هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission
اعتماد
NCAAA
2024
TP-153

Course Specification
(Bachelor)

Course Title:	**Mathematical Methods**
Course Code:	**MAT 1332**
Program:	**Bachelor of Science in Applied Mathematics**
Department:	**Mathematics and Statistics**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	**2024 – V1**
Last Revision Date:	**08/10/2024**

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A. General information about the course:

1. Course Identification

1. Credit hours:					
3 (2 Lectures, 0 Lab, 2 Tutorial)					
2. Course type					
A.	☐University	☒ College	☐ Program	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: Level 5 / Year 3					
4. Course general Description:					
The Mathematical Methods course provides students with essential techniques for solving complex mathematical problems in various fields. It covers series solutions of differential equations, including power series, Euler-Cauchy equations, and the Frobenius method, along with special functions like Gamma and Beta functions. The module also explores vector calculus, focusing on vector-valued functions, the Del operator, and fundamental theorems such as Green's, Divergence, and Stokes'. Additionally, students will learn about Fourier transforms, including Fourier series, integrals, and their properties, culminating in applications such as the Discrete Fourier Transform and Fast Fourier Transform.					
5. Pre-requirements for this course (if any):					
MAT1203 Calculus (3) and MAT 1231 Introduction to Differential Equations					
6. Co-requisites for this course (if any):					
None.					
7. Course Main Objective(s):					
This course plays a critical role in the program's structure by providing essential mathematical tools that underpin many advanced topics in applied mathematics, preparing students for real-world applications in science and engineering.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	**60**	**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**	30
2.	**Laboratory/Studio**	0
3.	**Field**	0
4.	**Tutorial**	30
5.	**Others (specify)**	0
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	Identify various techniques, including Power series method, Special functions, and Fourier series/transform, to solve differential equations.	K1	4 lecture hours\week 2 tutorial hours\week Self-study	Regular Exams Assignments Short Quizzes
1.2	Distinguish advanced differential and integral calculus theory.	K2	4 lecture hours\week 2 tutorial hours\week Self-study	Regular Exams Assignments Short Quizzes
2.0	**Skills**			
2.1	Apply appropriately Fourier transform and their inverse real-life problems involving differential equations in the context of mathematical method	S1, S2	Self-study Real-life problems	Participations Short Quizzes
2.2	Communicate mathematics clearly and precisely both orally and in writing.	S4	Self-study Real-life problems	Participations Short Quizzes
2.3	Use mathematical software and online solvers to solve differential equation in context of the course.	S5	Self-study Real-life problems	Participations Short Quizzes
2.4	Develop competency in mathematical presentation, written and verbal skills.	S3	Self-study Real-life problems	Participations Short Quizzes

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate confidence in solving given mathematical problems.	V1, V3	Class discussion	Individual classwork
3.2	Operate meaningfully and productively with others.	V1, V2	Team work	Group classwork

C. Course Content

No	List of Topics	Contact Hours
1.	**Series solutions of differential equations:** Power series solution of differential equations around ordinary points, Euler-Cauchy equations, Frobenius method for solving second order linear differential equations around regular singular points, Bessel's equations and Bessel's functions, Legendre's Equations. Special functions (Gamma and Beta functions).	**20**
2.	**Vector Calculus:** Vector-Valued Functions of one variable, Del operator: divergence, gradient, curl, and Laplacian, Line and Surface Integrals, conservative fields, Green's Theorem, Divergence Theorem, Stokes' Theorem, Vector operators in curvilinear coordinate systems, Some Physical Applications of Vector Calculus.	**20**
3.	**Fourier Series and Fourier Transforms:** Fourier Series, Cosine and Sine Fourier Series, Complex Fourier Series, Fourier Integrals and their convergence, Fourier Transform, Inverse Fourier Transform, Fourier Cosine and Sine transforms, Time and frequency shifting. Properties and Applications of the Fourier transforms.	**20**
Total		**60**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	HomeWorks, Quizzes, Mini-projects	During the term	10%
2.	First Midterm	Week 5-6	25%
3.	Second Midterm	Week 10-11	25%
4.	Final Exam	Week 15	40%

*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	**Elementary Differential Equations and Boundary Value Problems, W. Boyce and R. Di Prima, 9th edition, New York: John Wiley & Sons, (2010).**
Supportive References	**Advanced Engineering Mathematics, E. Kreyszig, John Wiley & Sons, INC 10th ed. (2010).** **Mathematical methods in the physical sciences, Boas, Mary L.: John Wiley & Sons, INC., (2005).** **Calculus, Robert T. Smith and Roland B. Minton, 4th Edition; McGraw-Hill, 2012.**
Electronic Materials	
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• **Classrooms:** Equipped with whiteboards, projectors, and Smart Boards for interactive lessons and group discussions. • **Laboratories:** Feature computers with internet access, enabling hands-on activities and exploration of algebraic and trigonometric concepts. • **Exhibition Rooms:** Spaces for showcasing projects and presentations to encourage collaborative learning.
Technology equipment (projector, smart board, software)	• **Data Show Projectors:** For clear presentations in classrooms and labs. • **Smart Boards:** To enhance interactivity during lessons. • **Mathematical Software:** Essential for graphing and analysis.
Other equipment (depending on the nature of the specialty)	• **Computers:** For mini-project and homework and practical applications in laboratories. • **Advanced Calculators:** For computations and problem-solving and supporting the study of limits, continuity, and differentiation. • **Whiteboards and Markers:** To facilitate brainstorming and collaboration.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Student and teaching staff	Surveys and Questionnaires
Effectiveness of Students assessment	Course Coordinator	Peer Reviews
Quality of learning resources	Students and teaching staff	Classroom Observations
The extent to which CLOs have been achieved	Student Representatives	Student Performance Evaluations (exams, projects) CLOs Excel sheet.
Other	**None**	

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
REFERENCE NO.	**8/1446**
DATE	**05/04/1446 (08/10/2024)**