# Course Outline Format

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| Program | BSEE |
| Credit Hours | **3** |
| Duration | One Semester |
| Prerequisites | (Applied Calculus) |
| Resource Person | **Dr. M. imran Asjad** |
| Counseling Timing | Tuesday, Wednesday and Thursday |
| Contact | [Imran.asjad@umt.edu.pk](mailto:Imran.asjad@umt.edu.pk)  0339869929 |

**Chairman/Director Programme signature………………. Dean’s signature…………**

**Date………………………………….**

**Learning Objective**

1. **Complex arithmetic, algebra and geometry:** Develop facility with complex numbers and the geometry of the complex plane culminating or applying in finding the nth roots of a complex number.
2. **Differentiable Functions and the Cauchy-Riemann equations:** Show knowledge of whether a complex function is differentiable and use the use the Cauchy-Riemann equations to calculate the derivative.
3. **Analytic and Harmonic functions:** Determine if a function is harmonic and find a harmonic conjugate via the Cauchy-Riemann equations.
4. **Sequences, Series and Power Series:** Determine whether a complex series converges.  Should know the proofs of different tests used for checking convergence/divergence of complex series. Show understanding of the region of convergence for power series.
5. **Elementary functions – exponential and logarithm:** Understand the similarities and differences between the real and complex exponential function.  Compute the complex logarithm.
6. **Elementary functions – trigonometric and hyperbolic:** Understand the relationships among the exponential, trigonometric and hyperbolic functions. Derive simple identities.
7. **Complex integration – contour integrals:** Set up and directly evaluate contour integrals and applications
8. **Fourier Series**,**:** Solution of Heat Equations Using Fourier Series

**Learning Methodology**

Lecture, interactive, participative

**Grade Evaluation Criteria**

Following is the criteria for the distribution of marks to evaluate final grade in a semester.

**Marks Evaluation Marks in percentage**

Quizzes 10

Assignments 15

Mid Term 25

Attendance & Class Participation

Term Project

Presentations

Final exam 50

Total 100

**Recommended Text Books**

Complex Analysis for Mathematics and Engineering by John H. Mathews and Russell W. Howell Jones and Bartlett Publishers, Latest edition.( 3rd Edition)

**Reference Books**

* Advanced Engineering Mathematics –by Erwin Kreyszig (latest Edition), John Wiley;
* Mathematical Physics - by H. K Dass (latest Edition),

**Calendar of Course contents to be covered during semester**

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| **Week** | **Activity** | **Reference** |
| **1** | 1. Discussion of Course Plan 2. *Algebra* of complex numbers. | Pages: 5 - 11 |
| **2** | *Geometry* of Complex Numbers | Pages: 12 - 23 |
| **3** | 1. *De Moivre's* formula and its applications.   2) *Functions* of a complex variable. | Pages: 24 - 29  Pages: 38 - 40 |
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| **4** | 1. *Limits* and *Continuity*, 2. *Differentiable* functions. | Pages: 53 - 59  Pages: 71 - 75 |
| **5** | The Cauchy – Riemann equations | Pages: 76 - 83 |
| **6** | 1. Analytic and harmonic functions. 2. Complex *Logarithm* and complex *exponents*. | Pages: 84 - 89,  92 – 93  Pages: 132 - 142 |
| **7** | *Trigonometric*, *hyperbolic*, **inverse** trigonometric andhyperbolic functions. | Pages: 143 -156 |
| **8** | *Sequences* and *Series* (Convergence **tests**). | Pages: 95 - 109 |
| **9** | Power series functions (*Radius* of convergence) | Pages: 109 - 115 |
| **10** | Complex **integrals** and **contours** | Pages: 157 - 163 |
| **11** | Contour integrals | Pages: 164 - 175 |
| **12** | *Simply* and *multiple* connected domains. | Pages: 175 - 177 |

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| **13** | Fourier Series, | Pages: 552 - 570 |
| **14** | Solution of Heat Equations Using Fourier Series | Pages: 570 - 582 |
| **15** | Solution of Laplace Equation | Pages: |
| **16** | **FINAL EXAM** |  |