

YEDİTEPE UNIVERSITY
FACULTY OF ARTS AND SCIENCES

Undergraduate Program in
MATHEMATICS

BOLOGNA INFORMATION PACKAGE

2024



**YEDİTEPE
UNIVERSITY**



YEDİTEPE UNIVERSITY

FACULTY OF ARTS AND SCIENCES UNDERGRADUATE PROGRAM IN MATHEMATICS

INFORMATION PACKAGE (2024)

History: Founded in 1996.

Qualification Awarded: The Bachelor's Degree in Mathematics is awarded to the graduates who have successfully completed all courses in the curriculum.

Level of Qualification: First Cycle

Specific Admission Requirements: The general requirements explained in "Enrollment Procedures" on the University web site are applied for admission of students.

Undergraduate Program Rules and Regulations:

Yeditepe University Mathematics Undergraduate Program is carried out as a 4-year (8 semester) program within the framework of the principles specified in the Higher Education Law and Yeditepe University Associate Bachelor's and Undergraduate Teaching and Learning Regulation. The language of education is English and formal education is provided. Before starting the department, students are expected to pass the English proficiency exam of Yeditepe University English Preparatory School or one of the English exams deemed equivalent by this school (see Yeditepe University Foreign Language Preparatory Programs Education, Teaching and Exam Regulation). Our students who fail the language exams continue their English preparatory education for 1-3 semesters at Yeditepe University English Preparatory School, depending on their language level.

Qualification Requirements and Regulations:

Students must obtain a grade point average of at least 2.00 out of 4.00 and successfully pass all courses on the program. (Equivalent to a total 240 ECTS).

Profile of the Program:

Our vision is to form a department, which is highly esteemed by its quality of education both at national and international levels, which renovates itself incessantly according to contemporary progress, and which provides a medium for scientific research at international standards.

Main Perspectives of Undergraduate Education

1. Providing courses on basic notions of mathematics such as limit, derivative, integral calculus, logic, linear algebra and discrete mathematics,
2. Providing fundamental courses on fundamental sub disciplines and research topics of mathematics such as analysis, algebra, differential equations and differential geometry,
3. Supporting students' formation of their own academic career and future plans by providing a wide range of selected courses portfolio on mathematics and related fields under the supervision of their advisors for choosing and forming their selective courses curriculum.
4. Supporting the development of students' knowledge and skills in non-professional areas, and consciousness of professional and social ethics,
5. Supporting the development of students' ability to become individuals who could make interdisciplinary work and communicate actively,
6. Supporting students' ability to access information and use information technologies,
7. Supporting students' ability to transform their academic and social identity acquired during their undergraduate education into a lifelong learning process.

Occupational Profiles of Graduates:

A graduate of the Mathematics program has job opportunities in the following areas:

- at departments of organizations for computing and planning which provides services in any field of activity

- at firms which specializing in topics such as programming, system analysis
- at banking and insurance sector
- at institutions of stock market, financial and capital market instruments
- at institutions of education
- at universities as an academician

Access to Further Studies:

The graduates holding Bachelor’s Degrees are eligible to apply to Master’s Degree programs at national level and/or international level both in the same and in related disciplines.

Examination Regulations, Assessment and Grading:

Students are required to take a mid-term examination and/or complete other assigned projects/homework during the semester and, additionally, are required to take a final examination and/or complete a final project of course evaluation. The assessment for each course is described in detail in “Individual Course Description”.

| Course Grade | Grade Points |
|--------------|--|
| AA | 4.0 |
| BA | 3.5 |
| BB | 3.0 |
| CB | 2.5 |
| CC | 2.0 |
| DC | 1.5 |
| DD | 1.0 |
| FA | 0.0 Unsuccessful (For unattended students) |
| FF | 0.0 Unsuccessful |

Other Grades:

I: Incomplete is given to a student who provides supporting evidence through genuine and valid documentation of illness or other reason which has prevented her/him from completing the necessary course work. In such a case, within 15 days from the day of submitting the grades to the Registrar’s Office, the student required complete the missing work and obtain a grade. Otherwise, the I grade will automatically become an F

L: Leave

P: Pass is given to students who are successful in taking non-credit courses.

X: In Progress is used when the work of a student is a course extends past the time for reporting grades.

T: Transfer is given to courses accepted as equivalents in transfers from other universities.

W: Withdrawal is given if a student withdraws from a course after the add/drop period within the first 10 weeks after the semester starts, with the recommendation of her/his advisor and the permission of the instructor concerned.

NC: Non-Credit is given to the students who are successful in non-credit courses.

ND: Non-Degree is given to an applicant who wishes to take graduate courses but does not wish to be in a degree program may request admission on a non-degree basis.

R: Repeat

RR: Repeat resigned

Graduation Requirements:

Graduation requirements are explained in the section "Qualification Requirements and Regulations".

Mode of Study: Full-Time

Address, Program Director or Equivalent:

Head of Mathematics Department: Assoc. Prof. İlknur Kuşbeyzi Aybar,

Email: ikusbeyzi@yeditepe.edu.tr

Phone: 0216 578 06 82

ECTS Coordinator: Assist. Prof. Neslihan Oflaz Sariyer

Email: neslihan.oflaz@yeditepe.edu.tr

Phone: +90 216 578 18 88

Department Secretary: Burcu Ebeler

Email: burcu.ebeler@yeditepe.edu.tr

Tel : 0 216 578 06 71, Fax: 0 216 578 06 72

Address: Yeditepe Üniversitesi, 26 Ağustos Yerleşimi, Fen-Edebiyat Fakültesi, Matematik Bölümü,
İnönü Mah., Kayışdağı, 34755, ATAŞEHİR, İSTANBUL, TÜRKİYE

Facilities:

In the Mathematics Major Program there are 2 professors, 1 associate professor and 8 assistant professors.

There is one computer per each person in each office and a common printer for the department to which all the computers are connected.

Our students can reach the sources they need through the computer by the database of the library of the university and the written articles by the library. Yeditepe University that was established in 1996 owns a library in the Rectorate building, that serves over an area of 6000 square meters and with 400 seats.

There are computer terminals at various places which are open to the students. In our department there is a seminar room and a computer lab where 6 machines are for the use of our students.

The "Graduate, Ph. D. and unified Ph. D." programs in Mathematics provide students with the possibility of continuing their academic careers.

There are also "double major programs" between Mathematics and one of the following Departments, provided that the GPA of the student is sufficient: Computer Eng., Electrical and Electronics Eng., Physics and Mathematics Education.

In the framework of the "Erasmus students exchange program" we also have relationships with some European universities such as Leiden University (Germany), University of Loughborough (UK) open to our Mathematics major students.

Program Learning Outcomes:

PL01. The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry)

PL02. Acquiring fundamental knowledge on fundamental research fields in mathematics,

PL03. Ability form and interpret the relations between research topics in mathematics,

PL04. Ability to define, formulate and solve mathematical problems,

PL05. Consciousness of professional ethics and responsibility,

PL06. Ability to communicate actively,

PL07. Ability of self-development in fields of interest,

PL08. Ability to learn, choose and use necessary information technologies,

PL09. Lifelong education

Course Plan:

| | | FIRST SEMESTER | T | L | U | Y | A | | | SECOND SEMESTER | T | L | U | Y | A |
|------|-----|--------------------------------------|---|---|---|----|----|------|-----|----------------------------|---|---|---|----|----|
| MATH | 101 | Introduction to Set Theory and Logic | 3 | 0 | 2 | 4 | 7 | MATH | 102 | Basic Algebraic Structures | 3 | 0 | 2 | 4 | 7 |
| MATH | 111 | Analytical Geometry | 3 | 0 | 2 | 4 | 7 | MATH | 158 | Combinatorics | 2 | 0 | 2 | 3 | 7 |
| MATH | 155 | Analysis I | 3 | 0 | 2 | 4 | 8 | MATH | 156 | Analysis II | 3 | 0 | 2 | 4 | 8 |
| PHYS | 101 | Physics I | 3 | 2 | 0 | 4 | 6 | PHYS | 102 | Physics II | 3 | 2 | 0 | 4 | 6 |
| TKL | 201 | Turkish I | 2 | 0 | 0 | 2 | 2 | TKL | 202 | Turkish II | 2 | 0 | 0 | 2 | 2 |
| | | | | | | | | | | | | | | | |
| | | | | | | 18 | 30 | | | | | | | 17 | 30 |
| | | | | | | | | | | | | | | | |
| | | THIRD SEMESTER | T | L | U | Y | A | | | FOURTH SEMESTER | T | L | U | Y | A |
| MATH | 245 | Ordinary Differential Equations | 3 | 0 | 2 | 4 | 7 | MATH | 212 | Differential Geometry | 2 | 0 | 2 | 3 | 6 |
| MATH | 255 | Calculus III | 3 | 0 | 2 | 4 | 7 | MATH | 252 | Real Analysis I | 3 | 0 | 2 | 4 | 7 |
| MATH | 231 | Linear Algebra I | 3 | 0 | 2 | 4 | 7 | MATH | 232 | Linear Algebra II | 3 | 0 | 2 | 4 | 7 |
| MATH | 201 | Mathematical Software I | 3 | 0 | 0 | 3 | 6 | MATH | 202 | Mathematical Software II | 3 | 0 | 0 | 3 | 6 |
| HUM | 103 | Humanities | 2 | 0 | 0 | 2 | 3 | XXX | XXX | Free Elective I | 3 | 0 | 0 | 3 | 4 |
| | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | |
|-------------|------------|--|----------|----------|----------|----------|----------|--|-------------|-----------------------|---|----------|----------|----------|----------|----------|
| | | | | | | 17 | 30 | | | | | | | 17 | 30 | |
| | | | | | | | | | | | | | | | | |
| | | FIFTH SEMESTER | T | L | U | Y | A | | | SIXTH SEMESTER | T | L | U | Y | A | |
| MATH | 357 | Complex Analysis | 3 | 0 | 2 | 4 | 7 | | MATH | 362 | Mathematical Probability | 2 | 0 | 2 | 3 | 6 |
| MATH | 321 | Introduction to Group Theory | 2 | 0 | 2 | 3 | 6 | | MATH | 322 | Abstract Algebra | 2 | 0 | 2 | 3 | 6 |
| MATH | 325 | Number Theory | 3 | 0 | 0 | 3 | 6 | | MATH | 343 | Partial Differential Equations | 2 | 0 | 2 | 3 | 6 |
| DEPT | XXX | Departmental Elective I | 3 | 0 | 0 | 3 | 7 | | DEPT | XXX | Departmental Elective II | 3 | 0 | 0 | 3 | 7 |
| XXX | XXX | Free Elective II | 3 | 0 | 0 | 3 | 4 | | XXX | XXX | Free Elective III | 3 | 0 | 0 | 3 | 5 |
| | | | | | | | | | | | | | | | | |
| | | | | | | 16 | 30 | | | | | | | 15 | 30 | |
| | | | | | | | | | | | | | | | | |
| | | SEVENTH SEMESTER | T | L | U | Y | A | | | EIGHT SEMESTER | T | L | U | Y | A | |
| MATH | 439 | Metric and Topological Spaces | 2 | 0 | 2 | 3 | 7 | | MATH | 456 | Functional Analysis | 2 | 0 | 2 | 3 | 9 |
| MATH | 491 | Senior Project and Seminar | 3 | 0 | 0 | 3 | 7 | | HTR | 302 | History of Turkish Revolution II | 2 | 0 | 0 | 2 | 2 |
| HTR | 301 | History of Turkish Revolution I | 2 | 0 | 0 | 2 | 2 | | DEPT | XXX | Departmental Elective V | 3 | 0 | 0 | 3 | 7 |

| | | | | | | | | | | | | | | | | |
|------|-----|---------------------------|---|---|---|----|----|--|------|-----|--------------------------|---|---|---|----|----|
| DEPT | XXX | Departmental Elective III | 3 | 0 | 0 | 3 | 7 | | DEPT | XXX | Departmental Elective VI | 3 | 0 | 0 | 3 | 7 |
| DEPT | XXX | Departmental Elective IV | 3 | 0 | 0 | 3 | 7 | | XXX | XXX | Free Elective IV | 3 | 0 | 0 | 3 | 5 |
| | | | | | | | | | | | | | | | | |
| | | | | | | 14 | 30 | | | | | | | | 14 | 30 |

Course & Program Learning Outcomes:

| | PLO1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 | PLO 8 | PLO 9 |
|----------|------|-------|-------|-------|-------|-------|-------|-------|-------|
| MATH 101 | 1 | 3 | 5 | 5 | 5 | 3 | 5 | 1 | 5 |
| MATH 102 | 5 | 5 | 5 | 5 | 2 | 1 | 3 | 1 | 3 |
| MATH 111 | 1 | 2 | 5 | 4 | 3 | 3 | 4 | 1 | 3 |
| MATH 155 | 5 | 5 | 5 | 5 | 3 | 0 | 5 | 0 | 3 |
| MATH 156 | 5 | 5 | 5 | 5 | 3 | 0 | 5 | 0 | 3 |
| MATH 158 | 5 | 1 | 1 | 4 | 4 | 1 | 5 | 1 | 4 |
| MATH 201 | 2 | 5 | 5 | 5 | 3 | 3 | 4 | 3 | 3 |
| MATH 202 | 2 | 5 | 5 | 5 | 3 | 3 | 4 | 3 | 3 |
| MATH 212 | 2 | 5 | 5 | 5 | 3 | 3 | 4 | 3 | 3 |
| MATH 231 | 5 | 5 | 5 | 4 | 5 | 3 | 5 | 5 | 5 |
| MATH 232 | 5 | 5 | 5 | 4 | 5 | 3 | 5 | 5 | 5 |
| MATH 245 | 3 | 4 | 3 | 2 | 1 | 1 | 5 | 1 | 3 |
| MATH 252 | 5 | 5 | 5 | 5 | 3 | 3 | 4 | 3 | 3 |
| MATH 255 | 5 | 5 | 5 | 5 | 3 | 3 | 5 | 0 | 0 |
| MATH 321 | 3 | 5 | 5 | 5 | 5 | 2 | 5 | 3 | 5 |
| MATH 322 | 3 | 5 | 5 | 5 | 5 | 2 | 5 | 3 | 5 |
| MATH 325 | 3 | 5 | 5 | 5 | 5 | 3 | 5 | 2 | 5 |
| MATH 343 | 1 | 5 | 4 | 4 | 4 | 1 | 4 | 1 | 3 |
| MATH 357 | 3 | 4 | 5 | 5 | 5 | 4 | 4 | 4 | 5 |

