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| **Course Name** | **Code** | **Local Credits** | **ECTS** |
| **Introduction to Real and Complex Analysis** |  | 6 | 6 |

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| **Academic Institution offering the course** | University of Debrecen |
| **Mode of Delivery**  **(in class/online/blended)** | Blended |
| **Prerequisites by topic** | Topology and Geometry |
| **Language of Instruction** | English |
| **Level of Course Unit**  **(1/2/3)** | 2 |
| **Course Coordinator** | Zoltan MUZSNAY and Laszlo KOZMA |
| **Course Lecturer(s)** |  |
| **Course Assistant(s)** |  |
| **Course Objectives** | To provide an introduction to the techniques of general topology and diffferentail geometry. |
| **Course Contents** | Topological spaces. Topological constructions. The separation axioms. Connectedness. Compactness. -- Smooth manifold, smooth mapping. Immersion, submersion, submanifolds. Smooth distribution and their integration. Exterior algebra on manifolds. Integration of differential forms. |
| **Learning Outcomes of the Course Unit** | 1. To know the basic concepts of differential geometry and topology..  2. To describe scientific problems by appropriate mathematical models in order to get sufficiently accurate solutions.  3. To develop skills for analyzing basic topological properties of spaces. |
| **Planned Learning Activities and Teaching Methods** | 2 hours lecture and 2 hours seminar per week, homework assigment regularly |

**WEEKLY SUBJECTS AND RELATED PREPARATION STUDIES**

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| **Week** | **Subjects** | **Related Preparation** |
| **1** | Topological spaces, open and closed sets, interior, closure, and boundary, limit points, basis, countability axioms |  |
| **2** | Continuity and homeomorphisms, product topology, subspace topology, quotient topology, metric topology |  |
| **3** | The separation axioms, Hausdorff space, regular and normal spaces, Urysohn’s lemma |  |
| **4** | Connectedness, path-connected spaces, cut points, connected components and path components |  |
| **5** | Compact spaces, compact sets in Hausdorff spaces, compact sets in Euclidean space, product of compact spaces |  |
| **6** | Smooth manifold, smooth mapping, Tangent field, tangent space, tangent bundle, tangent mapping, curve |  |
| **7** | Immersion, submersion , submanifolds |  |
| **8** | Integral curve and flow, Smooth distribution and their integration. |  |
| **9** | Exterior algebra on manifolds, derivation of exterior algebra. |  |
| **10** | Integration of differential forms, The Stokes theorem. |  |

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| **Recomended or Required Reading** | 1. K Janich*: Topology.* Springer, 1984. 2. John M Lee: *Introduction to smooth manifolds*, (Springer, 2003). |
| **Other Course Resources** |  |

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| **ASSESSMENT METHODS AND CRITERIA** | | | **ECTS / WORKLOAD** | | | |
| **Module Requirements** | **Number** | **Percentage of Grade (%)** | **Activities** | **Number** | **Duration (hours)** | **Total Workload** |
| **Attendance / Participation** | **14** | **5** | **Course Hours (Including Exam Week)** | **14** | **2** | **28** |
| **Laboratory** | 0 | 0 | **Laboratory** | 0 | 0 | 0 |
| **Practice / Exercise** | **14** | **15** | **Practice / Exercise** | **14** | **2** | **28** |
| **Field Work** | 0 | 0 | **Field Work** | 0 | 0 | 0 |
| **Project** | 0 | 0 | **Project** | 0 | 0 | 0 |
| **Homework Assignments** | **9** | **20** | **Homework Assignments** | **10** | **3** | **30** |
| **Extra-Class Activities (Reading, Individual Work, etc.)** | **14** | **0** | **Extra-Class Activities (Reading, Individual Work, etc.)** | **14** | **2** | **28** |
| **Mid-Terms / Oral Exams / Quizes** | **3** | **10** | **Mid-Terms / Oral Exams / Quizes(Exam Hours and Preparation)** | **3** | **8** | **24** |
| **Final Exam** | **1** | **50** | **Final Exam (Exam Hours and Preparation)** | **1** | **12** | **12** |
| **TOTAL** |  | **%100** | **TOTAL WORKLOAD** |  |  | **150 Hours**  **6 ECTS** |
| **1 ECTS = 25 hours workload** | | | | | | |