# Advanced Mathematical Methods for Scientists and Engineers

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| Program | **MS** |
| Credit Hours | **3** |
| Duration | **15-Weeks** |
| Prerequisites | **Calculus, Quantum Mechanics** |
| Resource Person | **Dr. M. Imran Jamil** |
| Counseling Timing | **Tuesday:02:00pm-04:00pm**  **Thursday: 02:00pm-04:00pm** |
| Contact | **3486**  **3S-38** |

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

**Date………………………………….**

**Learning Objective**

**Credit Hours:3**

**Resource Person: Dr. M. Imran Jamil Semester: Spring-2023**

**Objective: The purpose of this course is to teach the mathematical methods which are necessary to do the research work.Secondly to develop the mathematical skills in the students so that they can better understand advanced courses of physics.**

**Syllabus:** Linear vector space,Active and passive transformations,Inner product or dot product in complex spaces. The dot product in the Dirac notaion, GramSchmidt Process, The Fourier analysis, The Fourier series, Integral Transform, Fourier Transform, Fourier transform of derivatives, Fourier integral theorem, Laplace transform, Dirac delta function, Orthogonal matrices Hermitian matrices, Unitary matrices, Diagonalization of matrices (Eigen values and eigen vectors),Tensors Analysis,Green’s Function,Complex algebra, Cauchy’s integral formula. MATHEMATICA

**Learning Methodology**

**Grade Evaluation Criteria**

**Marks Evaluation Marks in percentage**

Quizzes 15

*Assignments /*Presentations10

*Mid Term* 25

Attendance & Class Participation

Term Project

Final exam 50

Total 100

**Recommended Books**

1. Mathematical Physics by Eugene Butkov, Addison-Wesley Publishing Company, London, 1973.
2. Mathematical methods for physicists, sixth edition,by George B. Arfken, Hans J. Weber. Elsevier academic press, 2005.

**Reference Books**

1. Advanced Engineering Mathematics, Ninth edition, Erwin Kreyszig, John Wiley and Sons INC, 2006.
2. Mathematical Methods in the Physical Sciences, 3rd edition byMary L. Boas, Kaye Pace, 2006.

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

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| **Week** | **Activity**  SCHEDULE OF LECTURES | **Reference** |
| WEEK-1 | Linear vector space | Butkov |
| WEEK-2 | Active and passive transformations (Continue) | Butkov |
| WEEK-3 | Active and passive transformations | Butkov |
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| WEEK-4 | Inner product or dot product in complex spaces. The dot product in the Dirac notaion | Butkov |
| WEEK-5 | The Fourier analysis, The Fourier series. | Butkov |
| WEEK-6 | Integral Transform, Fourier Transform, Fourier transform of derivatives. | Butkov |
| WEEK-7 | Fourier integral theorem, Laplace transform. | Butkov |

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| WEEK-8 | Dirac delta function | Butkov |
| WEEK-9 | Orthogonal matrices,Hermitian matrices, Unitary matrices, Diagonalization of matrices (continue). | Butkov,  Mary L. Boas |
| WEEK-10 | Tensors Analysis | Arfken,  Butkov, K. L. Mir |
| WEEK-11 | Green’s Function | Butkov |
| WEEK-12 | Complex algebra. | Arfken |
| WEEK-13 | MATHEMATICA | Wolfram Research |
| WEEK-14 | MATHEMATICA | Wolfram Research |
| WEEK-15 | MATHEMATICA | Wolfram Research |