| | | | | | | | | | |
|-----------------|---|---|---|---|---|---|---|---|---|
| MATH 362 | 5 | 5 | 3 | 5 | 2 | 3 | 3 | 3 | 4 |
| MATH 439 | 5 | 5 | 5 | 5 | 3 | 3 | 5 | 1 | 3 |
| MATH 456 | 5 | 5 | 5 | 5 | 3 | 3 | 5 | 1 | 3 |
| MATH 491 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 5 | 5 |
| PHYS 101 | 4 | 2 | 2 | 4 | 3 | 3 | 4 | 2 | 4 |
| PHYS 102 | 4 | 2 | 2 | 4 | 3 | 3 | 4 | 2 | 4 |
| HUM 103 | 0 | 0 | 0 | 0 | 3 | 3 | 4 | 0 | 4 |
| TKL 201 | 0 | 0 | 0 | 0 | 3 | 5 | 4 | 0 | 4 |
| TKL 202 | 0 | 0 | 0 | 0 | 3 | 5 | 4 | 0 | 4 |
| HTR 301 | 0 | 0 | 0 | 0 | 3 | 3 | 4 | 0 | 4 |
| HTR 302 | 0 | 0 | 0 | 0 | 3 | 3 | 4 | 0 | 4 |
| MATH 311 | 1 | 4 | 4 | 4 | 4 | 1 | 4 | 1 | 3 |
| MATH 344 | 1 | 4 | 4 | 4 | 4 | 1 | 4 | 1 | 3 |
| MATH 346 | 5 | 4 | 3 | 2 | 4 | 4 | 3 | 3 | 4 |
| MATH 348 | 5 | 2 | 2 | 5 | 4 | 4 | 4 | 2 | 5 |
| MATH 353 | 5 | 5 | 5 | 5 | 3 | 3 | 4 | 3 | 3 |
| MATH 355 | 5 | 5 | 5 | 5 | 3 | 3 | 4 | 3 | 3 |
| MATH 365 | 5 | 2 | 3 | 5 | 3 | 1 | 5 | 4 | 4 |
| MATH 411 | 3 | 5 | 5 | 5 | 3 | 3 | 4 | 3 | 5 |
| MATH 413 | 3 | 5 | 5 | 5 | 5 | 3 | 5 | 2 | 5 |
| MATH 416 | 3 | 5 | 5 | 5 | 5 | 3 | 5 | 2 | 5 |
| MATH 422 | 3 | 5 | 5 | 5 | 5 | 3 | 5 | 2 | 5 |
| MATH 423 | 3 | 5 | 5 | 5 | 5 | 2 | 5 | 3 | 5 |
| MATH 424 | 4 | 5 | 5 | 5 | 3 | 3 | 4 | 3 | 3 |
| MATH 425 | 1 | 5 | 5 | 4 | 4 | 4 | 5 | 1 | 5 |
| MATH 426 | 4 | 5 | 5 | 5 | 3 | 3 | 4 | 3 | 3 |
| MATH 427 | 5 | 5 | 5 | 5 | 4 | 3 | 5 | 5 | 3 |
| MATH 440 | 5 | 5 | 5 | 5 | 3 | 3 | 5 | 3 | 3 |
| MATH 441 | 1 | 5 | 5 | 4 | 4 | 4 | 5 | 1 | 5 |

| | | | | | | | | | |
|---------------------|---|---|---|---|---|---|---|---|---|
| MATH 453 | 1 | 5 | 5 | 4 | 4 | 4 | 5 | 1 | 5 |
| MATH 454 | 4 | 3 | 5 | 5 | 3 | 3 | 5 | 3 | 3 |
| MATH 462 | 5 | 5 | 5 | 4 | 4 | 4 | 5 | 1 | 5 |

0: Not supported

3: Moderately supported

5: Supported by an advanced level.

Course Categories:

| Course Categories | ECTS |
|--|-------------|
| Support courses | |
| PHYS101 Physics I | 6 |
| PHYS102 Physics II | 6 |
| Free Elective I | 4 |
| Free Elective II | 4 |
| Free Elective III | 5 |
| Free Elective IV | 5 |
| Total | 30 |
| Core Courses | |
| MATH101 Introduction to Set Theory and Logic | 7 |
| MATH102 Basic Algebraic Structures | 7 |
| MATH111 Analytical Geometry | 7 |
| MATH155 Analysis I | 8 |
| MATH156 Analysis II | 8 |
| MATH158 Combinatorics | 7 |
| MATH231 Linear Algebra I | 7 |
| MATH232 Linear Algebra II | 7 |
| MATH255 Calculus III | 7 |
| Total | 65 |
| Expertise/ Field Courses | |
| MATH201 Mathematical Software I | 6 |
| MATH202 Mathematical Software II | 6 |
| MATH212 Differential Geometry | 6 |
| MATH245 Ordinary Differential Equations | 7 |
| MATH252 Real Analysis I | 7 |
| MATH321 Introduction to Group Theory | 6 |
| MATH322 Abstract Algebra | 6 |
| MATH325 Elementary Number Theory | 6 |
| MATH343 Partial Differential Equations | 6 |
| MATH357 Complex Analysis | 7 |

| | |
|--|------------|
| MATH362 Mathematical Probability | 6 |
| MATH439 Metric and Topological Spaces | 7 |
| MATH456 Functional Analysis | 9 |
| MATH491 Senior Project and Seminar | 7 |
| MATHXXX Mathematics Elective I | 7 |
| MATHXXX Mathematics Elective II | 7 |
| MATHXXX Mathematics Elective III | 7 |
| MATHXXX Mathematics Elective IV | 7 |
| MATHXXX Mathematics Elective V | 7 |
| MATHXXX Mathematics Elective VI | 7 |
| Total | 134 |
| Humanities, Communication and Management Skills Courses | |
| HUM103 Humanities | 3 |
| TKL201 Turkish I | 2 |
| TKL202 Turkish II | 2 |
| HTR301 History of Turkish Revolution I | 2 |
| HTR302 History of Turkish Revolution II | 2 |
| Total | 11 |
| Total ECTS of all courses | 240 |

Mathematics Department's Teaching & Learning Methods:

| Teaching Methods | Main Learning Activities | Teaching aids |
|-------------------------|---|--|
| 1-Lecture | Listening and information processing | Standard classroom technologies, multimedia devices, projector, computer, overhead projector |
| 2-Problem Solving | Set special skills | |
| 3-Question-Answer | Listening and information processing, observing/analyzing cases, critical thinking, generating questions, team work | Standard classroom technologies, multimedia devices, projector, computer, overhead projector |
| 4-Assignment | Research – life-long learning, writing, reading, IT | Online databases, library databases, e-mail |
| 5-Quiz | | |
| 6-Oral Exam | Research – life-long learning, analyzing cases, generating questions, interpreting, presenting | |

| COURSE INFORMATION | | | | | |
|--------------------------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| INTRODUCTION TO SET THEORY AND LOGIC | MATH 101 | 1 | 3 + 2 | 4 | 7 |

| | |
|----------------------|---|
| Prerequisites | - |
|----------------------|---|

| | |
|--------------------------------|---|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Program) |
| Course Type | Compulsory |
| Course Coordinator | Neslihan Oflaz Sariyer |
| Instructors | Neslihan Oflaz Sariyer |
| Assistants | Dilara Karşlıoğlu |
| Goals | To teach the usage of analytical tools for mathematical thinking. |
| Content | Propositional and predicate calculus. Introduction to logic. Methods of proof. Axioms of set theory. Cartesian product, relations and functions. Partial and total orderings. Finite, countable and uncountable sets. |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|--|---------------------------|------------------|--------------------|
| 1) Thinks like a mathematician. | 3,4,5 | 1,2,3,4 | A |
| 2) Applies laws of logic in reasoning. | 3,7,9 | 1,2,3,4 | A |
| 3) Tests the validity of an argument by using laws of logic. | 7,9 | 1,2,3,4 | A |
| 4) Identifies the properties of a given function, relation or an ordering. | 3,7,9 | 1,2,3,4 | A |
| 5) Understands that there are different sizes of infinity. | 3,4,5 | 1,2,3,4 | A |
| 6) Applies set theory axioms to deduce results about denumerable and uncountable sets. | 4,5,7 | 1,2,3,4 | A |

| | |
|----------------------------|---|
| Teaching Methods: | 1: Lecture, 2: Problem Solving, 3: Question-answer, 4: Homework |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|---|-----------------|
| Week | Topics | Study Materials |
| 1 | Basic connectives and truth tables | Textbook |
| 2 | Logical equivalence: The laws of logic | Textbook |
| 3 | Logical implication: The rules of inference | Textbook |
| 4 | The use of quantifiers | Textbook |
| 5 | Formal thinking: Methods of proof | Textbook |
| 6 | Sets, operations on sets | Textbook |

| | | |
|----|-------------------------------------|----------|
| 7 | Ordered pairs and Cartesian product | Textbook |
| 8 | Relations | Textbook |
| 9 | Ordering relations | Textbook |
| 10 | Equivalence relations | Textbook |
| 11 | Functions | Textbook |
| 12 | Equinumerous sets, Finite sets | Textbook |
| 13 | Countable sets | Textbook |
| 14 | Uncountable sets | Textbook |

| RECOMMENDED SOURCES | |
|-----------------------------|--|
| Textbook | <i>Intro. to Mathematical Structures, Steven Galovich. HBJ</i> |
| Additional Resources | |

| MATERIAL SHARING | |
|--------------------|---------|
| Documents | Yulearn |
| Assignments | |
| Exams | |

| ASSESSMENT | | |
|---|--------|------------|
| IN-TERM STUDIES | NUMBER | PERCENTAGE |
| Mid-terms | 2 | 100 |
| Quizzes | - | - |
| Assignments | - | - |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 40 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 60 |
| Total | | 100 |

| | |
|------------------------|--------------|
| COURSE CATEGORY | Core Courses |
|------------------------|--------------|

| COURSE'S CONTRIBUTION TO PROGRAM | | | | | | |
|----------------------------------|--|--------------|---|---|---|---|
| No | Program Learning Outcomes | Contribution | | | | |
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | x | | | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | x | | |

| | | | | | | |
|---|---|---|--|---|--|---|
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | x |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | x |
| 5 | Consciousness of professional ethics and responsibility | | | | | x |
| 6 | Ability to communicate actively | | | x | | |
| 7 | Ability of self-development in fields of interest | | | | | x |
| 8 | Ability to learn, choose and use necessary information technologies | x | | | | |
| 9 | Lifelong education | | | | | x |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|---|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 5 | 70 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 5 | 70 |
| Mid-terms (Including self-study) | 2 | 10 | 20 |
| Quizzes | - | - | - |
| Assignments | - | - | - |
| Final examination (Including self-study) | 1 | 15 | 15 |
| Total Work Load | | | 175 |
| Total Work Load / 25 (h) | | | 7 |
| ECTS Credit of the Course | | | 7 |

| COURSE INFORMATION | | | | | |
|----------------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| BASIC ALGEBRAIC STRUCTURES | MATH 102 | 2 | 3+2 | 4 | 7 |

| | |
|----------------------|----------|
| Prerequisites | MATH 101 |
|----------------------|----------|

| | |
|--------------------------------|--|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Compulsory |
| Course Coordinator | Mehmet Akif Erdal |
| Instructors | Mehmet Akif Erdal |
| Assistants | Melin Özbaylanlı |
| Goals | To introduce basic algebraic structures and proof techniques |
| Content | Algebraic structures, integers, rings, fields, groups, homomorphisms and isomorphisms, natural numbers and their properties, rational numbers, real numbers and their properties, complex numbers. |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|--|---------------------------|------------------|--------------------|
| 1) Facilitates abstract thinking | 1,2,3,4 | 1,2 | A |
| 2) Learns proof techniques | 1,2,3,4 | 1,2 | A |
| 3) Recognizes algebraic structures | 2,3,4 | 1,2 | A |
| 4) Interprets relations between algebraic structures | 1,2,3,4 | 1,2 | A |

| | |
|----------------------------|-------------------------------------|
| Teaching Methods: | 1: Lecture, 2: Problem Solving |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|----------------------------------|-----------------|
| Week | Topics | Study Materials |
| 1 | Review of algebraic structures | Textbook |
| 2 | Algebraic properties of integers | Textbook |
| 3 | Rings | Textbook |
| 4 | Fields | Textbook |
| 5 | Groups | Textbook |
| 6 | Homomorphisms and isomorphisms | Textbook |
| 7 | Natural numbers | Textbook |

| | | |
|----|---|----------|
| 8 | Arithmetic and ordering properties of natural numbers | Textbook |
| 9 | Integers | Textbook |
| 10 | Rational numbers | Textbook |
| 11 | Real numbers | Textbook |
| 12 | Algebraic and ordering properties of real numbers | Textbook |
| 13 | Complex Numbers | Textbook |
| 14 | Complex Numbers | Textbook |

| RECOMMENDED SOURCES | |
|-----------------------------|---|
| Textbook | <i>Intro. to Mathematical Structures, Steven Galovich. HBJ.</i> |
| Additional Resources | |

| MATERIAL SHARING | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

| ASSESSMENT | | |
|---|---------------|-------------------|
| IN-TERM STUDIES | NUMBER | PERCENTAGE |
| Mid-terms | 2 | 100 |
| Quizzes | | |
| Assignments | | |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 50 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 50 |
| Total | | 100 |

| | |
|------------------------|--------------|
| COURSE CATEGORY | Core Courses |
|------------------------|--------------|

| COURSE'S CONTRIBUTION TO PROGRAM | | | | | | |
|----------------------------------|--|--------------|---|---|---|---|
| No | Program Learning Outcomes | Contribution | | | | |
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | | | x |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | x |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | x |

| | | | | | | |
|---|---|---|---|---|--|---|
| 4 | Ability to define, formulate and solve mathematical problems | | | | | x |
| 5 | Consciousness of professional ethics and responsibility | | x | | | |
| 6 | Ability to communicate actively | x | | | | |
| 7 | Ability of self-development in fields of interest | | | x | | |
| 8 | Ability to learn, choose and use necessary information technologies | x | | | | |
| 9 | Lifelong education | | | x | | |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|---|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 5 | 70 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 5 | 70 |
| Mid-terms (Including self study) | 2 | 10 | 20 |
| Quizzes | - | - | - |
| Assignments | - | - | - |
| Final examination (Including self study) | 1 | 15 | 15 |
| Total Work Load | | | 175 |
| Total Work Load / 25 (h) | | | 7 |
| ECTS Credit of the Course | | | 7 |

| COURSE INFORMATION | | | | | |
|---------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| ANALYTICAL GEOMETRY | MATH 111 | 1 | 3 + 2 | 4 | 7 |

| | |
|----------------------|---|
| Prerequisites | - |
|----------------------|---|

| | |
|--------------------------------|--|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Compulsory |
| Course Coordinator | Hasan Gümral |
| Instructors | Hasan Gümral |
| Assistants | Esra Başar |
| Goals | To give the concepts of vectors and most fundamental analytic geometry (in two and three dimensions) together with some of their properties. |
| Content | Vectors, linear operations with vectors. Products of vectors. Definition of Euclidean space. Lines and planes. Circle and sphere. Parametrizations of curves and surfaces. Conics and quadrics, their symmetries and classifications. Translations, orthogonal transformations, similarities and inversions. |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|---|---------------------------|------------------|--------------------|
| 1) calculate vectors and matrices | 3,4 | 1,2,5 | A,B,C |
| 2) solve the problems about lines and planes | 4 | 1,2,5 | A,B,C |
| 3) define conics and obtain canonic equations | 3,4 | 1,2,5 | A,B,C |
| 4) find the tangent planes of quadratic planes | 3,4,7 | 1,2,5 | A,B,C |
| 5) describe quadratic planes with canonic equations | 3,4,7 | 1,2,5 | A,B,C |
| 6) reduce the general quadratic equations to canonic form | 3,4,7 | 1,2,5 | A,B,C |

