

12. Pre-requisites or Other Academic Requirements	<div style="display: flex; justify-content: space-around;"> A MA201a B MA201b </div> Ordinary Differential Equations A (MA201a) or Ordinary Differential Equations B (MA201b)
13. Courses for which this course is a pre-requisite	This course is for undergraduates who are science, engineering, mathematics, or financial mathematics majors.
14. Cross-listing Dept.	None

SYLLABUS

15. **Course Objectives**

Partial Differential Equations (PDEs) is a branch of mathematics which is concerned with the establishment of mathematical models, the theoretical analysis and interpretation of objective phenomena and the solution of practical problems. This course will provide students with the basic concepts, theories and methods of PDEs, with emphasis on the understanding of PDEs models and their applications in other disciplines.

16. **Learning Outcomes**

Poisson
d'Alembert

Laplace
Green

Through this course, students will master some basic concepts, theories and methods of Partial Differential Equations. Master the physical background and mathematical derivation of transport equation, heat equation, Laplace equation, Poisson equation and wave equation. Master the method of characteristics, method of separation of variables, energy methods, method of fundamental solution, method of Green's function and d'Alembert formula. Master the maximum-minimum principle and its applications.

17.

Course Contents (in Parts/Chapters/Sections/Weeks. Please notify name of instructor for course section(s), if this is a team teaching or module course.)

	(1)
	3
2.1	
2.2	
	(18)
3.1	
3.2	
3.3	
3.4	
3.5	Sturm-Liouville
3.6	
3.7	
3.8	
	16
4.1 Laplace	Poisson
4.2	
4.3 Laplace	
4.4 Green	
4.5	
4.6 Green	
	10
5.1	
5.2	
5.3	
5.4 d'Alembert	
Chapter 1 Introduction (1 Credit Hour)	
Definition of Partial Differential Equations (PDEs); order, linearity, homogeneity, superposition principle; general solutions, initial and boundary conditions; classifications of second order PDEs; examples of PDEs	
Chapter 2 First-order Partial Differential Equations (3 Credit Hours)	
2.1 Transport equation: derivation	
2.2 First-order linear PDEs: method of characteristics, general solutions and break-down of smoothness	
Chapter 3 Parabolic Equations (18 Credit Hours)	
3.1 Heat equation and reaction-diffusion equation: derivation	
3.2 Boundary conditions for heat and diffusion equations	
3.3 Uniqueness of solution of heat equation via energy method	
3.4 Method of separation of variables	
3.5 Eigenvalue problems: Sturm-Liouville theory and eigen-expansion	
3.6 Non-homogeneous problem	
3.7 Fundamental solution of heat equation	
3.8 The Maximum principles	
Chapter 4 Elliptic Equations (16 Credit Hours)	
4.1 Laplace and Poisson equations	
4.2 Separation of variables	
4.3 Fundamental solution of Laplace equation	
4.4 Green's identities and applications	
4.5 Maximum-minimum principle	
4.6 Method of Green's function	
Chapter 5 Hyperbolic Equations (10 Credit Hours)	
5.1 Wave equation: string vibration	
5.2 Energy and uniqueness	
5.3 Method of separation of variables	
5.4 d'Alembert formula and wave propagation	

18. **Textbook and Supplementary Readings**

Textbook:

Lecture notes on Partial Differential Equations, Tao Tang and Xuefeng Wang.

Reference:

1. A First Course in Partial Differential Equations with Complex Variables and Transform Methods, H. F. Weinberger, 1995.
2. , , , 2005.
3. Partial Differential Equations: An Introduction, second edition, Walter A. Strauss, 2008.

ASSESSMENT

19.

Type of Assessment	Time	% of final score	Penalty	Notes
Attendance				
Class Performance				
Quiz				
Projects				
Assignments	3 hours per week	20		
Mid-Term Test	2 hours	40		
Final Exam	3 hours	40		
Final Presentation				
Others (The above may be modified as necessary)				

20. **GRADING SYSTEM**

A.	Letter Grading
B.	/ Pass/Fail Grading

REVIEW AND APPROVAL

21. /
This Course has been approved by the following person or committee of authority

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