University**

Table of Contents

A. Course Identification

1. Credit hours: 3
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐
3. Level/year at which this course is offered: Level4/Year2
4. Pre-requisites for this course (if any)**: 201 MATH**
5. Co-requisites for this course (if any)**:NIL**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	**36**	**80 %**
2	**Blended**	**6**	**13 %**
3	**E-learning**		
4	**Distance learning**		
5	**Other (lab)**	**3**	**07%**

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	**40**
2	**Laboratory/Studio**	--
3	**Tutorial**	**5**
4	**Others** (specify)	--
	Total	**45**

B. Course Objectives and Learning Outcomes

1. Course Description

The objective of this course is to provide the students with necessary mathematical tools for formulating physics problems. Acquiring these tools is a must for any physics students.

2. Course Main Objective

This course is designed to ;

- Provide students with the fundamental mathematical tools to understand other physics courses.
- Develop their skills in problem solving and formulating physical problems.

Apply the knowledge they acquire in this course to other physics related situations and identify their solutions.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**Define** the complex numbers, Euler formula, matrix operation, determinant, Fourier series and integrals, Gamma and beta functions.	**PLO1.1**
1.2	**Describe** the required tools and various relevant equations needed to solve a physical problem and the conditions for the validity of such equations.	**PLO1.1**
1.3	**Discuss** various concepts in complex numbers, linear algebra, Fourier analysis and gamma and beta functions.	**PLO1.2**
2	**Skills :**	
2.1	**Derive** the Euler formula, Cramer's rule, Fourier coefficients, and Gamma functions for simple cases.	**PLO2.1**
2.2	**Solve** problems related complex numbers, linear algebraic equations, Fourier Series and some special functions.	**PLO2.2**
2.3	**Develop** communication and critical thinking competencies during interactive discussion, group assignments, essays or web-based activities	**PLO2.4**
2.4		
3	**Values:**	
3.1	**Develop** abilities of team work, bear individual responsibilities on assigned tasks	**PLO3.1**
3...		

C. Course Content

Theoretical Part

No	List of Topics	Contact Hours
1	**Complex numbers**: Complex plane, Complex algebra, Complex conjugate and absolute value of complex numbers, Complex equations, Graphs and physical applications of complex numbers, Elementary functions of complex numbers, and Exponential and trigonometric functions.	**9**
2	**Linear Algebra** : The fundamental operation of matrices, Relation between matrices and linear equations, Cramer's rule, Vectors, lines and planes, Linear combination, linear functions and linear operators, Eigenvalue and eigenvector of a transformations.	**12**
3	**Fourier series and Fourier integrals**: Periodic and non-periodic functions, Average value of a function, Fourier series, Complex form of Fourier series, Even and odd functions, Fourier transforms and Laplace transforms.	**15**
4	**Special functions**: The factorial function, The Gamma function and recursion relation. The Beta function and relation between the Gamma and Beta functions.	**6**
5	**Review**	**3**
Total		**45**

Experimental Part: NA

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** the complex numbers, Euler formula, matrix operation, determinant, Fourier series and integrals, Gamma and beta functions.	Lectures, blackboard and visualization, group and interactive guided discussion, Interactive discussion	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey
1.2	**Describe** the required tools and various relevant equations needed to solve a physical problem, and the conditions for the validity of such equations.	Lectures, blackboard and diagram illustration, group discussion, Interactive illustrations- Student contribution	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
1.3	**Discuss** various concepts in complex numbers, linear algebra, Fourier analysis and gamma and beta functions.	Lectures, blackboard and diagram illustration, group discussion, Interactive illustrations- Student contribution	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
2.0	**Skills**		
2.1	**Derive** the Euler formula, Cramer's rule, Fourier coefficients, and Gamma functions for simple cases.	Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustration – Problem based learning	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey
2.2	**Solve** problems related complex numbers, linear algebraic equations, Fourier Series and some special functions.	Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustration – Problem based learning	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey
2.3	**Develop** communication and critical thinking competencies during interactive discussion, group assignments, essays or web-based activities	Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustration – Problem based learning	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey
3.0	**Values**		
3.1	**Develop** abilities of team work, bear	Interactive and	**Direct** (formative and

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	individual responsibilities on assigned tasks	Group discussion, expository and discovery teaching	summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey
…			

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Homework assignment- Contribution in interactive discussion**	**4**	**5 (5%)**
2	**Quiz 1**	**5**	**2 (2%)**
3	**First Mid-term exam**	**7**	**15 (15%)**
4	**Homework assignment- Contribution in interactive discussion**	**8**	**6 (6%)**
5	**Quiz 2**	**9**	**2 (2%)**
6	**Second mid-term exam**	**12**	**15 (15%)**
7	**Homework assignment- Contribution in interactive discussion- Group work-essay or Project discussion**	**13**	**5 (5%)**
8	**Final Exam**	**16**	**50 (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 :

Available through the department and office hours; 10 office per week are allocated for students to see faculty or teaching staff.

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	Mary L. Boas Mathematical Methods in the Physical Sciences; 3rd edition, John Wiley& Sons, USA, (2006).
Essential References Materials	G Arfken, H Weber and F Harris Mathematical Methods for Physicists, Academic Press (2013). C Wong Introduction to Mathematical Physics , Oxford University Press (1991)
Electronic Materials	**http://mathworld.wolfram.com/Sine.html** **http://www.wikipedia.org/**
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	COMPUTER ROOM
Technology Resources (AV, data show, Smart Board, software, etc.)	SOFTWARES , MATHEMATICA , MATLAB
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (CES)- Indirect peer evaluation
Assessment	Program assessment committee , students	Direct/ Indirect
Extent of achievement of course learning outcomes	Instructor	Direct/Indirect
Quality of learning resources	Students, Faculty members	Indirect
Effectiveness of teaching	Students, Peer and program leader	Indirect (CES)- Indirect peer evaluation

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 council**
Reference No.	**8**
Date	**16/4/1442**