| | |
|----------------------------|--|
| Teaching Methods: | 1: Lecture, 2: Problem Solving 5: Quiz |
| Assessment Methods: | A: Written examination, B: Homework, C: Quiz |

| COURSE CONTENT | | |
|----------------|--|-----------------|
| Week | Topics | Study Materials |
| 1 | Points, oriented segments, parallel translation, vectors, collinear and coplanar vectors, | Textbooks |
| 2 | Linear operations with vectors, linear dependence, coordinates of vectors and points. | Textbooks |
| 3 | Scalar(dot) product of vectors, projection, direction cosines, cosine theorem. Vector product, orientation of plane, | Textbooks |
| 4 | Lagrange identity, area, collinear points, triple (mixed) product, | Textbooks |

| | | |
|----|---|-----------|
| 5 | Volume, double vector product. A definition of affine and Euclidean spaces. | Textbooks |
| 6 | Curves and surfaces, parametric, explicit and implicit equations, geometric locus. Equations of straight lines and planes, normal vectors. | Textbooks |
| 7 | Geometric problems with lines and planes. Menelaos and Ceva theorems. Intersections, angles, skew lines, distances, pencils. | Textbooks |
| 8 | Review and midterm exam, | Textbooks |
| 9 | Circles and spheres, parametric equations, polar, cylindrical and spherical coordinates, | Textbooks |
| 10 | Intersection with a line, secant and tangent, normal, polar line and plane. | Textbooks |
| 11 | Conics: canonical equation of ellipse and hyperbola, focuses and vertices, asymptotes. Directrix, eccentricity, parabola. Parametric equations. | Textbooks |
| 12 | Quadrics: ellipsoid of revolution, hyperboloids, asymptotic cone, elliptic and hyperbolic paraboloids, | Textbooks |
| 13 | Conics and quadrics: affine classification theorem of Gauss. | Textbooks |
| 14 | Review and midterm exam | Textbooks |

RECOMMENDED SOURCES

| | |
|-----------------------------|--|
| Textbook | I. Vaisman, "Analytical Geometry" H. İ. Karakaş, "Analytic Geometry" |
| Additional Resources | V. Gutenmacher and N. B. Vasilyev, Lines and Curves, Birkhauser 2004, QA 459.G983 2004. C. B. Boyer, History of Analytic Geometry, Dover 1956, QA 551.B813 2004. There are chapters on several books named "calculus and analytical geometry". |

MATERIAL SHARING

| | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

ASSESSMENT

| IN-TERM STUDIES | NUMBER | PERCENTAGE |
|---|--------|------------|
| Mid-terms | 2 | 100 |
| Quizzes | | |
| Assignments | | |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 30 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 70 |
| Total | | 100 |

| | |
|------------------------|--------------|
| COURSE CATEGORY | Core Courses |
|------------------------|--------------|

COURSE'S CONTRIBUTION TO PROGRAM

| | | |
|--------|---------------------------|--------------|
| N o | Program Learning Outcomes | Contribution |
|--------|---------------------------|--------------|

| | | | | | | |
|---|--|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | X | | | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | X | | | |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | X |
| 4 | Ability to define, formulate and solve mathematical problems | | | | X | |
| 5 | Consciousness of professional ethics and responsibility | | | X | | |
| 6 | Ability to communicate actively | | | X | | |
| 7 | Ability of self-development in fields of interest | | | | X | |
| 8 | Ability to learn, choose and use necessary information technologies | X | | | | |
| 9 | Lifelong education | | | X | | |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|--|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 5 | 70 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 5 | 70 |
| Mid-terms (Including self study) | 2 | 10 | 20 |
| Quizzes | - | - | - |
| Assignments | - | - | - |
| Final examination (Including self study) | 1 | 15 | 15 |
| Total Work Load | | | 175 |
| Total Work Load / 25 (h) | | | 7 |
| ECTS Credit of the Course | | | 7 |

| COURSE INFORMATION | | | | | |
|--------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| ANALYSIS I | MATH 155 | 1 | 3 + 2 | 4 | 8 |

| | |
|----------------------|---|
| Prerequisites | - |
|----------------------|---|

| | |
|--------------------------------|--|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Compulsory |
| Course Coordinator | Melike İřim Efe |
| Instructors | Melike İřim Efe |
| Assistants | Sefer Furkan řahin |
| Goals | To teach the students the concepts of limits, derivatives and integrals of functions of a single variable and have them maintain the ability to make calculations in these issues, which are the fundamental knowledge that is necessary for main research areas in mathematics. |
| Content | Introduction to calculus, sequences, series, convergence. Functions limits and derivatives. Differentiation rules, the chain rule, implicit differentiation, linear approximations. Applications of differentiation, minimum and maximum values, shapes of curves, optimization, applications to business and economics. |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|--|---------------------------|------------------|--------------------|
| 1) Learns the concept of limit, continuity | 1,2,4,7 | 1,2 | A |
| 2) Learns the concept of convergence of sequences and series | 2,4,7 | 1,2 | A |
| 3) Evaluates derivatives | 1,2,4,7 | 1,2 | A |
| 4) Uses derivative to find extremum | 1,4,7 | 1,2 | A |
| 5) Uses L'Hospital rule to evaluate limits | 4,7 | 1,2 | A |
| 6) Calculates using the Fundamental Theorem of Calculus | 1,2,4,7 | 1,2 | A |

| | |
|----------------------------|-------------------------------------|
| Teaching Methods: | 1: Lecture, 2: Problem Solving |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|--|-----------------|
| Week | Topics | Study Materials |
| 1 | Introduction to Calculus | |
| 2 | Sequences, Series, Limit | |
| 3 | Functions, Composition of Functions, Inverse Functions | |
| 4 | Exponential Functions and Logarithms | |

| | | |
|----|---|--|
| 5 | Trigonometric Functions | |
| 6 | The Limit of a function, Calculating limits using limit Laws | |
| 7 | Continuity, Limits involving infinity | |
| 8 | Tangents, Velocities, and Other Rates of Change, Derivatives, The Derivative as a Function | |
| 9 | What Does f' say about f ? Derivatives of Polynomials and Exponential Functions, The Product and Quotient Rules | |
| 10 | Derivatives of Trigonometric Functions, The Chain Rule | |
| 11 | Implicit Differentiation, Derivatives of Logarithmic Functions, Linear Approximations, Taylor Polynomial | |
| 12 | Maximum and Minimum Values | |
| 13 | Graphing with Calculus and Calculators | |
| 14 | Intermediate Forms and L' Hospital's Rule, Optimization Problems, Applications to Business and Economics | |

RECOMMENDED SOURCES

| | |
|-----------------------------|--|
| Textbook | Calculus, Concepts & Contexts by James Stewart, 7 th edition. |
| Additional Resources | |

MATERIAL SHARING

| | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

ASSESSMENT

| IN-TERM STUDIES | NUMBER | PERCENTAGE |
|---|--------|------------|
| Mid-terms | 1 | 100 |
| Quizzes | 0 | 0 |
| Assignments | 0 | 0 |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | 1 | 60 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 40 |
| Total | | 100 |

| | |
|------------------------|--------------|
| COURSE CATEGORY | Core Courses |
|------------------------|--------------|

COURSE'S CONTRIBUTION TO PROGRAM

| N o | Program Learning Outcomes | Contribution | | | | |
|--------|---|--------------|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, | | | | | X |

| | | | | | | | |
|---|--|---|--|---|--|--|---|
| | integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | | | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | | X |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | | X |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | | X |
| 5 | Consciousness of professional ethics and responsibility | | | X | | | |
| 6 | Ability to communicate actively | | | X | | | |
| 7 | Ability of self-development in fields of interest | | | | | | X |
| 8 | Ability to learn, choose and use necessary information technologies | X | | | | | |
| 9 | Lifelong education | | | X | | | |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|--|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 5 | 70 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 6 | 84 |
| Mid-terms (Including self study) | 1 | 20 | 20 |
| Quizzes | | | |
| Assignments | | | |
| Final examination (Including self study) | 1 | 25 | 25 |
| Total Work Load | | | 199 |
| Total Work Load / 25 (h) | | | 7,99 |
| ECTS Credit of the Course | | | 8 |

| COURSE INFORMATION | | | | | |
|--------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| ANALYSIS II | MATH 156 | 2 | 3 +2 | 4 | 8 |

| | |
|----------------------|----------|
| Prerequisites | MATH 155 |
|----------------------|----------|

| | |
|--------------------------------|---|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Compulsory |
| Course Coordinator | Barış Efe |
| Instructors | Barış Efe |
| Assistants | Melin Özbaylanlı |
| Goals | To teach integration techniques and some applications of integrals such as calculating areas and volumes. To teach sequences and series and their convergence and divergence. |
| Content | General review. Integrals; Fundamental theorem of calculus, integration by parts, approximate integration, improper integrals. Applications of integration; Areas, volumes, arc length, average value of a function, other applications. Infinite sequences and series; sequences, series, convergence tests, representations of functions as power series Taylor and Maclaurin series. |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|--|---------------------------|------------------|--------------------|
| 1) Evaluates the integrals of functions of single variable. | 1,2,4,7 | 1,2 | A |
| 2) Uses integrals to evaluate areas and volumes. | 1,2,7 | 1,2 | A |
| 3) Learns the notion of convergence of a series. | 2,4,7 | 1,2 | A |
| 4) Represents some functions with power series. | 1,2,4,7 | 1,2 | A |
| 5) Calculates partial derivatives of multi variable functions. | 1,4,7 | 1,2 | A |
| 6) Calculates local and global minimum and maximum values. | 1,2,4,7 | 1,2 | A |

| | |
|----------------------------|-------------------------------------|
| Teaching Methods: | 1: Lecture, 2: Problem Solving |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|---|-----------------|
| Week | Topics | Study Materials |
| 1 | Definite integral and indefinite integral | |
| 2 | Fundamental theorem of calculus, substitution, integration by parts | |
| 3 | Trigonometric substitutions, integrals of rational functions | |
| 4 | Areas of plane regions, improper integral | |

| | | |
|----|--|--|
| 5 | Volume, arclength and surface area | |
| 6 | The algebraic and order properties of real numbers | |
| 7 | The completeness property. applications of the supremum property | |
| 8 | Sequences and their limits , limit theorems for sequences | |
| 9 | Monotone sequences, subsequences and the Bolzano-Weierstrass theorem . | |
| 10 | Cauchy sequences, the Cauchy criterion | |
| 11 | Infinite series, series with positive terms. comparison tests | |
| 12 | Tests for convergence | |
| 13 | Absolute and conditional convergence | |
| 14 | Power series, Taylor series and applications | |

| RECOMMENDED SOURCES | |
|-----------------------------|---|
| Textbook | James Stewart, Calculus: Concepts and Contexts, 2nd Edition |
| Additional Resources | |

| MATERIAL SHARING | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

| ASSESSMENT | | |
|---|--------|------------|
| IN-TERM STUDIES | NUMBER | PERCENTAGE |
| Mid-terms | 2 | 100 |
| Quizzes | | |
| Assignments | | |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 60 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 40 |
| Total | | 100 |

| | |
|------------------------|--------------|
| COURSE CATEGORY | Core Courses |
|------------------------|--------------|

| COURSE'S CONTRIBUTION TO PROGRAM | | | | | | |
|----------------------------------|--|--------------|---|---|---|---|
| No | Program Learning Outcomes | Contribution | | | | |
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the | | | | | x |

| | | | | | | | |
|---|---|--|--|---|--|--|---|
| | fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | | | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | | x |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | | |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | | x |
| 5 | Consciousness of professional ethics and responsibility | | | x | | | |
| 6 | Ability to communicate actively | | | | | | |
| 7 | Ability of self-development in fields of interest | | | x | | | |
| 8 | Ability to learn, choose and use necessary information technologies | | | | | | |
| 9 | Lifelong education | | | x | | | |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|---|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 5 | 70 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 6 | 84 |
| Mid-terms (Including self study) | 1 | 20 | 20 |
| Quizzes | | | |
| Assignments | | | |
| Final examination (Including self study) | 1 | 25 | 25 |
| Total Work Load | | | 199 |
| Total Work Load / 25 (h) | | | 7,99 |
| ECTS Credit of the Course | | | 8 |

| COURSE INFORMATION | | | | | |
|--------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| COMBINATORICS | MATH 158 | 2 | 2 + 2 | 3 | 7 |

| | |
|----------------------|--|
| Prerequisites | |
|----------------------|--|

| | |
|--------------------------------|---|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Compulsory |
| Course Coordinator | Melike İřim Efe |
| Instructors | Melike İřim Efe |
| Assistants | |
| Goals | The aim of this course is to introduce the topics and techniques of discrete methods and combinatorial reasoning with wide variety of applications. |
| Content | Fundamental principle of counting. Introduction to discrete probability. Pigeonhole principle. The principle of inclusion and exclusion. Recurrence relations. Introduction to graph theory. Languages and finite state machines. |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|---|---------------------------|------------------|--------------------|
| 1) Understands and solves problems in counting using the basic principles of counting. | 1,2,4,7 | 1,2 | A |
| 2) Uses the principle of inclusion and exclusion to solve related problems indirectly. | 1,2,7 | 1,2 | A |
| 3) Solves first-order linear recurrence relations, second-order linear homogeneous recurrence relations with constant coefficients and some particular nonhomogeneous recurrence relations. | 2,4,7 | 1,2 | A |
| 4) Models a given particular situation or a problem using graph theory. | 1,2,4,7 | 1,2 | A |
| 5) Decides whether or not given graphs are isomorphic. | 1,4,7 | 1,2 | A |
| 6) Understands the structure of languages and finite state machines. | 1,2,4,7 | 1,2 | A |

| | |
|----------------------------|--------------------------------|
| Teaching Methods: | 1: Lecture, 2: Problem Solving |
| Assessment Methods: | A: Written examination |

| COURSE CONTENT | | |
|----------------|--|-----------------|
| Week | Topics | Study Materials |
| 1 | The rules of sum and product. Permutations | 1.1, 1.2 |
| 2 | Combinations. The binomial theorem. Combinations with repetition | 1.3, 1.4 |
| 3 | The pigeonhole principle | 5.5 |
| 4 | Well ordering principle, Mathematical Induction | 4.1, 4.2 |

| | | |
|----|--|---------------|
| 5 | Division Algorithm. The Euclidean Algorithm. The Fundamental Theorem of Arithmetic | 4.3, 4.4, 4.5 |
| 6 | The Principle of Inclusion and Exclusion | 8.1, 8.2 |
| 7 | Generating Functions | 9.1, 9.2 |
| 8 | Partition of integers, | 9.3, 9.4 |
| 9 | The first-order linear recurrence relation | 10.1 |
| 10 | The second-order linear homogeneous recurrence relation with constant coefficients | 10.2 |
| 11 | The nonhomogeneous recurrence relation | 10.3 |
| 12 | The method of generating functions | 10.4 |
| 13 | Graph theory: Graphs ,Subgraphs, Complements, Graph Isomorphisms | 11.1 |
| 14 | Languages: Finite state machine. | 6.1, 6.2, 6.3 |

