# DIFFERENTIAL GEOMETRY I

| 1 | Course Title: | DIFFERENTIAL GEOMETRY I |
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| 2 | Course Code: | MAT3015 |
| 3 | Type of Course: | Compulsory |
| 4 | Level of Course: | First Cycle |
| 5 | Year of Study: | 3 |
| 6 | Semester: | 5 |
| 7 | ECTS Credits Allocated: | 6.00 |
| 8 | Theoretical (hour/week): | 2.00 |
| 9 | Practice (hour/week): | 2.00 |
| 10 | Laboratory (hour/week): | 0 |
| 11 | Prerequisites: | MAT 2013 Analytic Geometry I, MAT 2013 Analytic Geometry II |
| 12 | Language: | Turkish |
| 13 | Mode of Delivery: | Face to face |
| 14 | Course Coordinator: | Prof. Dr. Kadri Arslan |
| 15 | Course Lecturers: | |
| 16 | Contact information of the Course Coordinator: | arslan@uludag.edu.tr (0 224) 294 17 75 Uludağ Üniversitesi, Fen-Edebiyat Fakültesi, Matematik Bölümü |
| 17 | Website: | |
| 18 | Objective of the Course: | The purpose of this course to teach the basic concepts of differential geometry undergraduate level students. Especially some concepts of Euclidean space was introduced. Such as tangent vectors, tangent space, vector space, space of vector fields, directional derivative, cotangent space, 1-form are introduced. However, the course aims are to examine and curves, velocity vector of the curve, and the Serret-Frenet curvatures and Serret-Frenet formulas of the curves in Euclidean spaces. |
| 19 | Contribution of the Course to Professional Development: | |
| 20 | Learning Outcomes: | |

| | | 1 | He/She defines the basic concepts of differential geometry. |
|---|---|---|---|
| | | 2 | He/She relates mathematics and fundamental sciences to discipline of differential geometry, |
| | | 3 | He/She compares the structure of affine space with structure of Euclidean space, |
| | | 4 | He/She decides to the Euclidean space is a topologic space, |
| | | 5 | He/She adapts concepts of directional derivative and differentiation from analysis courses to directional derivative along a vector and differentiation on manifolds, |
| | | 6 | He/She adapts functions of gradient divergence and rotational from analysis courses to functions on manifolds, |
| | | 7 | He/She defines the concept of the curve, |
| | | 8 | He/She constructs the Frenet frame of the curve, |
| | | 9 | He/She formulates the curvatures of the curve, |
| | | 10 | He/She defines and characterizes the types of the curves, |

| 21 | Course Content: | |
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| | Course Content: | |
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| Week | Theoretical | Practice |
| 1 | The concepts of differentiable functions, Euclidean space, Euclidean coordinates, the Euclidean frame are handled. | Some examples of a differentiable functionsare given |
| 2 | Tangent vectors, tangent space, vector fields are considered. | Some examples of a tangent vectors and vector fields are given |
| 3 | The directional derivative of a function is given. | Some examples of a directional derivative are given |
| 4 | Curves, the parameters, arc length of the curve are discussed. | Some examles of arc length of the curve are given |
| 5 | Serret-Frenet formulas, and curvatures are analyzed. | Some examles of Serret-Frenet curvatures are given |
| 6 | Osculator planes of the curve, the circle of curvature, curvature of the sphere, osculator sphere are discussed. | Some examles of osculator planes of the curve are given |
| 7 | Spherical curves and lines of curvatures are characterized. | Some examles of lines of curvatures are given |
| 8 | Repeating courses and midterm exam | The classification of curves are given. |
| 9 | Integral curves of a curve are discussed. | Some examles of integral curves are given |
| 10 | Evolute and involute, Bertrand curve, indicatrix of a curve are analyzed. | Some examles of evolute and involutes are given |
| 11 | Helices, and some special curves are discussed. | Some examles of some special curves are given |
| 12 | Transformations and isometries of Euclidean | Some examles of isometry and orientation are given |

| Activites | Number | Duration (hour) | Total Work Load (hour) |
|---|---|---|---|
| Theoretical | 14 | 2.00 | 28.00 |
| Practicals/Labs | 14 | 2.00 | 28.00 |
| Self study and preperation | 10 | 4.00 | 40.00 |
| Homeworks | 0 | 0.00 | 0.00 |
| Projects | 0 | 0.00 | 0.00 |
| Field Studies | 0 | 0.00 | 0.00 |
| Midterm exams | 1 | 2.00 | 2.00 |
| Others | 2 | 40.00 | 80.00 |
| Final Exams | 1 | 2.00 | 2.00 |
| Total Work Load | | | 180.00 |
| Total work load/ 30 hr | | | 6.00 |
| ECTS Credit of the Course | | | 6.00 |

| 14 | Lie bracket operator, 1-forms, gradient, divergence and rotational functions are | Some examles of gradient, divergence and rotational of the functions are given |

| 22 | Textbooks, References and/or Other | O'Neill, B. Elementary Differential Geometry, Academic Gray, A. "Modern Differential Geometry of Curves and Surfaces", CRC Press, Boca Raton Ann Abor London Andrew Pressley, Elementary Differential Geometry, Springer-Verlag London Limited, Great Britain, 2001 |

| | | Number | Duration (hour) | |
|---|---|---|---|---|
| Midterm Exam | | 1 | 40.00 | |
| Quiz | | 0 | 0.00 | |
| Home work-project | | 0 | 0.00 | |
| Final Exam | | 1 | 60.00 | |
| Total | | 2 | 100.00 | |
| Contribution of Term (Year) Learning Activities to Success Grade | | 40.00 | | |
| Contribution of Final Exam to Success Grade | | 60.00 | | |
| Total | | 100.00 | | |
| Measurement and Evaluation Techniques Used in the Course | | | | |
| 24 | **ECTS / WORK LOAD TABLE** | | | |

| 25 | CONTRIBUTION OF LEARNING OUTCOMES TO PROGRAMME QUALIFICATIONS | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PQ1 | PQ2 | PQ3 | PQ4 | PQ5 | PQ6 | PQ7 | PQ8 | PQ9 | PQ10 | PQ11 | PQ12 | PQ13 | PQ14 | PQ15 | PQ16 |
| ÖK1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ÖK2 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ÖK3 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ÖK4 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ÖK5 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ÖK6 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ÖK7 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ÖK8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ÖK9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ÖK10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| LO: Learning Objectives    PQ: Program Qualifications | | | | | | | | | | | | | | | | |
| Contribution Level: | 1 very low | | 2 low | | 3  Medium | | | 4 High | | | | 5 Very High | | | | |