

COURSE OUTLINE

Course No: MATH 147 (A+B)

Course Title: Ordinary Differential Equation, Partial Differential Equations & Vector Calculus

Credit hours: 4.0

Contact hours: Office Time

Level/Term: L-1, T-2

Academic Session: 2019-2020

Course Teacher(s):

Name:	Office/Room	E-mail and Telephone: (optional)	Class routine	
1. Dr. Salma Parvin				
2. Khondoker Nazmoon Nabi	Ga-24, OAB Building (Ground Floor)	khnabi@math.buet.ac.bd	Sec A	Saturday: 11.00-11.50 a.m Tuesday: 8.00-8.50 a.m
			Sec B	Saturday: 10.00-10.50 a.m Tuesday: 9.00-9.50 a.m

Course Contents: *(To be filled from the course handbook)*

Ordinary Differential Equation (ODE): Degree and order of ordinary differential equation. Formation of differential equations. Solution of first order differential equations by various methods. Solution of first order but higher degree ordinary differential equations. Solution of general linear equations of second and higher orders with constant coefficients; Solution of homogeneous linear equations and its applications. Solution of differential equations of higher order when dependent and independent variables are absent. (1.5 credit)

Partial Differential Equations (PDE): Introduction; Solution of linear and non-linear PDE of order one. Second order linear PDE: its nomenclature and classifications to standard forms: Parabolic Elliptic and Hyperbolic. Solution of second order linear PDE by separation of variables. Higher order linear PDE with constant coefficients. (1.0 credit)

Vector Calculus: Multiple products of vectors. Differentiation and integration of vectors together with elementary applications. Gradient, divergence and curl of point functions. Various formulae. Definition of line, surface and volume integrals. Green's theorem. Gauss's theorem. Stoke's theorem. (1.5 credit)

Learning Outcomes/Objectives:

At the end this course, students will be able to:

- i. formulate differential equation in different area of science and engineering.
- ii. give an account of basic concepts and definitions for ordinary differential equations.
- iii. apply the fundamental concepts of ordinary differential equations for their resolution.
- iv. solve the ordinary differential equations of science and engineering problems by choosing the most suitable method.
- v. formulate and solve ordinary differential equation problems in the field of engineering.
- vi. identify linear and non-linear partial differential equations, it's order and degree.
- vii. solve linear and non-linear partial differential equations.
- viii. be familiar with some applications of partial differential equations and apply them in their desired field.
- ix. be familiar with a technique of solving second order partial differential equations by separation of variables.
- x. deal with the techniques of differentiation and integration of vector functions.
- xi. evaluate line, surface and volume integral.
- xii. interpret the physical significance of gradient, divergence and curl.
- xiii. apply Stokes theorem, Green's theorem, Gauss's theorem.

Assessment

Class Participation/Attendance: 10%

Homework Assignment and Quizzes: 20%

Term Final Exam: 70%

Text Book:

- i. Elementary Differential Equations by Earl D. Rainville and Phillip E. Bedient.
- ii. A First Course in Differential Equations with Modeling Applications by Dennis G. Zill.
- iii. Ordinary and Partial Differential Equations by M.D. Raisinghania
- iv. Elements of Partial Differential Equations by Ian Naismith Sneddon.
- v. Calculus by Howard Anton, Irl Bivens and Stephen Davis.
- vi. Schaum's Outline of Theory and Problems of Vector Analysis by Murray R. Spiegel.
- vii. Vector Analysis by M.D. Raisinghania.

Reference Books:

- i. Differential Equations with Applications by M. M. K. Chowdhury.
- ii. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley)
- iii. Introduction to Partial Differential Equations and Boundary Value Problems by Rene Denneweyer.

Weekly schedule: For Ordinary Differential Equations

Week	Topics	Teacher's Initial/Remarks
Week-1	Degree and order of ordinary differential equations, Formation of differential equations.	
Week-2	Formation of differential equations, Solution of first order differential equations by various methods (separable form and reducible to separable form).	
Week-3	Solution of first order differential equations by various methods (homogeneous form and reducible to homogeneous form).	
Week-4	Solution of first order differential equations by various methods (linear differential equation and Bernoulli's differential equation).	
Week-5	Solution of first order differential equations by various methods (exact differential equation, non-exact differential equation and integrating factor by inspection).	
Week-6	Class Test	
Week-7	Classification of solutions of differential equations, Application of first order differential equations.	
Week-8	Solution of first order but higher degree ordinary differential equations.	
Week-9	Solution of general linear equations of second and higher order with constant coefficients (homogeneous and non-homogeneous).	
Week-10	Solution of general linear equations of second and higher order with constant coefficients (non-homogeneous).	

Week-11	Solution of homogeneous linear equations (Cauchy-Euler equations) with applications.	
Week-12	Solution of differential equations of the higher order when dependent and independent variables are absent.	
Week-13	Class Test	
Week-14	Review Class.	

Weekly schedule: For Vector Algebra

Week	Topics	Teacher's Initial/Remarks
Week-1	Ordinary Differential Equations	
Week-2		
Week-3		
Week-4		
Week-5		
Week-6		
Week-7		
Week-8	Multiple products of vectors, Differentiation and integration of vectors together with elementary applications.	
Week-9		
Week-10	Gradient of scalar functions. Divergence and curl of vector functions.	
Week-11	Physical significance of gradient, divergence and curl.	
Week-12	Solving problems related to gradient, divergence and curl.	
Week-13		
Week-14		

Weekly schedule: For Partial Differential Equations

Week	Topics	Teacher's Initial/Remarks
Week-1	Introduction to partial differential equations.	
Week-2	Introduction to partial differential equations.	
Week-3	First order Linear partial differential equations.	
Week-4	First order Linear partial differential equations.	
Week-5	First order Non-linear partial differential equations.	
Week-6	First order Non-linear partial differential equations.	
Week-7	Class Test	
Week-8	Linear equations of higher order.	
Week-9	Linear equations of higher order.	
Week-10	Second order PDE with variable coefficient.	
Week-11	Second order linear PDE: it's nomenclature and classifications to standard forms: Parabolic Elliptic and Hyperbolic.	
Week-12	Solutions of second order PDE by separation of variables.	
Week-13	Solutions of second order PDE by separation of variables.	
Week-14	Class Test	

Weekly schedule: For Vector Calculus

Week	Topics	Teacher's Initial/Remarks
Week-1	Line integrals.	
Week-2	Solving problems related to Line integrals.	
Week-3		
Week-4		
Week-4	Green's theorem and Solving problems related to this theorem	
Week-5		
Week-6		
Week-7		
Week-7	Surface and volume integrals.	
Week-8		
Week-9		
Week-10		
Week-11		
Week-11	Gauss's theorem and Solving problems related to this theorem.	
Week-12	Stokes theorem and Solving problems related to this theorem.	
Week-13		
Week-14		