RECOMMENDED SOURCES

| | | |
|-----------------------------|------|--|
| Textbook | (I) | Discrete and Combinatorial Mathematics, 5th Ed. R. P. Grimaldi, Pearson. 2013. |
| Additional Resources | (II) | Discrete Mathematics and Its Applications, K. H. Rosen, Mc Graw Hill, 6th edition, 2007. |

MATERIAL SHARING

| | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

ASSESSMENT

| IN-TERM STUDIES | NUMBER | PERCENTAGE |
|---|--------|------------|
| Mid-terms | 1 | 100 |
| Quizzes | | |
| Assignments | | |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 60 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 40 |
| Total | | 100 |

| | |
|------------------------|--------------|
| COURSE CATEGORY | Core Courses |
|------------------------|--------------|

COURSE'S CONTRIBUTION TO PROGRAM

| No | Program Learning Outcomes | Contribution | | | | |
|----|--|--------------|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis | | | | | x |

| | | | | | | |
|---|---|---|--|--|---|---|
| | for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | x | | | | |
| 3 | Ability form and interpret the relations between research topics in mathematics | x | | | | |
| 4 | Ability to define, formulate and solve mathematical problems | | | | x | |
| 5 | Consciousness of professional ethics and responsibility | | | | x | |
| 6 | Ability to communicate actively | x | | | | |
| 7 | Ability of self-development in fields of interest | | | | | x |
| 8 | Ability to learn, choose and use necessary information technologies | x | | | | |
| 9 | Lifelong education | | | | x | |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|---|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 4 | 56 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 6 | 84 |
| Mid-terms (Including self study) | 1 | 15 | 15 |
| Quizzes | | | |
| Assignments | | | |
| Final examination (Including self study) | 1 | 20 | 20 |
| Total Work Load | | | 175 |
| Total Work Load / 25 (h) | | | 7 |
| ECTS Credit of the Course | | | 7 |

| COURSE INFORMATION | | | | | |
|--------------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| MATHEMATICAL SOFTWARES I | MATH 201 | 1 | 3 + 0 | 3 | 6 |

| | |
|----------------------|--|
| Prerequisites | |
|----------------------|--|

| | |
|--------------------------------|---|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programs) |
| Course Type | Compulsory |
| Course Coordinator | Neslihan Oflaz Sariyer |
| Instructors | Neslihan Oflaz Sariyer |
| Assistants | |
| Goals | To provide information about mathematical typesetting, symbolic computation and numerical computation software. |
| Content | Fundamentals of Latex, Maxima and Octave software |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|--|---------------------------|------------------|--------------------|
| 1) To learn using Latex software | 7,8,9 | 1,2 | A,B |
| 2) To learn using Maxima software | 7,8,9 | 1,2 | A,B |
| 3) To learn using Octave software | 7,8,9 | 1,2 | A,B |
| 4) To learn using symbolic computation software | 8,9 | 1,2 | A,B |
| 5) To learn using numerical computation software | 7,8 | 1,2 | A,B |

| | |
|----------------------------|-------------------------------------|
| Teaching Methods: | 1: Lecture, 2: Problem Solving |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|--|---|
| Week | Topics | Study Materials |
| 1 | Basics; LATEX Input Files; Input File Structure; Command lines; The Layout of the Document; Document classes; Packages | The Not So Short Introduction to LATEX2e, Chapter 1 |
| 2 | Typesetting Text ; The Structure of Text and Language; Line breaking and page breaking ; Justified Paragraphs ; Hyphenation; Readymade Strings; Special Characters and Symbols; International Language Support ; The Space between Words; Titles, Chapters, and Sections; Cross References; Footnotes; Emphasized Words; Environments; Floating Bodies; Protecting fragile commands. | The Not So Short Introduction to LATEX2e, Chapter 2 |
| 3 | Typesetting Mathematical Formulae; Grouping in Math Mode; Building Blocks of a Mathematical Formula; Math Spacing; Vertically Aligned Material; Phantom: Math Font Size; Theorems, Laws; Bold symbols; List of Mathematical Symbols. | The Not So Short Introduction to LATEX2e, Chapter 3 |

| | | |
|----|---|---|
| 4 | Including EPS Graphics; Bibliography; Indexing; Fancy Headers; The Verbatim Package; Downloading and Installing LATEX Packages. | The Not So Short Introduction to LATEX2e, Chapter 4 |
| 5 | Introduction, Available interfaces to Maxima, The Basics | The Maxima Book, Chapters 1,2,3, |
| 6 | Trig through Calculus; Advanced Mathematics - ODEs and Beyond; Matrix Operations and Vectors | The Maxima Book, Chapters 4,5,6 |
| 7 | Introduction to Maxima's Programming Language; | The Maxima Book, Chapter 7 |
| 8 | Graphics and Forms of Output | The Maxima Book, Chapter 8 |
| 9 | Additional Packages | The Maxima Book, Chapters 13, 14, 15, 17 |
| 10 | Getting started, | Introduction to GNU Octave, Chapter 1 |
| 11 | Matrices and Linear Systems | Introduction to GNU Octave, Chapter 2 |
| 12 | Single variable calculus | Introduction to GNU Octave, Chapter 3 |
| 13 | Eigenvalue problems | Introduction to GNU Octave, Chapter 5 |
| 14 | Multivariable calculus and differential equations | Introduction to GNU Octave, Chapter 6 |

RECOMMENDED SOURCES

| | |
|-----------------------------|--|
| Textbook | The Not So Short Introduction to LATEX2e, Or LATEX2" in 95 minutes; Tobias Oetiker, Hubert Partl, Irene Hyna and Elisabeth Schlegl; Version 3.20, 09 August, 2001 The Maxima Book; Paulo Ney de Souza, Richard J. Fateman, Joel Moses, Cliff Yapp, Introduction to GNU Octave, A brief tutorial for linear algebra and calculus students; Jason Lachniet, Wytheville Community College, Third Edition |
| Additional Resources | The Latex Companion, 2nd Edition, Frank Mittelbach and Michel Goossens |

MATERIAL SHARING

| | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

ASSESSMENT

| IN-TERM STUDIES | NUMBER | PERCENTAGE |
|---|--------|------------|
| Mid-terms | 2 | 70 |
| Quizzes | | - |
| Assignments | 3 | 30 |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 40 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 60 |
| Total | | 100 |

| | |
|------------------------|-------------------------|
| COURSE CATEGORY | Expertise/Field Courses |
|------------------------|-------------------------|

| COURSE'S CONTRIBUTION TO PROGRAM | | | | | | | |
|----------------------------------|--|--------------|---|---|---|---|---|
| No | Program Learning Outcomes | Contribution | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | x | | | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | | x |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | | x |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | | x |
| 5 | Consciousness of professional ethics and responsibility | | | x | | | |
| 6 | Ability to communicate actively | | | x | | | |
| 7 | Ability of self-development in fields of interest | | | | | x | |
| 8 | Ability to learn, choose and use necessary information technologies | | | x | | | |
| 9 | Lifelong education | | | x | | | |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|--|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 3 | 42 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 3 | 42 |
| Mid-terms (Including self-study) | 2 | 12 | 24 |
| Quizzes | - | - | - |
| Assignments | 7 | 3 | 21 |
| Final examination (Including self-study) | 1 | 21 | 21 |
| Total Work Load | | | 150 |
| Total Work Load / 25 (h) | | | 6 |
| ECTS Credit of the Course | | | 6 |

| COURSE INFORMATION | | | | | |
|---------------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| MATHEMATICAL SOFTWARES II | MATH 202 | 2 | 3 + 0 | 3 | 6 |

| | |
|----------------------|--|
| Prerequisites | |
|----------------------|--|

| | |
|--------------------------------|---|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Compulsory |
| Course Coordinator | Neslihan Oflaz Sariyer |
| Instructors | Neslihan Oflaz Sariyer |
| Assistants | |
| Goals | Symbolic and numerical computation by using Python language |
| Content | Fundamentals of Python language and its modules NumPy, SymPy and Matplotlib |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|---|---------------------------|------------------|--------------------|
| 1) To learn basics of Python language | 1,4,5,7,8,9 | 1 | A,B |
| 2) To learn numerical computation by using NumPy module | 4,5,7 | 1 | A,B |
| 3) To learn symbolic computation by using SymPy module | 7,8,9 | 1 | A,B |
| 4) To learn plotting graphs of functions by using Matplotlib module | 1,4,5,9 | 1 | A,B |

| | |
|----------------------------|-------------------------------------|
| Teaching Methods: | 1: Lecture, 2: Problem Solving |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|--|------------------------|
| Week | Topics | Study Materials |
| 1 | Python Basics | [T1] Chapter 1 |
| 2 | Variables and Basic Data Structures | [T1] Chapter 2 |
| 3 | Functions | [T1] Chapter 3 |
| 4 | Branching Statements; Iteration | [T1] Chapter 4-5 |
| 5 | Class and Object; Round-Off Errors | [T1] Sections 7.2, 9.3 |
| 6 | Visualization and Plotting; MIDTERM EXAM 1 | [T1] Chapter 12 |
| 7 | Linear Algebra and Systems of Linear Equations | [T1] Chapter 14 |
| 8 | Eigenvalues and Eigenvectors | [T1] Chapter 15 |

| | | |
|----|---|--------------------|
| 9 | Creating and manipulating expressions by using SymPy | [T2] pp.17-28 |
| 10 | Calculus with SymPy | [T2] pp.31-34 |
| 11 | Solving equations by SymPy; MIDTERM EXAM 2 | [T2] pp.35-37 |
| 12 | Taylor Series; Root Finding | [T1] Chapter 18-19 |
| 13 | Numerical Differentiation; Numerical Integration | [T1] Chapter 20-21 |
| 14 | Ordinary Differential Equations (ODEs) Initial-Value Problems | [T1] Chapter 22 |

| RECOMMENDED SOURCES | |
|-----------------------------|--|
| Textbook | [T1] Kong, Qingkai, et al. <i>Python Programming and Numerical Methods: A Guide for Engineers and Scientists</i> . Academic Press, 2021. [T2] Lamy, Ronan. <i>Instant SymPy Starter: Learn to Use SymPy's Symbolic Engine to Simplify Python Calculations</i> . Packt Publishing, 2013. |
| Additional Resources | |

| MATERIAL SHARING | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

| ASSESSMENT | | |
|---|--------|------------|
| IN-TERM STUDIES | NUMBER | PERCENTAGE |
| Mid-terms | 2 | 70 |
| Quizzes | | - |
| Assignments | 3 | 30 |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 40 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 60 |
| Total | | 100 |

| | |
|------------------------|-------------------------|
| COURSE CATEGORY | Expertise/Field Courses |
|------------------------|-------------------------|

| COURSE'S CONTRIBUTION TO PROGRAM | | | | | | |
|----------------------------------|--|--------------|---|---|---|---|
| No | Program Learning Outcomes | Contribution | | | | |
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | x | | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | x |

| | | | | | | | |
|---|---|--|--|--|---|---|---|
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | | x |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | | x |
| 5 | Consciousness of professional ethics and responsibility | | | | x | | |
| 6 | Ability to communicate actively | | | | x | | |
| 7 | Ability of self-development in fields of interest | | | | | x | |
| 8 | Ability to learn, choose and use necessary information technologies | | | | x | | |
| 9 | Lifelong education | | | | x | | |

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
|---|----------|-----------------|-----------------------|
| Course Duration (14x Total course hours) | 14 | 3 | 42 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 3 | 42 |
| Mid-terms (Including self study) | 2 | 12 | 24 |
| Quizzes | - | - | - |
| Assignments | 7 | 3 | 21 |
| Final examination (Including self study) | 1 | 21 | 21 |
| Total Work Load | | | 150 |
| Total Work Load / 25 (h) | | | 6 |
| ECTS Credit of the Course | | | 6 |

| COURSE INFORMATION | | | | | |
|-----------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| DIFFERENTIAL GEOMETRY | MATH 212 | 2 | 2 + 2 | 3 | 6 |

| | |
|----------------------|----------|
| Prerequisites | MATH 255 |
|----------------------|----------|

| | |
|--------------------------------|---|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Compulsory |
| Course Coordinator | İlker Savaş Yüce |
| Instructors | İlker Savaş Yüce |
| Assistants | |
| Goals | To provide information about the local and global structures of curves and surfaces in three dimensions. |
| Content | Curves in plane and 3-space, the local theory of curves, Serret-Frenet formulas. Closed curves, isoperimetric inequality and four-vertex theorem. Surfaces, first and second fundamental forms. Geometry of Gauss map. Structure equations. Theorema Egregium. Formulation with differential forms. Gauss-Bonnet theorem. Intrinsic and extrinsic geometry of surfaces. |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|--|---------------------------|------------------|--------------------|
| 1) Learns the local behaviour of curves | 1,2,3,4,9 | 1 | A |
| 2) Learns the local behaviour of surfaces | 1,2,3,4,9 | 1 | A |
| 3) Learns how to distinguish local and global behaviours of curves | 2,3,4,9 | 1 | A |
| 4) Learns how to distinguish local and global behaviours of surfaces | 2,3,4,9 | 1 | A |
| 5) Learns how to obtain global information about curves | 1,2,3,4,9 | 1 | A |
| 6) Learns how to obtain global information about surfaces | 1,2,3,4,9 | 1 | A |

| | |
|----------------------------|-------------------------------------|
| Teaching Methods: | 1: Lecture, 2: Problem Solving |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|-------------------------------|-----------------------|
| Week | Topics | Study Materials |
| 1 | Local Curve Theory in 2D | From textbook 2.1-2.3 |
| 2 | Local Curve Theory in 3D | 2.4-2.6 |
| 3 | Global Theory of Plane Curves | 3.1-3.3 |
| 4 | Global Theory of Plane Curves | 3.4-3.6 |

| | | |
|----|---|---------------|
| 5 | MIDTERM and discussion of solutions | |
| 6 | Local Surface Theory (First and Second Fundamental Forms) | 4.1-4.3, 4.7 |
| 7 | Local Surface Theory (Parallelism and Curvatures) | 4.4-4.6, 4.8, |
| 8 | Local Surface Theory (Fundamental Theorem of Surfaces) | 4.10 |
| 9 | Local Surface Theory (Theorema Egregium) | 4.9 |
| 10 | MIDTERM and discussion of solutions | |
| 11 | Global Theory of Space Curves | 5.1-5.3 |
| 12 | Global Theory of Surfaces (Curvature, Orientability) | 6.1-6.3 |
| 13 | Global Theory of Surfaces (Gauss-Bonnet Formula) | 6.4-6.6 |
| 14 | Global Theory of Surfaces (Index of a Vector Field) | 6.7 |

