

## University of Asia Pacific (UAP) Department of Basic Sciences & Humanities

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### Course Outline

<b>Program:</b>	Computer Science & Engineering (CSE)
<b>Course Title:</b>	Math IV
<b>Course Code:</b>	MTH 205
<b>Semester:</b>	Spring -2018
<b>Level:</b>	2 <sup>nd</sup> year 2 <sup>nd</sup> Semester
<b>Credit Hour:</b>	3.0
<b>Name &amp; Designation of Teacher:</b>	Dr. Md. Manirul Alam Sarker, Professor, Department of Mathematics, BUET (Part-time faculty of UAP)
<b>Office/Room:</b>	Department of BS&H, 2 <sup>nd</sup> floor, UAP campus
<b>Class room:</b>	<b>Sunday -714, Thursday -713</b>
<b>Class Hours:</b>	Sunday: 3:30-4:45 pm, Thursday: 5:00-6:15 pm ( <b>Sec A</b> ) Sunday: 5:00-6:15 pm, Thursday: 3:30-4:45 pm ( <b>Sec B</b> )
<b>Consultation Hours:</b>	Sunday: 2:30-3.30 pm Thursday: 2:30-3.30 pm
<b>E-mail:</b>	masarker45@gmail.com
<b>Mobile:</b>	01715362127
<b>Rationale:</b>	Differential equations occur in numerous problems encountered in the various branches of science and engineering, such as the problem of determining the motion of a projectile, rocket, satellite or planet; the charge or current in an electric circuit. Differential equations are required for the students to be able to build up mathematical models and to analyze them and finally to solve different physical problems.
<b>Pre-requisite (if any):</b>	MTH 201
<b>Course Synopsis:</b>	<p><b>First Order Differential Equations:</b> Linear Equations, Separable Equations, Exact Equations, Bernoulli Differential Equations, Substitutions, Intervals of Validity, Modeling with First Order Differential Equations, Equilibrium Solutions, Euler's Method.</p> <p><b>Laplace Transforms:</b> Laplace Transforms, Inverse Laplace Transforms, Step Functions, Solving Initial Value Problems with Laplace Transforms.</p> <p><b>Systems of Differential Equations:</b> Second Order Equations and Systems, Euler's Method for Systems, Qualitative Analysis, Linear Systems (Vector Representations of Solutions of Linear Systems, Eigen values and Eigenvectors Technique, Qualitative Analysis of Linear Systems), Nonlinear Systems (Equilibrium Point Analysis: Linearization Technique.</p>

**Series Solutions:** Series Solutions, Euler Equations.

**Higher Order Differential Equations:** Basic Concepts for  $n^{\text{th}}$  Order Linear Equations, Linear Homogeneous Differential Equations, Undetermined Coefficients, Variation of Parameters, Laplace Transforms, Systems of Differential Equations, Series Solutions.

**Boundary Value Problems & Fourier Series:** Boundary Value Problems, Eigen values and Eigen functions, Periodic Functions and Orthogonal Functions, Fourier Sine Series, Fourier Cosine Series, Fourier Series, Convergence of Fourier Series.

**Partial Differential Equations:** The Heat Equation, The Wave Equation, Terminology, Separation of Variables, Solving the Heat Equation, Heat Equation with Non-Zero Temperature Boundaries, Laplace's Equation, Vibrating String.

**Course Objectives (CO):**

The objectives of this course are to:

1. Apply appropriate methods to find the solutions of differential equations, systems of differential equations, series solutions, and partial differential equations.
2. Explain Laplace transform and inverse Laplace transforms of standard functions both from the definition and by using tables. Application based problems of ODE using Laplace and inverse Laplace transforms.
3. Introduce periodic function, odd and even function. Determine appropriate coefficients and to be able to apply Fourier series to simple initial value problems and wave problems.

**Learning Outcomes (LO):**

After completion of the course student will be able to:

1. Recognize and solve differential equations by using various methods with and without initial conditions.
2. Find the solution of partial differential equations and series solution.
3. Determine Laplace transforms and inverse Laplace transforms of various functions. Use the method of Laplace transforms to solve initial-value problems and boundary value problems.
4. Understand the nature of the Fourier series that represent even and odd functions as a half-range cosine or sine Fourier series and how the derivation of a Fourier series can be simplified.

