

**MNS Department**

**Summer - 2017**

**Course no. MAT 215(Sec-02)**

**Course title: Mathematics –III**

**(Complex Variables and Laplace Transformation)**

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| **INSTRUCTOR DETAILS** | |
| A H M Mahbubur Rahman  Lecturer  Department of Mathematics and Natural Sciences  BRAC University | **Office:** 15th Floor, Building 2, Dept. of MNS.  **E-mail: mahbubur.rahman@bracu.ac.bd** |

**LECTURE & CONSULTATION SCHEDULE**

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| **CLASS** | | | **CONSULTATION SCHEDULE** | | |
| **DAY** | TIME | ROOM | **DAY** | TIME | OFFICE |
| SUN | 3:30PM―4:50PM | UB10201 | TUE | 09.30AM – 12:20PM | 15th floor,UB2 |
| TUE | 3:30PM―4:50PM | UB10201 | THU | 09.30AM – 12:20PM |  |

**Course Contents:**

**Part-I: Complex variables**

Complex Number system, General function of a complex variable, Limits and Continuity of a function of complex variables and related theorems, Complex differentiation and Cauchy-Riemann equations, Line integral of a complex function, Contour Integral, Cauchy’s theorem, Cauchy’s integral formula, Taylor’s and Laurent’s theorem, Singular points, Residue, Cauchy’s residue theorem, Evaluation of residues, Contour Integration

**Part-II: Laplace Transformation**

Laplace transformation, Sufficient condition for existence of Laplace theorem, Inverse Laplace theorem, Laplace transforms of derivatives, the unit step function, Periodic function, Some special theorem on Laplace theorem, Solutions of differential equation by Laplace transform, Evaluation of improper integrals.

**Learning Outcome:** By the end of this course, the students will be able to:

* Define and explain the complex number system, different forms of a complex number, complex variables, complex plane and region.
* Define different complex variable functions.
* Understand the limit, continuity and differentiability concept of complex valued functions and evaluate them.
* Evaluate Integrals of complex-valued function, Contour Integrals.
* Find the infinite series and the residues of a complex-valued function.
* Define the Laplace and the Inverse Laplace transformation. Derive the Laplace transforms of some basic functions.
* Application of Laplace Transformation in solving Differential Equations.

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| Recommended Text Books: | 1. Complex Variables and Applications: James W.Brown and Ruel V. Churchill; 6th Edition. 2. A first Course in Differential Equations: Dennis G. Zill, 7’th Edition. 3. Complex Variables: M.R. Spiegel, Schaum’s Outline Series. 4. Laplace Transform: M.R. Spiegel, Schaum’s Outline Series. |

**Course Webpage:** You can obtain soft copy of books, tutorial sheets or any instruction from [\\TSR\SUMMER\MNS\MAT215](file:///\\TSR\SUMMER\MNS\MAT215)

**Administrative Information:** There will be two 1 hour and 20 minutes lectures every week, for this course. A pass in this course will earn you 3 credits. Attendance at lectures (minimum 70% and above) are essential for access to the final examirrespective of the reason of absences, and student will be listed as an absentee.. **Four quizzes** will be taken and **best three** will be counted out of them. **There will be no make up quizzes.** Zero will be given for missed quizzes.

**Grade Distribution:** The final grade is based on the attendance, quiz performances, midterm and final exams contributing 5%, 25%, 20% and 50% respectively.

**Office Hours:** You are strongly encouraged to drop by my office to ask questions, discuss problems. I will usually be available for questions immediately after class. If you are unable to meet with me at these times, I am available at other times by appointment.

**Lecture Delivery Plan:**

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| **Lecture No** | **Content** |
| 1 | Introduction to Real and Complex number system, Algebraic Properties |
| 2 | Inverse, Modulus, Argument, Conjugates, Triangular Inequality |
| 3 | Polar and Exponential form of Complex numbers, Euler’s formula |
| 4 | DeMoivre’s theorem, Roots of complex numbers |
| 5 | Review of the previous lecture **Quiz # 01** |
| 6 | Complex variables, Complex plane and region |
| 7 | Complex function, Limits and Continuity |
| 8 | Derivatives and Differentiation formulae, Cauchy Riemann Equation, the necessary and sufficient condition for differentiability |
| 9 | Analytic functions, harmonic functions, harmonic Conjugate functions |
| 10 | Exponential and Trigonometric Function |
| 11 | Hyperbolic and logarithmic function **Quiz # 02** |
| 12 | Concept of multiple functions and Branches, Complex exponent, Inverse trigonometric and Hyperbolic function |
| 13 | **Midterm(Tentative)** |
| 14 | Integrals of complex-valued function, Concept of contour in complex plane, Contour Integrals of complex valued function of complex variables |
| 15 | Anti-derivatives of complex-valued function, Cauchy-Goursat Theorem |
| 16 | Application of Cauchy-Goursat Theorem in simply and multiply connected domain, Cauchy’s Integral formula  **Quiz # 03** |
| 17 | Cauchy’s Integral Formula and related theorems |
| 18 | Taylor’s series and Laurent’s series |
| 19 | Concept of Residues, Cauchy’s residue theorem |
| 20 | Concept of singular points, Different types of singular points, Residues at pole **Quiz # 04** |
| 21 | Evaluation of improper integrals using contour integration, evaluation of definite integrals involving sine and cosine |
| 22 | Laplace Transform: definition and examples, Laplace transform of some basic functions, existence of Laplace transform, Inverse transform, transform of derivative, Solution of ODE. |
| 23 | Translation theorem, inverse form of the theorem, Convolution theorem and related problem |
| 24 | Laplace transform of dirac-delta function , Application of Laplace in solving ODE |

**There will be changes in lecture plans, if necessary, according to the progress of the students.**