| RECOMMENDED SOURCES | |
|-----------------------------|---|
| Textbook | R.S. Millman, G.D. Parker, Elements of Differential Geometry, Pearson, 1977 |
| Additional Resources | |

| MATERIAL SHARING | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

| ASSESSMENT | | |
|---|--------|------------|
| IN-TERM STUDIES | NUMBER | PERCENTAGE |
| Mid-terms | 2 | 100 |
| Quizzes | - | - |
| Assignments | - | - |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 40 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 60 |
| Total | | 100 |

| | |
|------------------------|-------------------------|
| COURSE CATEGORY | Expertise/Field Courses |
|------------------------|-------------------------|

| COURSE'S CONTRIBUTION TO PROGRAM | | | | | | |
|----------------------------------|--|--------------|---|---|---|---|
| No | Program Learning Outcomes | Contribution | | | | |
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis | | x | | | |

| | | | | | | |
|---|---|--|--|---|---|---|
| | for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | x |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | x |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | x |
| 5 | Consciousness of professional ethics and responsibility | | | x | | |
| 6 | Ability to communicate actively | | | x | | |
| 7 | Ability of self-development in fields of interest | | | | x | |
| 8 | Ability to learn, choose and use necessary information technologies | | | x | | |
| 9 | Lifelong education | | | x | | |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|---|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 4 | 56 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 4 | 56 |
| Mid-terms (Including self study) | 2 | 10 | 20 |
| Quizzes | - | - | - |
| Assignments | - | - | - |
| Final examination (Including self study) | 1 | 18 | 18 |
| Total Work Load | | | 150 |
| Total Work Load / 25 (h) | | | 6 |
| ECTS Credit of the Course | | | 6 |

| COURSE INFORMATION | | | | | |
|--------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| LINEAR ALGEBRA I | MATH 231 | 1 | 3 + 2 | 4 | 7 |

| | |
|----------------------|---|
| Prerequisites | - |
|----------------------|---|

| | |
|--------------------------------|---|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Compulsory |
| Course Coordinator | Bariş Efe |
| Instructors | Bariş Efe |
| Assistants | Melin Özbaylanlı |
| Goals | To provide tools for dealing with problems in many fields from a variety of disciplines and to serve as a bridge from the typical intuitive treatment of calculus to more rigorous courses such as abstract algebra and analysis. |
| Content | Matrices and systems of linear equations. Vector spaces; subspaces, sums and direct sums of subspaces. Linear dependence, bases, dimension, quotient spaces. Linear transformations, kernel, range, isomorphism. Spaces of linear transformations. Representations of linear transformations by matrices. Determinants. Inverse of a matrix. Eigenvalues and eigenvectors. Diagonalization of a matrix. |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|---|---------------------------|------------------|--------------------|
| 1) Solves the systems of linear equations using matrices. | 1,2,7 | 1,2 | A |
| 2) Determines spanning sets for a given vector space. | 1,2 | 1,2 | A |
| 3) Applies Gram-Schmidt Process to an independent set of vectors to obtain an orthogonal set. | 1,2,4,7 | 1,2 | A |
| 4) Determines if a given matrix is nonsingular. | 1,2 | 1,2 | A |
| 5) Uses elementary matrices to compute the inverse of a matrix. | 1,2 | 1,2 | A |
| 6) Uses determinant and adjoint to compute the inverse of a matrix. | 1,2 | 1,2 | A |
| 7) Diagonalizes a matrix | 1,2 | 1,2 | A |

| | |
|----------------------------|-------------------------------------|
| Teaching Methods: | 1: Lecture, 2: Problem Solving |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|---|-----------------|
| Week | Topics | Study Materials |
| 1 | Vectors and linear equations. The idea of elimination | Textbook |
| 2 | Elimination using matrices | Textbook |
| 3 | Rules for matrix operations, inverse matrices | Textbook |

| | | |
|----|--|----------|
| 4 | LU-decomposition, transposes and permutations | Textbook |
| 5 | Spaces of vectors, | Textbook |
| 6 | Nullspace of A, The complete solution to $Ax=b$ | Textbook |
| 7 | Independence, basis and dimension, | Textbook |
| 8 | Dimensions of the four subspaces | Textbook |
| 9 | Orthogonality of the four subspaces | Textbook |
| 10 | Projections, orthonormal bases and Gram-Schmidt orthonormalization process | Textbook |
| 11 | The properties of determinants, permutations and cofactors, | Textbook |
| 12 | Cramer's rule, inverses and volumes | Textbook |
| 13 | Introduction to eigenvalues, | Textbook |
| 14 | Diagonalizing a matrix | Textbook |

RECOMMENDED SOURCES

| | |
|-----------------------------|--|
| Textbook | Gilbert Strang - Introduction to Linear Algebra Fifth Edition-Wellesley-Cambridge Press (2016) |
| Additional Resources | |

MATERIAL SHARING

| | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

ASSESSMENT

| IN-TERM STUDIES | NUMBER | PERCENTAGE |
|---|--------|------------|
| Mid-terms | 1 | 100 |
| Quizzes | | |
| Assignments | | |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 60 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 40 |
| Total | | 100 |

| | |
|------------------------|--------------|
| COURSE CATEGORY | Core Courses |
|------------------------|--------------|

COURSE'S CONTRIBUTION TO PROGRAM

| | | | | | | |
|--------|---------------------------|--------------|---|---|---|---|
| N o | Program Learning Outcomes | Contribution | | | | |
| | | 1 | 2 | 3 | 4 | 5 |

| | | | | | | | |
|---|--|--|--|---|--|---|---|
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | | | | x |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | | x |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | | x |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | x | |
| 5 | Consciousness of professional ethics and responsibility | | | | | | x |
| 6 | Ability to communicate actively | | | x | | | |
| 7 | Ability of self-development in fields of interest | | | | | | x |
| 8 | Ability to learn, choose and use necessary information technologies | | | | | | x |
| 9 | Lifelong education | | | | | | x |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|--|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 5 | 70 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 5 | 70 |
| Mid-terms (Including self study) | 1 | 15 | 15 |
| Quizzes | - | - | - |
| Assignments | - | - | - |
| Final examination (Including self study) | 1 | 20 | 20 |
| Total Work Load | | | 175 |
| Total Work Load / 25 (h) | | | 7 |
| ECTS Credit of the Course | | | 7 |

| COURSE INFORMATION | | | | | |
|--------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| LINEAR ALGEBRA II | MATH 232 | 2 | 3 + 2 | 4 | 7 |

| | |
|----------------------|----------|
| Prerequisites | MATH 231 |
|----------------------|----------|

| | |
|--------------------------------|---|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Compulsory |
| Course Coordinator | Bariş Efe |
| Instructors | Bariş Efe |
| Assistants | Esmanur Yıldız Akıl |
| Goals | To provide tools for dealing with problems in many fields from a variety of disciplines and to serve as a bridge from the typical intuitive treatment of calculus to more rigorous courses such as abstract algebra and analysis. |
| Content | Characteristic and minimal polynomials of an operator, eigenvalues, diagonalizability, canonical forms, Jordan and rational forms of matrices. Inner product spaces, norm and orthogonality, projections. Linear operators on inner product spaces, adjoint of an operator, normal, self adjoint, unitary and positive operators. Bilinear and quadratic forms. |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|--|---------------------------|------------------|--------------------|
| 1) Determines if a given set is independent and/or spanning set. | 1,2 | 1,2,3,4 | A |
| 2) Constructs an orthonormal basis for a given vector space. | 1,2,4 | 1,2,3,4 | A |
| 3) Determines if a given linear transformation is injective, surjective or invertible. | 1,2 | 1,2,3,4 | A |
| 4) Represents a linear transformation by matrices and obtains information about transformation by using these representations. | 1,2,4 | 1,2,3,4 | A |
| 5) Determines if a matrix is diagonalizable and if it is, diagonalizes the matrix. | 1,2,4 | 1,2,3,4 | A |
| 6) Computes the Jordan canonical form of a matrix. | 1,2 | 1,2,3,4 | A |

| | |
|----------------------------|---|
| Teaching Methods: | 1: Lecture, 2: Problem solving 3: question – answer 4: Homework |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|---|-----------------|
| Week | Topics | Study Materials |
| 1 | Vector spaces, subspaces | Textbook |
| 2 | Bases, dimension and coordinates. | Textbook |
| 3 | Linear transformations, the algebra of linear transformations | Textbook |

| | | |
|----|---|----------|
| 4 | Isomorphism, the representation of linear transformations by matrices | Textbook |
| 5 | Linear functionals, the double dual, the transpose of a linear transformation | Textbook |
| 6 | Determinant functions, permutations and uniqueness of determinants, | Textbook |
| 7 | Additional properties of determinants | Textbook |
| 8 | Elementary canonical forms, characteristic values, annihilating polynomials, invariant subspaces, | Textbook |
| 9 | Direct sum decompositions, invariant direct sums, | Textbook |
| 10 | Primary decomposition theorem | Textbook |
| 11 | Cyclic subspaces and annihilators, | Textbook |
| 12 | Cyclic decompositions and the rational form | Textbook |
| 13 | The Jordan form | Textbook |
| 14 | Computation of invariant factors | Textbook |

RECOMMENDED SOURCES

| | |
|-----------------------------|--|
| Textbook | Kenneth M Hoffman, Ray Kunze - Linear Algebra Second Edition -Prentice Hall (1971) |
| Additional Resources | |

MATERIAL SHARING

| | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

ASSESSMENT

| IN-TERM STUDIES | NUMBER | PERCENTAGE |
|---|--------|------------|
| Mid-terms | 1 | 100 |
| Quizzes | - | - |
| Assignments | - | - |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 60 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 40 |
| Total | | 100 |

| | |
|------------------------|--------------|
| COURSE CATEGORY | Core Courses |
|------------------------|--------------|

COURSE'S CONTRIBUTION TO PROGRAM

| N o | Program Learning Outcomes | Contribution | | | | |
|--------|---------------------------|--------------|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |

| | | | | | | | |
|---|--|--|--|---|--|---|---|
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | | | | x |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | | x |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | | x |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | x | |
| 5 | Consciousness of professional ethics and responsibility | | | | | | x |
| 6 | Ability to communicate actively | | | x | | | |
| 7 | Ability of self-development in fields of interest | | | | | | x |
| 8 | Ability to learn, choose and use necessary information technologies | | | | | | x |
| 9 | Lifelong education | | | | | | x |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|--|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 5 | 70 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 5 | 70 |
| Mid-terms (Including self study) | 1 | 15 | 15 |
| Quizzes | - | - | - |
| Assignments | - | - | - |
| Final examination (Including self study) | 1 | 20 | 20 |
| Total Work Load | | | 175 |
| Total Work Load / 25 (h) | | | 7 |
| ECTS Credit of the Course | | | 7 |

| COURSE INFORMATION | | | | | |
|---------------------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| ORDINARY DIFFERENTIAL EQUATIONS | MATH 245 | 1 | 3 + 2 | 4 | 7 |

| | |
|----------------------|----------|
| Prerequisites | MATH 156 |
|----------------------|----------|

| | |
|--------------------------------|--|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Compulsory |
| Course Coordinator | Melike İřim Efe |
| Instructors | Melike İřim Efe |
| Assistants | Dilara Karlıođlu |
| Goals | Determining the type of a given first or higher order differential equation, examining the existence and uniqueness solution and being able to select the appropriate analytical technique for finding the solution if it can be obtained. Understanding the fundamental theorems of differential equations, understanding Laplace transform and application to differential equations, Finding an infinite series solution to a given differential equation |
| Content | First order equations and various applications. Higher order linear differential equations. Power series solutions: ordinary and regular singular points. The Laplace transform: solution of initial value problems. Systems of linear differential equations: solutions by operator method, by Laplace transform. |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|--|---------------------------|------------------|--------------------|
| 1) Can classify the first and higher order ordinary differential equations. | 2,3 | 1,2,3,4 | A |
| 2) Can determine the appropriate solution method for a given differential equation. | 1,2,4,7 | 1,2,3,4 | A |
| 3) Can investigate the existence and uniqueness of solutions for initial value problems. | 2,3,4,7 | 1,2,3,4 | A |
| 4) Can use Laplace transforms. | 1,2,4,7 | 1,2,3,4 | A |
| 5) Can determine an infinite series solution for a given differential equation. | 1,2,4,7 | 1,2,3,4 | A |

| | |
|----------------------------|---|
| Teaching Methods: | 1: Lecture, 2: Problem Solving, 3: Question-Answer, 4: Homework |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|--|------------------------------|
| Week | Topics | Study Materials |
| 1 | Introduction, Solution of Differential Equations, Classification of DEs, Initial and Boundary conditions. Separable equations. | Course book, Chapter 1 , 2.2 |
| 2 | Homogeneous, Linear 1 st Order Differential Equations, Bernoulli, Ricatti equations | 2.2,2.1,2.4 |
| 3 | Clairaut Differential Equations Exact Differential Equations and Integrating Factors | 2.6 |
| 4 | Existence and Uniqueness Theorem for 1 st order ODEs, discontinuous coefficient, forcing function | 2.4,2.8 |

| | | |
|----|--|------------------|
| 5 | Higher Order Linear ODEs Homogeneous Eqs with constant coefficients Existence and Uniqueness for general higher order equations | 3.1,3.2,4.1 |
| 6 | Midterm I Fundamental Set of Solutions of linear Homogeneous DE s, Linear Independence, Wronskian, Complex roots of the characteristic equation, Reduction of Order, | - 3.2,3.3,3.4 |
| 7 | Repeated roots of characteristic equation for constant coefficient homogenous equation Cauchy-Euler Equation | 3.5,5.5,3.6 |
| 8 | Linear Non-Homogeneous DE s (Method of Undetermined Coefficients),Variation of Parameters | 4.3,3.7 |
| 9 | Definition of Laplace Transform, Solution of Initial Value Problems, Step Functions | 6.1,6.2,6.3 |
| 10 | Midterm II, Differential Equations with discontinuous forcing functions, | - 6.4 |
| 11 | Impulse Function, The Convolution Integral, Review of Power Series, Ordinary Points, Singular Points | 6.5,6.6,5.1 |
| 12 | Series Solutions near an Ordinary Point, Regular Singular Points, Series Solutions near a Regular Singular Point, | 5.2, 5.3,5.4 |
| 13 | Bessel, Legendre, Hermite, Chebyshev Equation | 5.5,5.6 |
| 14 | System of differential equations | 7.1, ch 6 |

