

**Bachelor program,  
Instrumentation Engineering (INEN) program, “General and Applied Mathematics”  
department**

|  |  |            |
|--|--|------------|
| <b>Course Unit Title</b>   | Calculus 2   |            |
| <b>Course Unit Code</b>  | VTSS-B02.2   |            |
| <b>Type of Course Unit</b>   | Compulsory   |            |
| <b>Level of Course Unit</b>  | First cycle Bachelor   |            |
| <b>National Credits</b>  | 4  |            |
| <b>Number of ECTS Credits Allocated</b>  | 5  |            |
| <b>Theoretical (hour/week)</b>   | 1  |            |
| <b>Practice (hour/week)</b>  | 1  |            |
| <b>Laboratory (hour/week)</b>  | -  |            |
| <b>Year of Study</b>   | 2 <sup>st</sup> year   |            |
| <b>Semester when the course unit is delivered</b>  | 3  |            |
| <b>Course Coordinator</b>  | Afruz Niftaliyeva  |            |
| <b>Name of Lecturer (s)</b>  | Afruz Niftaliyeva  |            |
| <b>Name of Assistant (s)</b>   | -  |            |
| <b>Mode of Delivery</b>  | Face to Face   |            |
| <b>Language of Instruction</b>   | English  |            |
| <b>Prerequisites</b>   | -  |            |
| <b>Recommended Optional Programme Components</b>   | -  |            |
| <b>Course description:</b>   |  |            |
| Calculus II covers integration, numerical series and functional series, functions of two variables and its partial derivatives. Each module begins with a prerequisite material review section, in which critical skills from Precalculus, and Calculus I are revisited. |  |            |
| <b>Objectives of the Course:</b>   |  |            |
| The student will be able to recognize the problem type, select an appropriate solution strategy and apply rules and procedures for solving the problem. The student will begin to be able to apply theorems and major concepts of calculus to solve real-world problems. |  |            |
| <b>Learning Outcomes</b>   |  |            |
| At the end of the course the student will be able to   |  | Assessment |
| 1.   | The participants have a thorough knowledge and an in-depth understanding of mathematical terms and methods.  | 1,3        |
| 2.   | Students can apply these methods to mechatronics tasks.  | 1,2,3      |
| 3.   | Students have an analytical mindset required to solve engineering problems.  | 2,3        |
| 4.   | Students are able to formulate technical relationships in mathematical language, to solve problems numerically and to critically evaluate the results.   | 2,3        |
| Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm exam  |  |            |
| <b>Course's Contribution to Program</b>  |  |            |
|  |  | CL         |
| 1  | Identify, formulate, and solve complex mechatronics engineering problems properly applying the principles, methods, techniques and tools of engineering, science, and mathematics.   | 5          |
| 2  | Ability to analyze a problem identify algorithmic principles, and computer simulation techniques in the modelling and design of computer-based systems.  | 3          |
| 3  | Get problem-solving skills needed for making decisions in uncertain situations.  | 3          |
| 4  | Acquire an understanding ethical and social issues responsibilities and the relationships between product development, product manufacturing and product use in environment-related fields.  | 3          |
| 5  | Design systems, components, or processes meeting specified needs for broadly defined engineering problems and to penetrate products, processes, and methods of the disciplines of mechatronics engineering.  | 3          |
| 6  | Analyze situations and problems, define interfaces between different technologies and implement them in different applications   | 3          |
| 7  | Combine theory and practice to analyze engineering issues basing on methodical research methods as well as understand applicable techniques and methods.   | 3          |
| 8  | Ability to work in design, implementation, and integration of engineering applications, such as electronic, mechanical, electromechanical, control and computer systems that contain software and hardware components, including sensors, and controllers. | 3          |
| 9  | Apply principles of mechanical and electrical engineering to the practice of engineering, robotics, mechatronics, and related industries.  | 2          |

