# Faculty of Engineering & Technology

## Complex Variable and Special Functions (Math 5)

### Information :

| **Course Code :** | MTH 311 | **Level** | **:** | Undergraduate | **Course Hours :** | 3.00- Hours |
|---|---|---|---|---|---|---|

| **Department :** | Department of Petroleum Engineering |
|---|---|

### Instructor Information :

| Title | Name | Office hours |
|---|---|---|
| Lecturer | Soliman Abdulkarim Alkhatib | 7 |
| Lecturer | Soliman Abdulkarim Alkhatib | 7 |
| Lecturer | Ahmed Mahsoup Mohamed ElHadidi | 9 |
| Assistant Lecturer | Doaa Nabil Sayed Mohamed Elsayed Khodair | 2 |
| Assistant Lecturer | Basma Magdy Ahmed Mohamed | 4 |
| Teaching Assistant | Bassel Yasser Mohamed Kamel | 1 |
| Teaching Assistant | Reham Shawket Mostafa Taha Khalaaf | |
| Teaching Assistant | Ahmed Elsayed Abdellatif Ibrahim Bedeir | |
| Teaching Assistant | Ahmed Elsayed Abdellatif Ibrahim Bedeir | |

### Area Of Study :

 Demonstrate a conscious understanding of the concepts of special functions and complex analysis.
 Develop students mathematical skills for the methods of solution of partial differential equations.
 Acquire skills for the application of special functions and complex analysis to solve electrical engineering problems

### Description :

Power Series solutions of ordinary Differential equations. Solutions about Ordinary Points, Solutions about Singular Points. Frobineous theorem. Special functions, Partial differential equations, heat and wave equations. Laplace equation in Rectangular and Polar coordinates, D'lambert solution, Numerical solutions of Partial differential equations. Functions of complex variables, Cauchy Riemann Equations, Complex integrals, Laurent series, Evaluation of real integrals by residues. Conformal mappings.

### Course outcomes :

| a.Knowledge and Understanding: : | |
|---|---|
| 1 - | Explain the Power Series solutions of ordinary Differential Solutions using Frobineus theorem. |
| 2 - | Identify Partial differential equations, their types and methods of solutions. |
| 3 - | Define Gamma, Beta, and Bessel functions, and Legendre Polynomials as solutions of partial differential equations. |
| 4 - | Define Elementary complex functions, Cauchy-Riemann Equations, Complex integrals, Laurent series, and the evaluation of real integrals by residues. |
| 5 - | Describe conformal mappings for electrical engineering applications. |

| | | |
|---|---|---|
| **b.Intellectual Skills: :** | | |
| 1 - | Apply Special functions, power series solutions to solve electrical engineering problems. | |
| 2 - | Apply numerical solutions of P.D.E to solve the Wave equation. | |
| 3 - | Solve improper integrals converted to Gamma and Beta functions. | |
| 4 - | Apply Cauchy-Riemann Equations, Laurent series, and residues theorem for the solution of complex engineering problems. | |
| 5 - | Create conformal mapping procedures for the solution of complex functions problems. | |
| **c.Professional and Practical Skills: :** | | |
| 1 - | Use special functions to represent Engineering problems. | |
| 2 - | Apply Complex functions theorems to solve engineering systems problems. | |
| **d.General and Transferable Skills: :** | | |
| 1 - | Communicate effectively. | |

## Course Topic And Contents :

| Topic | No. of hours | Lecture | Tutorial / Practical |
|---|---|---|---|
| Power Series solutions of ordinary Differential equations. | 5 | 3 | 2 |
| Frobineous Theorem | 5 | 3 | 2 |
| Special functions , Gamma , Beta , Bessel functions | 5 | 3 | 2 |
| Legendre Polynomial | 5 | 3 | 2 |
| Partial differential equations, Definitions and Classification of equations, | 5 | 3 | 2 |
| Separable Partial differential equations, heat equation, Wave equation | 5 | 3 | 2 |
| D¢ambert solution of wave equation | 5 | 3 | 2 |
| Laplace equation in Rectangular and Polar coordinates | 5 | 3 | 2 |
| Numerical solutions of Partial differential equations, Finite difference method | 10 | 6 | 4 |
| Functions of complex variables, Elementary complex functions | 5 | 3 | 2 |
| Cauchy-Riemann Equations | 5 | 3 | 2 |
| Complex integrals, Laurent series | 5 | 3 | 2 |
| Conformal mappings | 5 | 3 | 2 |
| Evaluation of real integrals by residues | 5 | 3 | 2 |

## Teaching And Learning Methodologies :

| |
|---|
| Interactive Lecture |
| Discussion |
| Problem-based Learning |
| Report |

Ô[ ]ˆ¦ãˉ@¢Á ÁG∈FHⱫˇ č¦^Áʍ, ᾶç^¦•ãˆÁ₃ÁÒˇˆ]ɕⱫÆ¦Áãˉ@•Á^•^¦ç^åÈ

**Course Assessment :**

| Methods of assessment | Relative weight % | Week No | Assess What |
|---|---|---|---|
| Assignment | 5.00 | | |
| Final Exam | 40.00 | | |
| lab. Computer | 5.00 | | |
| Mid- Exam I | 15.00 | | |
| Mid- Exam II | 25.00 | | |
| Quizzes | 10.00 | | |

http://www.fue.edu.eg

Ô[ ]ˆ¦ã̃@¢Á́ÁGŒFHẴŌˇč¦^ÁW¸ãç^¦•ãˇÁⱥ́ÁÒˆˆ]ₐ̃ẌŒ¦Áã̃@»Á^•^¦ç^åÈ