RECOMMENDED SOURCES

| | |
|-----------------------------|---|
| Textbook | Elementary Differential Equations and Boundary Value Problems, W. E. Boyce and R. C. DiPrima, John Wiley and Sons, 2009 |
| Additional Resources | |

MATERIAL SHARING

| | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

ASSESSMENT

| IN-TERM STUDIES | NUMBER | PERCENTAGE |
|---|--------|------------|
| Mid-terms | 2 | 100 |
| Quizzes | - | |
| Assignments | - | |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 40 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 60 |
| Total | | 100 |

| | |
|------------------------|-------------------------|
| COURSE CATEGORY | Expertise/Field Courses |
|------------------------|-------------------------|

COURSE'S CONTRIBUTION TO PROGRAM

| |
|--|
| |
|--|

| No | Program Learning Outcomes | Contribution | | | | |
|----|--|--------------|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | X | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | X | |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | X | | |
| 4 | Ability to define, formulate and solve mathematical problems | | X | | | |
| 5 | Consciousness of professional ethics and responsibility | X | | | | |
| 6 | Ability to communicate actively | X | | | | |
| 7 | Ability of self-development in fields of interest | | | | | X |
| 8 | Ability to learn, choose and use necessary information technologies | X | | | | |
| 9 | Lifelong education | | | X | | |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|--|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 5 | 70 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 5 | 70 |
| Mid-terms (Including self study) | 2 | 15 | 30 |
| Quizzes | - | - | - |
| Assignments | - | - | - |
| Final examination (Including self study) | 1 | 20 | 20 |
| Total Work Load | | | 190 |
| Total Work Load / 25 (h) | | | 7.60 |
| ECTS Credit of the Course | | | 8 |

| COURSE INFORMATION | | | | | |
|--------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| REAL ANALYSIS I | MATH 252 | 1 | 3 +2 | 4 | 7 |

| | |
|----------------------|--|
| Prerequisites | |
|----------------------|--|

| | |
|--------------------------------|---|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programs) |
| Course Type | Compulsory |
| Course Coordinator | Mehmet Akif Erdal |
| Instructors | Mehmet Akif Erdal |
| Assistants | Esra Başar |
| Goals | This course constitutes the pillar of many topics in mathematics such as complex analysis, differential equations, differential and integral calculus, and differential geometry. It is impossible to assimilate these areas of mathematics without having this basic knowledge of analysis. The aim of the course is to equip students with this basic knowledge. |
| Content | Limits of functions, continuous functions. Inverse function theorem, sequences of functions, uniform convergence. Cauchy criterion for uniform convergence. The derivative, the mean value theorem, L'Hospital rules, Taylor's theorem. Riemann sum, Riemann integrability. Boundedness theorem. Riemann Integrable Functions, Cauchy Criterion. Squeeze Theorem, Classes of Riemann Integrable Functions. Additivity Theorem, The Fundamental Theorem of Calculus. Substitution Theorem, Lebesgue's Integrability Criterion. Integration by Parts, Taylor's Theorem with the Remainder |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|--|---------------------------|------------------|--------------------|
| 1) Grasp the structure of the real numbers as a complete ordered field | 2,3 | 1 | A,B |
| 2) Learn how to handle the convergence of sequences, series | 1,2,4,7 | 1 | A,B |
| 3) Master the concept of the limit of functions and the concept of continuity; | 2,3,4,7 | 1 | A,B |
| 4) Acquire the knowledge of differentiability of functions | 1,2,4,7 | 1 | A,B |
| 5) Learn integration and classes of Riemann integrable functions | 1,2,4,7 | 1 | A,B |

| | |
|----------------------------|-------------------------------------|
| Teaching Methods: | 1: Lecture, 2: Problem Solving |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|--------|-----------------|
| Week | Topics | Study Materials |
| | | |

| | | |
|----|---|----------|
| 1 | Limits of Functions, Limit Theorems, Cauchy Convergence criterion | Textbook |
| 2 | Continuous Functions, Combinations of Continuous Functions, Continuous Functions on Intervals | Textbook |
| 3 | Uniform Continuity. Monotone functions. Inverse Function Theorem | Textbook |
| 4 | Continuous and Monotone Functions, Sequences of Functions, Pointwise and Uniform Convergence | Textbook |
| 5 | Cauchy Criterion for Uniform Convergence | Textbook |
| 6 | The Derivative, The Mean Value Theorem, L'Hospital Rules, Taylor's Theorem | Textbook |
| 7 | Partitions and Tagged Partitions, Riemann sum, Riemann integrability | Textbook |
| 8 | Some Properties of the Integral, Boundedness Theorem | Textbook |
| 9 | Riemann Integrable Functions, Cauchy Criterion, | Textbook |
| 10 | Squeeze Theorem, Classes of Riemann Integrable Functions | Textbook |
| 11 | Additivity Theorem, The Fundamental Theorem of Calculus, | Textbook |
| 12 | Substitution Theorem, Lebesgue's Integrability Criterion, | Textbook |
| 13 | Composition Theorem, The Product Theorem, | Textbook |
| 14 | Integration by Parts, Taylor's Theorem with the Remainder | Textbook |

RECOMMENDED SOURCES

| | |
|-----------------------------|--|
| Textbook | Robert G. Bartle, Donald R. Sherbert, Introduction to Real Analysis , Fourth Edition, John Wiley & Sons, Inc. (2011), ISBN-13: 978-0471433316 ISBN-10: 9780471433316. https://sciencemathematicseducation.files.wordpress.com/2014/01/0471433314realanalysis4.pdf |
| Additional Resources | Stephen Abbott, Understanding Analysis, Springer, 2. Edition (2015) |

MATERIAL SHARING

| | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

ASSESSMENT

| IN-TERM STUDIES | NUMBER | PERCENTAGE |
|-----------------|--------|------------|
| Mid-terms | 2 | 70 |
| Quizzes | | - |

| | | |
|---|---|------------|
| Assignments | 3 | 30 |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 40 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 60 |
| Total | | 100 |

| | |
|------------------------|-------------------------|
| COURSE CATEGORY | Expertise/Field Courses |
|------------------------|-------------------------|

| COURSE'S CONTRIBUTION TO PROGRAM | | | | | | |
|---|--|--------------|---|---|---|---|
| N o | Program Learning Outcomes | Contribution | | | | |
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | | | x |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | x |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | x |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | x |
| 5 | Consciousness of professional ethics and responsibility | | | x | | |
| 6 | Ability to communicate actively | | | x | | |
| 7 | Ability of self-development in fields of interest | | | | x | |
| 8 | Ability to learn, choose and use necessary information technologies | | | x | | |
| 9 | Lifelong education | | | x | | |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|---|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 5 | 70 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 4 | 56 |
| Mid-terms (Including self-study) | 2 | 10 | 20 |
| Quizzes | - | - | - |
| Assignments | 3 | 5 | 15 |
| Final examination (Including self-study) | 1 | 15 | 15 |
| Total Work Load | | | 176 |
| Total Work Load / 25 (h) | | | 7 |
| ECTS Credit of the Course | | | 7 |

| COURSE INFORMATION | | | | | |
|--------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| CALCULUS III | MATH 255 | 1 | 3 + 2 | 4 | 7 |

| | |
|----------------------|---------------------|
| Prerequisites | MATH 156 OR MATH132 |
|----------------------|---------------------|

| | |
|--------------------------------|---|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Compulsory |
| Course Coordinator | İlker Savaş Yüce |
| Instructors | İlker Savaş Yüce |
| Assistants | Esra Başar |
| Goals | The aim of this course is to provide students with an understanding of differentiation and integration of multivariable functions and their calculations. |
| Content | Functions of several variables; limits and continuity, partial derivatives, linear approximations, chain rule, directional derivatives, maximum and minimum values, Lagrange multipliers. Vector functions; space curves, derivatives and integrals, arc length, motion in space, parametric surfaces. Multiple integrals and applications. Vector calculus; vector fields, line integrals, Green's theorem, curl and divergence, surface integrals, Stokes' theorem, the divergence theorem. |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|---|---------------------------|------------------|--------------------|
| 1) Evaluates the arclength of space curves. | 1,2,7 | 1,2 | A |
| 2) Evaluates double and triple integrals. | 1,2,4,7 | 1,2 | A |
| 3) Changes variables in double and triple integrals. | 1,2,4,7 | 1,2 | A |
| 4) Evaluates line integrals and surface integrals. | 1,2,4,7 | 1,2 | A |
| 5) Expresses the concepts of circulation, work and flux using line and surface integrals. | 1,2,3,4,7 | 1,2 | A |
| 6) Uses Green's, Stokes' and the divergence theorems. | 1,2,3,4,7 | 1,2 | A |

| | |
|----------------------------|-------------------------------------|
| Teaching Methods: | 1: Lecture, 2: Problem Solving |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|---|-----------------|
| Week | Topics | Study Materials |
| 1 | Functions of Several Variables, Limits, Continuity, | Textbook |
| 2 | Partial Derivatives and Higher Order Derivatives | Textbook |
| 3 | Chain Rule, Gradient, Directional Derivatives, Extreme Values, Lagrange Multipliers | Textbook |
| 4 | Vector-Valued Functions : Arc Length, Vector Fields, Divergence and Curl | Textbook |

| | | |
|----|---|----------|
| 5 | Double and Triple Integrals : The Double Integral Over a Rectangle, The Double Integral Over More General Regions | Textbook |
| 6 | Changing the Order of Integration, The Triple Integral | Textbook |
| 7 | The Change of Variables Formula and Applications of Integration: The Geometry of Maps from R^2 to R^2 , The Change of Variables Theorem | Textbook |
| 8 | Applications of Double and Triple Integrals, Improper Integrals | Textbook |
| 9 | Integrals: The Path Integral, Line Integrals | Textbook |
| 10 | Parametrized Surfaces, Area of a Surface | Textbook |
| 11 | Integrals of Scalar Functions Over Surfaces, Surface Integrals of Vector Functions | Textbook |
| 12 | The Integral Theorems of Vector Analysis: Green's Theorem | Textbook |
| 13 | Stokes' Theorem, Conservative Fields, | Textbook |
| 14 | Gauss' Theorem | Textbook |

RECOMMENDED SOURCES

| | |
|-----------------------------|---|
| Textbook | "Vector Calculus", 6th Edition, by J. Marsden and A. Tromba |
| Additional Resources | |

MATERIAL SHARING

| | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

ASSESSMENT

| IN-TERM STUDIES | NUMBER | PERCENTAGE |
|---|--------|------------|
| Mid-terms | 2 | 100 |
| Quizzes | | |
| Assignments | | |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 60 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 40 |
| Total | | 100 |

| | |
|------------------------|--------------|
| COURSE CATEGORY | Core Courses |
|------------------------|--------------|

COURSE'S CONTRIBUTION TO PROGRAM

| No | Program Learning Outcomes | Contribution | | | | |
|----|--|--------------|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a | | | | | X |

| | | | | | | |
|---|---|--|--|---|--|---|
| | basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | X |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | X |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | X |
| 5 | Consciousness of professional ethics and responsibility | | | X | | |
| 6 | Ability to communicate actively | | | X | | |
| 7 | Ability of self-development in fields of interest | | | | | X |
| 8 | Ability to learn, choose and use necessary information technologies | | | | | |
| 9 | Lifelong education | | | | | |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|---|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 5 | 70 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 5 | 70 |
| Mid-terms (Including self study) | 2 | 10 | 20 |
| Quizzes | - | - | - |
| Assignments | - | - | - |
| Final examination (Including self study) | 1 | 15 | 15 |
| Total Work Load | | | 175 |
| Total Work Load / 25 (h) | | | 7 |
| ECTS Credit of the Course | | | 7 |

| COURSE INFORMATION | | | | | |
|------------------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| INTRODUCTION TO GROUP THEORY | MATH 321 | 1 | 2+2 | 3 | 6 |

| | |
|----------------------|----------|
| Prerequisites | MATH 102 |
|----------------------|----------|

| | |
|--------------------------------|--|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Compulsory |
| Course Coordinator | Meltem Özgül |
| Instructors | Meltem Özgül |
| Assistants | |
| Goals | To teach as much about groups as one can in a first course to constitute a firm foundation for more specialized work and to provide valuable experience for any further axiomatic study of mathematics. |
| Content | Binary operations, groups, subgroups, cyclic groups and generators. Permutation groups. Orbits, cycles and alternating groups. Cosets and Lagrange theorem. Direct products. Finitely generated Abelian groups. Isomorphism theorems. Cayley's theorem. Factor groups, simple groups, series of groups, group action. Sylow theorems and applications. Free groups. Group representations. |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|---|---------------------------|------------------|--------------------|
| 1) Classifies finite abelian groups | 1,2,3,4,7,9 | 1,2 | A |
| 2) Finds the Sylow subgroups of a group | 1,2,3,4,7,9 | 1,2 | A |
| 3) Compute factor groups | 1,2,4,7,9 | 1,2 | A |
| 4) Finds group homomorphisms | 1,2,4,7 | 1,2 | A |
| 5) Determines if groups are isomorphic or not | 1,2,3,4,7,9 | 1,2 | A |
| 6) Determines if a group is simple | 1,2,3,4,7,9 | 1,2 | A |

| | |
|----------------------------|-------------------------------------|
| Teaching Methods: | 1: Lecture, 2: Problem Solving |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|--|-----------------|
| Week | Topics | Study Materials |
| 1 | Groups, subgroups, cyclic groups | Textbook |
| 2 | Permutation groups, orbits, cycles, alternating groups | Textbook |
| 3 | Cosets and the theorem of Lagrange | Textbook |
| 4 | Direct product and finitely generated abelian groups | Textbook |

| | | |
|----|----------------------------------|----------|
| 5 | Homomorphisms, factor groups | Textbook |
| 6 | Simple groups | Textbook |
| 7 | Group action on a set | Textbook |
| 8 | Isomorphism theorems | Textbook |
| 9 | Series of groups | Textbook |
| 10 | Sylow theorems | Textbook |
| 11 | Applications of the Sylow theory | Textbook |
| 12 | Free abelian groups | Textbook |
| 13 | Free groups | Textbook |
| 14 | Groups presentations | Textbook |

| RECOMMENDED SOURCES | |
|-----------------------------|--|
| Textbook | A First Course in Abstract Algebra, J. Fraleigh. |
| Additional Resources | |

| MATERIAL SHARING | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

| ASSESSMENT | | |
|---|--------|------------|
| IN-TERM STUDIES | NUMBER | PERCENTAGE |
| Mid-terms | 2 | 100 |
| Quizzes | | |
| Assignments | | |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 40 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 60 |
| Total | | 100 |

| | |
|------------------------|-------------------------|
| COURSE CATEGORY | Expertise/Field Courses |
|------------------------|-------------------------|

| COURSE'S CONTRIBUTION TO PROGRAM | | | | | | |
|----------------------------------|--|--------------|---|---|---|---|
| No | Program Learning Outcomes | Contribution | | | | |
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis | | | x | | |