**Teaching-learning and Assessment Strategy:** Lectures, assignments, quizzes, exams.



### Linkage of LO with Assessment Methods & their Weights:

LO	Assessment Method	(%)
1-3	Quiz	15
1-4	Class attendance	10
4	Assignment	5
1, 2	Midterm Exam	20
1-4	Final Exam	50

**Minimum attendance:** 70% class attendance is mandatory for a student in order to appear at the final examination.

### Mapping of Course LO and Generic Skills:

Learning Outcome (LO) of the Course	Generic Skills* (Appendix-1)									
	1	2	3	4	5	6	7	8	9	10
Recognize and solve first order differential equations and higher order differential equations by using various methods with and without initial conditions.	√	√	√							
Find the solution of partial differential equations and series solution.	√	√								
Determine Laplace transforms and inverse Laplace transforms of various functions. Use the method of Laplace transforms to solve initial-value problems and boundary value problems for linear differential equations with constant coefficients.	√	√	√							
Understand the nature of the Fourier series that represent even and odd functions as a half-range cosine or sine Fourier Series and how derivation of a Fourier series can be simplified in this way.	√	√	√							

### Lecture Schedule

Weeks	Topics	Reading Materials
1	Definition and formulation of differential equation.	Ordinary and Partial Differential Equation by M. D. Raisinghanian
2-4	Solution of first order ordinary differential equations by various methods.	Ordinary and Partial Differential Equation by M. D. Raisinghanian and A First course in Differential Equations with Modeling Applications by Dennis G. Zill
	<b>QUIZ 1</b>	
5	Solution of ordinary differential equations of first order and higher degree.	Ordinary and Partial Differential Equation by M. D. Raisinghanian
6	Solution of general linear equations of second and higher orders with constant	Ordinary and Partial Differential Equation by M. D. Raisinghanian and

	coefficient.	A First course in Differential Equations with Modeling Applications by Dennis G. Zill
	<b>QUIZ 2</b>	
7	Solution of Euler's homogenous linear equations.	Ordinary and Partial Differential Equation by M. D. Raisinghania
8	Review of Midterm Syllabus	
	<b>MIDTERM EXAM</b>	
9	Definition, Laplace transforms of some elementary functions, Sufficient conditions for existence of Laplace transforms, the unit step function, Periodic functions	Schaum's Outline of Laplace Transforms by Murray R. Spiegel
	<b>QUIZ 3</b>	
10	Inverse Laplace transforms, some special theorems on Laplace transforms, partial fraction	Schaum's Outline of Laplace Transforms by Murray R. Spiegel
11	Laplace transforms of derivatives, Evolution of integral, Solutions of differential equations by Laplace transformations	Schaum's Outline of Laplace Transforms by Murray R. Spiegel
	<b>QUIZ 4</b>	
12-13	Fourier integral, Fourier transforms and their uses in solving Boundary value problem	Fourier Analysis with Applications to Boundary Value Problems by Schaum's Outline Series.
14	Review of Final Exam Syllabus	
	<b>FINAL EXAM</b>	

**Required Reference(s):**

1. M.D. Raisinghania, Ordinary and Partial Differential Equation (Revised Edition)
2. Dennis G. Zill, A First course in Differential Equations with Modeling Applications (7<sup>th</sup> Edition)
3. Murray R. Spiegel, Schaum's Outline of Theory and Problems of Laplace Transforms.
4. Murray R. Spiegel- Theory And Problems of Fourier Analysis with Applications To Boundary Value Problems.

**Recommended Reference(s):** Engineering Mathematics, H. K. Dass (HKD) [15<sup>th</sup> Edition]

**Student's responsibilities:**

- ✓ Students must come to the class prepared for the course material covered in the previous class (es).
- ✓ They must submit their assignments on time.
- ✓ They must be aware of the *Plagiarism Policy* as spelt out in the curriculum.
- ✓ No late or partial assignments will be acceptable. There will be no make-up quizzes



Prepared by	Checked by	Approved by
Dr. Md. Manirul Alam Sarker	Curriculum Committee, Department of BS&H	Head/Dean

#### **Appendix-1: Generic Skills**

No.	Generic Skills
1.	Intellectual skills
2.	Practical and Problem solving skills
3.	Scientific and Analytical skills
4.	Entrepreneurship and Innovation skills
5.	Communication & IT skills
6.	Values, Ethics and Morality
7.	Teamwork and Leadership skills
8.	Professionalism
9.	Social skills and responsibilities
10.	Life-long Learning skills

#### **Grading Policy**

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00