T-104
2022

Course Specification

(Postgraduate)

Course Title:**Partial Differential Equations**
Course Code:**MATH668**
Program: **Master Program in Mathematics**
Department: **Mathematics**
College: **Science**
Institution: **University of Tabuk, KSA**
Version: **2**
Last Revision Date:**1/12/1443 H**

Table of Contents:

A. General information about the course:

Course Identification	
1. Credit hours:	3 H
2. Course type	
a.	University ☐ College ☐ Department ☒Track☐ Others☐
b.	Required ☐ Elective☒
3. Level/year at which this course is offered: Level-2 or higher	
4. Course general description In this course, we will study the treatment of the theory of partial differential equations with emphasis on the fundamental features of elliptic equations, existence and uniqueness of solutions for various types of boundary conditions, discussion of representative examples of elliptic, parabolic hyperbolic equations, Sturm-Liouville Problems and sine-Gordon equation.	
5. Pre-requirements for this course (if any): None	
6. Co-requirements for this course (if any): None	
7. Course Main Objective(s) Upon completion of the course students will be able to: 1. Use knowledge of partial differential equations, modeling, the general structure of solutions, and analytic methods for solutions. 2. Formulate physical problems as PDEs. 3. Understand analogies between mathematical descriptions of different (wave) phenomena in physics and engineering. 4. Classify PDEs, apply analytical methods, and physically interpret the solutions.	

1. Teaching mode

No	Mode of Instruction	Contact Hours	Percentage
1.	Traditional classroom	45	100 %
2.	E-learning		
3.	Hybrid • Traditional classroom • E-learning		
4.	Distance learning		

2. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	3 H /week
2.	Laboratory/Studio	
3.	Field	
4.	Tutorial	
5.	Others (specify)	
	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: The students will be able to:			
1.1	Demonstrate advanced concepts in PDE's.	K1	Lectures, Group works, Presentations, Classroom discussion, Seminar, Case study, problem solving session	Exams, Quizzes, Research project, presentation, interactive discussion and participation, Surveys.
1.2	Describe different methods of PDE's problems and keep up with the recent advancements in this field.	K2		
2.0	Skills: The students will be able to:			
2.1	Apply advanced concepts and theorems of partial differential equation.	S1	Lectures, Group works, Presentations, Classroom discussion, Seminar, Case study, problem solving session	Exams, Quizzes, Home works, Assignments, Research project, presentation, interactive discussion and participation, Surveys.
2.2	Solve complicated PDE's using advanced analytical methods.	S2		
3.0	Values, autonomy, and responsibility: The students will be able to:			
3.1	Demonstrate responsibility during work individually or in group research.	V2	Lectures, Group works, Presentations, Classroom discussion, Seminar, Case study, problem solving session	Research project, Home works, Assignments, presentation, interactive discussion and participation, Surveys.
3.2	Writing technical reports on PDE's individually or in group.	V2		
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C. Course Content

No	List of Topics	Contact Hours
1	Classification of general second order quasi-linear equations and reduction to standard form for each type (elliptic, parabolic and hyperbolic).	3
2	Linear elliptic equations : Existence and regularity solution to Dirichlet problem. General elliptic boundary value problems. Operator properties of regular boundary value problems.	3
3	The Dirichlet problem on a domain with rough boundary and the Reimann mapping theorem (rough boundary).	3
4	The Hodge decomposition and harmonic forms.	3
5	The Neumann and Natural boundary problems for the Hodge Laplacian.	3
6	Linear Evolution Equations: The Heat equations on bounded domains.	3
7	**Mid-Exam #**	---
7	Linear Evolution Equations: The Heat equations on bounded domains.	3
8	Linear Evolution Equations: The Wave equation on bounded domains.	3
9	The Cauchy –Kowalewsky theorem,	3
10	Hyperbolic systems.	3
11	Variation principle for the nonlinear Klein-Gordon equations.	3
12	Variation principle for the nonlinear Klein-Gordon equations.	3
13	Sturm-Liouville Problems.	3
14	Sturm-Liouville Problems.	3
15	The solution of sine-Gordon equation using separable variables. Becklund transformation for Sine-Gordon Equations.	3
16+7	**Review & Final Exam**	
Total		**45**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Home works and Assignments	Weekly basis	20%

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
2.	Mid-term exam	6th week	25%
3.	Presentation and discussion	During the semester	15%
4.	Final exam	At the end of the semester	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	1. Michael E. Taylor, Partial Differential Equations I: Basic Theory, Springer; 2nd ed. 2011, 2. Giuseppe Gaeta, Perturbation Theory: Mathematics, Methods and Applications, , Springer New York, NY 2022.
Supportive References	None
Electronic Materials	Saudi electronic library.
Other Learning Materials	None

2. Required facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Lecture room with capacity of 15 students at most and equipped with White Board, Library
Technology equipment (projector, smart board, software)	Overhead projector and internet connection.
Other equipment (depending on the nature of the specialty)	

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Direct and Indirect
Effectiveness of students assessment	Teacher	Direct
Quality of learning resources	Students	Indirect
The extent to which CLOs have been achieved	Teacher, Quality Committee	Direct and Indirect
Other		

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

Assessment Methods(Direct, Indirect)

G. Specification Approval Data

Council / Committee	**Approval by the Department Council**
Reference No.	DEPARTMENT COUNCIL NO (26)

Date	11/9/1444 H