| | | | | | | |
|---|---|--|---|---|--|---|
| | for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | x |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | x |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | x |
| 5 | Consciousness of professional ethics and responsibilty | | | | | x |
| 6 | Ability to communicate actively | | x | | | |
| 7 | Ability of self-development in fields of interest | | | | | x |
| 8 | Ability to learn, choose and use necessary information technologies | | | x | | |
| 9 | Lifelong education | | | | | x |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|---|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 4 | 56 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 4 | 56 |
| Mid-terms (Including self study) | 1 | 15 | 15 |
| Quizzes | - | - | - |
| Assignments | - | - | - |
| Final examination (Including self study) | 1 | 20 | 20 |
| Total Work Load | | | 147 |
| Total Work Load / 25 (h) | | | 5.88 |
| ECTS Credit of the Course | | | 6 |

| COURSE INFORMATION | | | | | |
|--------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| ABSTRACT ALGEBRA | MATH 322 | 2 | 2+2 | 3 | 6 |

| | |
|----------------------|-----------------------|
| Prerequisites | MATH 231 and MATH 321 |
|----------------------|-----------------------|

| | |
|--------------------------------|---|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Compulsory |
| Course Coordinator | Meltem Özgül |
| Instructors | Meltem Özgül |
| Assistants | |
| Goals | To teach as much about rings and fields as one can in a first course to constitute a firm foundation for more specialized work and to provide valuable experience for any further axiomatic study of mathematics. |
| Content | Rings. Integral domains. Fermat's and Euler's theorems. Quotient field of an integral domain. Rings of polynomials. Factorization of polynomials over a field. Noncommutative rings. Ring homomorphisms and factor rings. Prime and maximal ideals. Unique factorization domains. Field extensions. Algebraic extensions. Geometric constructions. Finite fields. |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|--|---------------------------|------------------|--------------------|
| 1) Applies Fermat's and Euler's theorems | 1,2,4 | 1,2 | A |
| 2) Find maximal and prime ideals in a ring | 1,2,4,7 | 1,2 | A |
| 3) Constructs the field of quotients of an integral domain | 1,2,4,7 | 1,2 | A |
| 4) Factorizes polynomials over rings | 1,2,3,4,7,9 | 1,2 | A |
| 5) Finds ring homomorphisms | 1,2,4,7 | 1,2 | A |
| 6) Determines algebraic and transcendental elements over a field | 1,2,4,7,9 | 1,2 | A |

| | |
|----------------------------|-------------------------------------|
| Teaching Methods: | 1: Lecture, 2: Problem Solving |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|-------------------------------|-----------------|
| Week | Topics | Study Materials |
| 1 | Rings and fields | Textbook |
| 2 | Integral domains | Textbook |
| 3 | Fermat's and Euler's theorems | Textbook |

| | | |
|----|--|----------|
| 4 | The field of quotients of an integral domain | Textbook |
| 5 | Rings of polynomials | Textbook |
| 6 | Factorization of polynomials over a field | Textbook |
| 7 | Noncommutative examples | Textbook |
| 8 | Ordered rings and fields | Textbook |
| 9 | Homomorphisms and factor rings | Textbook |
| 10 | Prime and maximal ideals | Textbook |
| 11 | Introduction to Extension fields | Textbook |
| 12 | Algebraic extensions | Textbook |
| 13 | Geometric constructions | Textbook |
| 14 | Finite fields | Textbook |

RECOMMENDED SOURCES

| | |
|-----------------------------|--|
| Textbook | A First Course in Abstract Algebra, J. Fraleigh. |
| Additional Resources | |

MATERIAL SHARING

| | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

ASSESSMENT

| IN-TERM STUDIES | NUMBER | PERCENTAGE |
|---|--------|------------|
| Mid-terms | 2 | 100 |
| Quizzes | | |
| Assignments | | |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 40 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 60 |
| Total | | 100 |

COURSE CATEGORY

Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

| | | | | | | |
|--------|---------------------------|--------------|---|---|---|---|
| N o | Program Learning Outcomes | Contribution | | | | |
| | | 1 | 2 | 3 | 4 | 5 |

| | | | | | | |
|---|--|--|---|---|--|---|
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | x | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | x |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | x |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | x |
| 5 | Consciousness of professional ethics and responsibility | | | | | x |
| 6 | Ability to communicate actively | | x | | | |
| 7 | Ability of self-development in fields of interest | | | | | x |
| 8 | Ability to learn, choose and use necessary information technologies | | | x | | |
| 9 | Lifelong education | | | | | x |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|--|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 4 | 56 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 4 | 56 |
| Mid-terms (Including self study) | 2 | 15 | 30 |
| Quizzes | - | - | - |
| Assignments | - | - | - |
| Final examination (Including self study) | 1 | 16 | 16 |
| Total Work Load | | | 158 |
| Total Work Load / 25 (h) | | | 6.32 |
| ECTS Credit of the Course | | | 6 |

| COURSE INFORMATION | | | | | |
|--------------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| ELEMENTARY NUMBER THEORY | MATH 325 | 1 | 2+2 | 3 | 6 |

| | |
|----------------------|--|
| Prerequisites | |
|----------------------|--|

| | |
|--------------------------------|--|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Elective |
| Course Coordinator | Erol Serbest |
| Instructors | Erol Serbest |
| Assistants | |
| Goals | To introduce the fundamental topics in elementary number theory. |
| Content | Integers, divisibility, prime numbers, congruences, Chinese remainder theorem, arithmetic functions, quadratic reciprocity law, quadratic fields, Pell's equation, further topics including equations over finite fields, zeta functions and Weil conjectures. |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|---|---------------------------|------------------|--------------------|
| 1) Knows the basic properties of divisibility, prime numbers and the fundamental theorem of arithmetic. | 2,4 | 1 | A,B |
| 2) Using Euclidean algorithm, computes the greatest common divisor of integers and the least common multiple of integers. | 2,4,7 | 1 | A,B |
| 3) Solves congruence equations including systems of congruence equations by applying Chinese remainder theorem. | 1,2,4,7,9 | 1 | A,B |
| 4) Knows the basic properties of Euler's Phi-function, and arithmetic functions, applies Mobius inversion formula. | 1,2,3,4,7,9 | 1 | A,B |
| 5) Applies Gauss' quadratic reciprocity law. | 1,2,3,4,7,9 | 1 | A,B |
| 6) Knows the elementary theory of equations over finite fields and the statements of Weil conjectures. | 1,2,3,4,7,9 | 1 | A,B |

| | |
|----------------------------|-------------------------------------|
| Teaching Methods: | 1: Lecture, 2: Problem Solving |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|--|-----------------|
| Week | Topics | Study Materials |
| 1 | Divisibility, the greatest common divisor and the least common multiple, primes, unique factorization and the fundamental theorem of arithmetic. | |
| 2 | Congruences, Fermat's Little Theorem, Euler's Formula. | |
| 3 | Euler's Phi Function and the Chinese Remainder Theorem. | |

| | | |
|----|---|--|
| 4 | Counting Primes. Euler's Phi Function and Sums of Divisors. | |
| 5 | Arithmetical Functions, Mobius inversion formula. | |
| 6 | The structure of the unit group of \mathbf{Z}_n . | |
| 7 | Gauss' Quadratic Reciprocity. | |
| 8 | Arithmetic of quadratic number fields | |
| 9 | Pell's equation | |
| 10 | Quadratic Gauss sums | |
| 11 | Finite fields. | |
| 12 | Gauss and Jacobi sums | |
| 13 | Equations over finite fields. | |
| 14 | The zeta function and Weil conjectures. | |

RECOMMENDED SOURCES

| | |
|-----------------------------|---|
| Textbook | A Classical Introduction to Modern Number Theory, K. Ireland, M. Rosen, Graduate Texts in Math., Springer-Verlag. |
| Additional Resources | |

MATERIAL SHARING

| | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

ASSESSMENT

| IN-TERM STUDIES | NUMBER | PERCENTAGE |
|---|--------|------------|
| Mid-terms | | |
| Quizzes | | |
| Assignments | 7 | 100 |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 40 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 60 |
| Total | | 100 |

| | |
|------------------------|--------------------------|
| COURSE CATEGORY | Expertise/ Field Courses |
|------------------------|--------------------------|

COURSE'S CONTRIBUTION TO PROGRAM

| N o | Program Learning Outcomes | Contribution | | | | |
|--------|---------------------------|--------------|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |

| | | | | | | |
|---|--|--|---|---|--|---|
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | x | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | x |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | x |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | x |
| 5 | Consciousness of professional ethics and responsibility | | | | | x |
| 6 | Ability to communicate actively | | | x | | |
| 7 | Ability of self-development in fields of interest | | | | | x |
| 8 | Ability to learn, choose and use necessary information technologies | | x | | | |
| 9 | Lifelong education | | | | | x |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|--|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 4 | 56 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 3 | 42 |
| Mid-terms (Including self study) | | | |
| Quizzes | | | |
| Assignments | 7 | 5 | 35 |
| Final examination (Including self study) | 1 | 14 | 14 |
| Total Work Load | | | 148 |
| Total Work Load / 25 (h) | | | 5,92 |
| ECTS Credit of the Course | | | 6 |

| COURSE INFORMATION | | | | | |
|--------------------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| PARTIAL DIFFERENTIAL EQUATIONS | MATH 343 | 2 | 2+2 | 3 | 6 |

| | |
|----------------------|----------|
| Prerequisites | MATH 245 |
|----------------------|----------|

| | |
|--------------------------------|--|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Compulsory |
| Course Coordinator | Mustafa Polat |
| Instructors | Mustafa Polat |
| Assistants | |
| Goals | To give the students the formation of Partial Differential Equations, classifications and their solutions at the beginning level. |
| Content | First order equations; linear, quasilinear and nonlinear equations. Classification of second order linear partial differential equations, canonical forms, Cauchy problem. The Cauchy problem for the wave equation. Dirichlet and Neumann problems for the Laplace equation, maximum principle. Heat equation on the strip. |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|--|---------------------------|------------------|--------------------|
| 1) Understands the derivation of PDE and modelling | 1,2,4,5 | 1, 2 | A, B |
| 2) Knows the nonlinear equations, their properties and the solution techniques | 2, 3, 8 | 1, 2 | A, B |
| 3) Has a general information on higher order equations and on Cauchy problem | 3, 4, 6 | 1, 2 | A, B |
| 4) Knows the properties of wave equation and the solution techniques of initial value problems | 3, 4, 9 | 1, 2 | A, B |
| 5) Knows the properties of Laplace equation and the solution techniques of boundary value problems | 3, 4, 7, 9 | 1, 2 | A, B |
| 6) Knows the properties of heat equation and the solution techniques of initial value problems | 3, 4, 7, 9 | 1, 2 | A, B |

| | |
|----------------------------|-------------------------------------|
| Teaching Methods: | 1: Lecture, 2: Problem Solving |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|---|----------------------------------|
| Week | Topics | Study Materials |
| 1 | Introduction, First-order DE, | Relevant topics in the text book |
| 2 | Introduction, First-order DE, | Relevant topics in the text book |
| 3 | First-order nonlinear DE, Compatible systems Charpit's method | Relevant topics in the text book |
| 4 | First-order nonlinear DE, Compatible systems Charpit's method | Relevant topics in the text book |

| | | |
|----|---|----------------------------------|
| 5 | Linear second-order equations; constant coefficient and factorable operators, particular solutions. | Relevant topics in the text book |
| 6 | Linear second-order equations; constant coefficient and factorable operators, particular solutions. | Relevant topics in the text book |
| 7 | Normal forms; hyperbolic, parabolic, elliptic cases; Cauchy problem. | Relevant topics in the text book |
| 8 | Normal forms; hyperbolic, parabolic, elliptic cases; Cauchy problem. | Relevant topics in the text book |
| 9 | Elliptic equations | Relevant topics in the text book |
| 10 | Elliptic equations | Relevant topics in the text book |
| 11 | Hyperbolic equations | Relevant topics in the text book |
| 12 | Hyperbolic equations | Relevant topics in the text book |
| 13 | Parabolic equations | Relevant topics in the text book |
| 14 | Parabolic equations | Relevant topics in the text book |

| RECOMMENDED SOURCES | |
|-----------------------------|---|
| Textbook | 1. An introduction to PDE and BVP, by Rene Denneweyer, McGraw Hill. 2. Elements of PDE, by Ian Sneddon, McGraw Hill. |
| Additional Resources | |

| MATERIAL SHARING | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

| ASSESSMENT | | |
|---|--------|------------|
| IN-TERM STUDIES | NUMBER | PERCENTAGE |
| Mid-terms | 2 | 100 |
| Quizzes | 0 | 0 |
| Assignments | 0 | 0 |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 40 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 60 |
| Total | | 100 |

| | |
|------------------------|-------------------------|
| COURSE CATEGORY | Expertise/Field Courses |
|------------------------|-------------------------|

| COURSE'S CONTRIBUTION TO PROGRAM | | | | | | |
|----------------------------------|---------------------------|--------------|---|---|---|---|
| No | Program Learning Outcomes | Contribution | | | | |
| | | 1 | 2 | 3 | 4 | 5 |
| | | | | | | |

| | | | | | | |
|---|--|---|--|---|---|---|
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | x | | | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | x |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | x | |
| 4 | Ability to define, formulate and solve mathematical problems | | | | x | |
| 5 | Consciousness of professional ethics and responsibility | | | | x | |
| 6 | Ability to communicate actively | x | | | | |
| 7 | Ability of self-development in fields of interest | | | | x | |
| 8 | Ability to learn, choose and use necessary information technologies | x | | | | |
| 9 | Lifelong education | | | x | | |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|--|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 4 | 56 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 4 | 56 |
| Mid-terms (Including self study) | 2 | 9 | 18 |
| Quizzes | 0 | | 00 |
| Assignments | - | - | - |
| Final examination (Including self study) | 1 | 20 | 20 |
| Total Work Load | | | 150 |
| Total Work Load / 25 (h) | | | 6 |
| ECTS Credit of the Course | | | 6 |

| COURSE INFORMATION | | | | | |
|--------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| COMPLEX CALCULUS | MATH 357 | 1 | 3 + 2 | 4 | 7 |

| | |
|----------------------|----------|
| Prerequisites | MATH 132 |
|----------------------|----------|

| | |
|--------------------------------|---|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Compulsory |
| Course Coordinator | Melike İşim Efe |
| Instructors | Melike İşim Efe |
| Assistants | Sefer Furkan Şahin |
| Goals | Getting know about complex numbers, complex variable functions, complex sequences and series, being able to do calculations with them. Information about contour integral and residue and getting know how to evaluate some integral with such techniques. |
| Content | Algebra of complex numbers. Sequences and series with complex terms. Power series and convergence radius. Some elementary functions and mappings. Riemann surfaces. Regular functions and Cauchy - Riemann equations. Harmonic functions. Contour integrals and Cauchy theorem. Cauchy's integral formula and some of its direct results. Residue concept. Taylor and Laurent expansions. |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|--|---------------------------|------------------|--------------------|
| 1) Can do calculations with functions of complex variables and sequences of complex numbers. | 1,2 | 1,2,3 | A,B |
| 2) Can use Cauchy Riemann equations | 1,2,4 | 1,2,3 | A,B |
| 3) Knows the concepts of analytic functions and harmonic functions | 1,2,4 | 1,2,3 | A,B |
| 4) Knows how to evaluate contour integrals and knows Cauchy Integral Theorem. | 1,2,3,4,7,9 | 1,2,3 | A,B |
| 5) Can evaluate integrals using residues. | 2,3,4,7,9 | 1,2,3 | A,B |

| | |
|----------------------------|--|
| Teaching Methods: | 1: Lecture, 2: Problem Solving, 3: Question-Answer |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|--|--------------------------|
| Week | Topics | Study Materials |
| 1 | Introduction, Definitions and importance of the subject, Complex numbers and complex plane. Algebraic operations | Course Book 1.1, 1.2,1.3 |
| 2 | Complex Exponential, powers, roots | 1.4,1.5,1.6 |
| 3 | Functions, Limit and continuity, analyticity | 2.1,2.2,2.3 |
| 4 | Derivative, Cauchy Riemann equations, harmonic functions | 2.4,2.5 |

| | | |
|----|---|-------------|
| 5 | Elementary Functions and Inverses | 3.1,3.2,3.3 |
| 6 | Sequences, Series. | 5.1,5.2,5.3 |
| 7 | Introduction to complex Integration, contours | 4.1,4.2 |
| 8 | Cauchy theorem, Cauchy's formula and its consequences | 4.3,4.4,4.5 |
| 9 | Midterm | |
| 10 | Integral Theorems, Laurent Series | 4.5,5.5 |
| 11 | Singularities, Residue Theorem | 5.6,5.7,6.1 |
| 12 | Residue theorem | 6.1 |
| 13 | Trigonometric Integrals | 6.2 |
| 14 | Improper Integrals | 6.3,6.4 |