| 10  | Be able to take responsibility in industrial and public projects in the field of industrial manufacturing, research, and development. | 3   |            |
|---|---|---|------------|
| CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)  |   |   |            |
| <b>Course Contents</b>  |   |   |            |
| Week  | Chapter   | Topics  | Exam       |
| 1   | Textbook 1, Chapter 11  | <b>Numerical Series</b><br><i>Brief description:</i> Numerical series. Tests for convergence of positive series: Cauchy's integral test, Comparison tests, D'Alembert's test, Cauchy's root test.   |            |
| 2   | Textbook 1, Chapter 11  | <b>Alternating Series</b><br><i>Brief description:</i> Alternating series. Tests for convergence of alternating series: Leibniz's test, Abel's test, Dirichlet's test. Absolute and conditional convergence.  |            |
| 3   | Textbook 1, Chapter 12  | <b>Functional series</b><br><i>Brief description:</i> Functional series. Uniformly convergent. Test for uniformly convergent of functional series.  |            |
| 4   | Textbook 1, Chapter 12  | <b>Power Series. Taylor's Series</b><br><i>Brief description:</i> Power series. First Abel's theorem, radius of convergence, interval of convergence. Formulas for calculating of radius of convergence. Taylor's series.                                       |            |
| 5   | Textbook 1, Chapter 13  | <b>Fourier Series</b><br><i>Brief description:</i> Fourier series.  |            |
| 6   | Textbook 1, Chapter 13  | <b>The Limit of a Function of Several Variables</b><br><i>Brief description:</i> n-dimensional space. Convergence in n-dimensional space. The limit of a function of several variables.   |            |
| 7   | Textbook 1, Chapter 14  | <b>Partial Derivatives</b><br><i>Brief description:</i> Partial derivatives and the differential of a function. Directional derivative. Gradient.   | Midterm    |
| 8   | Textbook 1, Chapter 15  | <b>Partial Derivatives of Higher Order</b><br><i>Brief description:</i> Partial derivatives and differentials of higher order. Schwartz's theorem.  |            |
| 9   | Textbook 1, Chapter 16  | <b>Extrema of Functions of Several Variables</b><br><i>Brief description:</i> Extrema of functions of several variables: definition of points of extremum. Necessary condition for extremum. Sufficient conditions for extremum of a function of two variables. |            |
| 10  | Textbook 2, Chapter 15  | <b>Multiple Riemann Integral</b><br><i>Brief description:</i> Multiple Riemann integral. Rules for calculating multiple integrals (integral over rectangle. integral over an arbitrary plane region.)   |            |
| 11  | Textbook 2, Chapter 16  | <b>Line Integrals</b><br><i>Brief description:</i> Length of curve. Line integrals. Green's formula: application Green's formula for computing the area of the figure.  |            |
| 12  | Textbook 3, Chapter 16  | <b>Surface Integrals</b><br><i>Brief description:</i> Surface. Area of the surface. Surface Integrals. Gauss-Ostrogradsky's formula. Application Gauss- Ostrogradsky's formula for computing the volume of the figures.   |            |
| 13  | Textbook 3, Chapter 16  | <b>Integrals Dependent on Parameters</b><br><i>Brief description:</i> Integrals Dependent on Parameters   |            |
| 14  |   |   | Final exam |
| <b>Recommended Sources</b>  |   |   |            |
| <b>TEXTBOOK(S)</b>  |   |   |            |
| <ol style="list-style-type: none"> <li>1. James Stewart. Calculus (8<sup>th</sup> ed.). Brooks Cole, 2015, 1368 p.</li> <li>2. Ron Larson and Bruce Edwards. Calculus (10<sup>th</sup> ed.). Cengage Learning, 2013, 1280 p.</li> <li>3. Howard Anton, Irl Bivens, and Stephen Davis. Calculus (10<sup>th</sup> ed.). Wiley, 2012, 1312 p.</li> <li>4. Earl Swokowski, Michael Olinick, and Dennis Pence. Calculus (6<sup>th</sup> ed.). Brooks Cole, 1996, 1408 p.</li> <li>5. Raymond Barnett, Michael Ziegler, and Karl Byleen. College Mathematics for Business, Economics, Life Sciences, and Social Sciences (13<sup>th</sup> ed.). Pearson, 2014, 1040 p.</li> </ol> |   |   |            |
| <b>Assessment</b>   |   |   |            |
| Attendance  | 0%  | Less than 75% class attendance results in NA grade  |            |
| Presentation  | 20%   |   |            |
| Lab. works  | 0%  |   |            |

|              |      |              |
|--------------|------|--------------|
| Course work  | 0%   |              |
| Quiz         | 10%  |              |
| Midterm Exam | 20%  | Written Exam |
| Final Exam   | 50%  | Written Exam |
| Total        | 100% |              |

#### Assessment Criteria

Final grades are determined according to the Academic Regulations of Azerbaijan State Oil and Industry University for undergraduate studies

#### Course Policies

1. Attendance of the course is mandatory.
2. Material presented in the lecture as well as assigned readings will be included in testing.
3. Late assignments will not be accepted unless an agreement is reached with the lecturer.
4. Cheating and plagiarism will not be tolerated.
5. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

#### ECTS allocated based on Student Workload

| Activities   | Number | Duration (hour) | Total Workload (hour) |
|--|--------|-----------------|-----------------------|
| Course duration in class                               | 14     | 4               | 56                    |
| Preparation for Midterm Exam                           | 1      | 15              | 15                    |
| Individual or Group Work                               | 9      | 4               | 36                    |
| Midterm Exam   | 1      | 3               | 3                     |
| Paper/Project (including preparation and presentation) | 1      | 10              | 10                    |
| Homework   | 3      | 4               | 12                    |
| Preparation for the Final Exam                         | 1      | 12              | 12                    |
| Final Exam   | 1      | 3               | 3                     |
| <b>Total Workload</b>                                  |        |                 | 147                   |
| <b>Total Workload/30(h)</b>                            |        |                 | 4.9                   |
| <b>Course duration in class</b>                        |        |                 | 14                    |