RECOMMENDED SOURCES

| | |
|-----------------------------|--|
| Textbook | Fundamentals of Complex Analysis with Applications to Engineering, Science, and Mathematics (3rd Edition), E. Saff, A. Snider, Pearson Education, 2003. |
| Additional Resources | Complex variables and applications, R.V. Churchill and J.W. Brown, McGraw-Hill, 1996 Complex analysis, J. Back and D.J. Newman, Springer-Verlag, 1991 |

MATERIAL SHARING

| | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

ASSESSMENT

| IN-TERM STUDIES | NUMBER | PERCENTAGE |
|---|--------|------------|
| Mid-terms | 1 | 100 |
| Quizzes | | |
| Assignments | | |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 50 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 50 |
| Total | | 100 |

| | |
|------------------------|-------------------------|
| COURSE CATEGORY | Expertise/Field Courses |
|------------------------|-------------------------|

COURSE'S CONTRIBUTION TO PROGRAM

| No | Program Learning Outcomes | Contribution | | | | |
|----|---|--------------|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, | | | | | X |

| | | | | | | |
|---|--|---|---|---|---|---|
| | derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | X |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | X | | |
| 4 | Ability to define, formulate and solve mathematical problems | | | | X | |
| 5 | Consciousness of professional ethics and responsibility | | | X | | |
| 6 | Ability to communicate actively | | X | | | |
| 7 | Ability of self-development in fields of interest | | | X | | |
| 8 | Ability to learn, choose and use necessary information technologies | X | | | | |
| 9 | Lifelong education | | X | | | |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|---|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 5 | 70 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 6 | 84 |
| Mid-terms (Including self study) | 1 | 10 | 10 |
| Quizzes | | | |
| Assignments | | | |
| Final examination (Including self study) | 1 | 11 | 11 |
| Total Work Load | | | 175 |
| Total Work Load / 25 (h) | | | 7 |
| ECTS Credit of the Course | | | 7 |

| COURSE INFORMATION | | | | | |
|--------------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| MATHEMATICAL PROBABILITY | MATH 362 | 5 | 2+2 | 3 | 6 |

| | |
|----------------------|--|
| Prerequisites | |
|----------------------|--|

| | |
|--------------------------------|---|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Compulsory |
| Course Coordinator | Gülce Cüran Ulupınar |
| Instructors | Gülce Cüran Ulupınar |
| Assistants | |
| Goals | To prepare students for a career in actuarial science, graduate studies in financial engineering/mathematics and high school teachers to teach probability and statistics in high schools. |
| Content | Counting. Elements of probability theory. Random variables. Conditional probability. Bayes' rule. Probability distributions and densities. Uniform, Bernoulli, Binomial, Geometric, Hypergeometric, Poisson and Gaussian (normal) distributions. Uniform density. Expectations and moments. |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|--|---------------------------|------------------|--------------------|
| 1) Apply the counting principles | 2,3,4 | 1,2 | A,B |
| 2) Compute probabilities | 1,2,3,4 | 1,2 | A,B |
| 3) Know and apply Bayes' rule | 2,3,4 | 1,2 | A,B |
| 4) Know discrete probability functions | 1,2,3,4 | 1,2 | A,B |
| 5) Know continuous probability functions | 2,3,4 | 1,2 | A,B |
| 6) Know and apply normal distribution | 1,2,3,4 | 1,2 | A,B |

| | |
|----------------------------|-------------------------------------|
| Teaching Methods: | 1: Lecture, 2: Problem Solving |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|--|-----------------|
| Week | Topics | Study Materials |
| 1 | Random Experiments, Sample Spaces, Events Counting Sample Points, Probability of an Event | |
| 2 | Counting Principles, Permutations and Combinations | |
| 3 | Conditional Probability and the Independence of Events. The Law of Total Probability and Bayes' Rule | |
| 4 | Definiton of Discete Random variable. The Probability Distribution of a Discrete Random Variable. Expected value and Variance of a Random Variable | |
| 5 | The Binomial, Geometric, Negative Binomial and Hypergeometric and Poisson Probability Distributions | |

| | | |
|----|---|--|
| 6 | The Poisson Probability Distribution. Moments and Moment-Generating Functions for discrete distributions. | |
| 7 | Definition of Continuous Random Variable. The Probability Distribution of a Continuous Random Variable. Expected Values for a Continuous random Variable. | |
| 8 | The Uniform, Normal and Exponential Probability Functions. | |
| 9 | The Gamma, Weibull and Beta Probability Distributions. Moments and Moment-Generating Functions for continuous distributions. | |
| 10 | Sampling Distributions Related to the Normal Distribution. The Central Limit Theorem. The Normal Approximations to the Binomial. | |
| 11 | Bivariate and Multivariate Probability Distributions. Marginal and Conditional Probability Distributions | |
| 12 | Independent Random Variables. The Covariance of Two Random Variables. The Expected Value and Variance of Linear Functions of Random Variables | |
| 13 | Finding the Probability Distribution of a Function of Random Variables. Multivariate Transformations | |
| 14 | Tchebysheff's Inequality. Weak Law of Large Numbers. Order Statistics. | |

RECOMMENDED SOURCES

| | |
|-----------------------------|--|
| Textbook | Mathematical Statistics with Applicatins. Wackerly, Mendenhall, Scheaffer. Brooks/Cole |
| Additional Resources | |

MATERIAL SHARING

| | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

ASSESSMENT

| IN-TERM STUDIES | NUMBER | PERCENTAGE |
|---|--------|------------|
| Mid-terms | 2 | 100 |
| Quizzes | | |
| Assignments | | |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 40 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 60 |
| Total | | 100 |

COURSE CATEGORY

| | |
|--|--|
| | |
|--|--|

COURSE'S CONTRIBUTION TO PROGRAM

| No | Program Learning Outcomes | Contribution | | | | |
|----|--|--------------|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential | | | | x | |

| | | | | | | | |
|---|---|--|---|---|---|---|--|
| | equations and geometry) | | | | | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | x | |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | x | | | |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | x | |
| 5 | Consciousness of professional ethics and responsibility | | x | | | | |
| 6 | Ability to communicate actively | | | x | | | |
| 7 | Ability of self-development in fields of interest | | | x | | | |
| 8 | Ability to learn, choose and use necessary information technologies | | | x | | | |
| 9 | Lifelong education | | | | x | | |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|--|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 4 | 56 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 3 | 42 |
| Mid-terms (Including self study) | 2 | 14 | 28 |
| Quizzes | - | - | - |
| Assignments | - | - | - |
| Final examination (Including self study) | 1 | 24 | 24 |
| Total Work Load | | | 150 |
| Total Work Load / 25 (h) | | | 6 |
| ECTS Credit of the Course | | | 6 |

| COURSE INFORMATION | | | | | |
|-------------------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| METRIC AND TOPOLOGICAL SPACES | MATH 439 | 1 | 2+2 | 3 | 7 |

| | |
|----------------------|----------|
| Prerequisites | MATH 252 |
|----------------------|----------|

| | |
|--------------------------------|--|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Compulsory |
| Course Coordinator | Bariş Efe |
| Instructors | Bariş Efe |
| Assistants | |
| Goals | To develop the necessary background for modern analysis courses to follow |
| Content | Basic concepts about topological spaces and metric spaces. Complete metric spaces, Baire's theorem, Contracting mapping theorem and its applications. Compact spaces, Arzela-Ascoli Theorem Seperability, second countability, Urysohn's lemma and the Tietze extension theorem, Connected spaces, Weierstrass approximation theorem |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|---|---------------------------|------------------|--------------------|
| 1) Learns basic concepts of topological spaces with emphasis on metric spaces | 1,2,3,4 | 1,2 | A |
| 2) Learns Cauchy sequences and completeness | 1,2,3,4 | 2,2 | A |
| 3) Learns the concept of compact space | 1,2,3,4 | 1,2 | A |
| 4) Learns Baier's category | 1,2,3,4 | 1,2 | A |
| 5) Learns Ascoli-Arzela theorem, Weierstrass approximation | 1,2,3,4 | 1,2 | A |
| 6) Acquires the skill of applying these concepts | 1,2,3,4 | 1,2 | A |

| | |
|----------------------------|-------------------------------------|
| Teaching Methods: | 1: Lecture, 2: Problem Solving |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|--|-----------------|
| Week | Topics | Study Materials |
| 1 | Basic concepts about metric spaces and examples | |
| 2 | Open, closed sets, topology and convergence | |
| 3 | Cauchy sequences and complete metric spaces, Baire's theorem | |
| 4 | Continuity and uniformly continuity, spaces of continuous functions, Euclidean space | |
| 5 | Contracting mapping theorem and its applications | |

| | | |
|----|--|--|
| 6 | The definition of topological spaces and some examples , elementary concepts, Open bases and open subbases | |
| 7 | Compact spaces, Products of spaces,Tychonoff's theorem and locally compact spaces | |
| 8 | Compactness for metric spaces | |
| 9 | Arzela-Ascoli Theorem | |
| 10 | Seperability, second countability | |
| 11 | Hausdorff spaces, Completely regular spaces and normal spaces | |
| 12 | Urysohn's lemma and the Tietze extension theorem | |
| 13 | Connected spaces, The components of a space, Totally disconnected spaces, Locally connected spaces | |
| 14 | The Weierstrass approximation theorem ,The Stone-Weierstrass theorems | |

RECOMMENDED SOURCES

| | |
|-----------------------------|--|
| Textbook | 1. S. Kumaresan, Topology of Metric Spaces 2. George F. Simmons, Topology and Modern Analysis 3. W A Sutherland, Introduction to Metric and Topological Spaces 4. E T Copson, Metric Spaces |
| Additional Resources | |

MATERIAL SHARING

| | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

ASSESSMENT

| IN-TERM STUDIES | NUMBER | PERCENTAGE |
|---|--------|------------|
| Mid-terms | 2 | 100 |
| Quizzes | - | 0 |
| Assignments | - | 0 |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 60 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 40 |
| Total | | 100 |

COURSE CATEGORY

Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

| N o | Program Learning Outcomes | Contribution | | | | |
|--------|--|--------------|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a | | | | | X |

| | | | | | | |
|---|---|---|--|---|--|---|
| | basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | X |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | X |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | X |
| 5 | Consciousness of professional ethics and responsibilty | | | X | | |
| 6 | Ability to communicate actively | | | X | | |
| 7 | Ability of self-development in fields of interest | | | | | X |
| 8 | Ability to learn, choose and use necessary information technologies | X | | | | |
| 9 | Lifelong education | | | X | | |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|---|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 4 | 56 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 5 | 70 |
| Mid-terms (Including self study) | 2 | 15 | 30 |
| Quizzes | - | | |
| Assignments | - | | |
| Final examination (Including self study) | 1 | 19 | 175 |
| Total Work Load | | | 175 |
| Total Work Load / 25 (h) | | | 7 |
| ECTS Credit of the Course | | | 7 |

| COURSE INFORMATION | | | | | |
|---------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| FUNCTIONAL ANALYSIS | MATH 456 | 2 | 2+2 | 3 | 9 |

| | |
|----------------------|----------|
| Prerequisites | MATH 439 |
|----------------------|----------|

| | |
|--------------------------------|---|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Compulsory |
| Course Coordinator | Mehmet Akif Erdal |
| Instructors | Mehmet Akif Erdal |
| Assistants | |
| Goals | Functional analysis, is a subject that has many applications. We can count the theory of differential equations and applications in physics among them. |
| Content | Topological dual. Compact, closed and adjoint operators. Inner product spaces. Orthonormal sets and Fourier series. Linear operators on Hilbert spaces. Resolvent and spectrum of an operator. Spectra of continuous and compact linear operators. Spectral analysis on Hilbert spaces. Derivations of operators. |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|---|---------------------------|------------------|--------------------|
| 1) Learns inner product and Hilbert Spaces | 1,2,4,7 | 1,2 | A |
| 2) Computes the Fourier Coefficients with respect to an orthonormal basis | 1,2,4 | 1,2 | A |
| 3) Learns dual spaces and to utilize of Hahn-Banach theorem | 1,2,3,4,7 | 1,2 | A |
| 4) Learns Riesz Representation Theorem | 1,2,3,4,7,9 | 1,2 | A |
| 5) Learns the spectrum of linear operators | 1,2,3,4,7,9 | 1,2 | A |
| 6) Learns compact operators and how to apply them | 1,2,3,4,7,9 | 1,2 | A |

| | |
|----------------------------|-------------------------------------|
| Teaching Methods: | 1: Lecture, 2: Problem Solving |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|--|-----------------|
| Week | Topics | Study Materials |
| 1 | Inner Product Spaces, Hilbert Spaces, Orthogonality | |
| 2 | Orthonormal Bases in Infinite Dimensions, Fourier Series | |
| 3 | Continuous Linear Transformations | |
| 4 | Hahn-Banach Theorem | |
| 5 | Dual Spaces | |

| | | |
|----|--|--|
| 6 | The Second Dual, Reflexive Spaces and Dual Operators | |
| 7 | Projections and Complementary Subspaces | |
| 8 | Linear Operators on Hilbert Spaces, Riesz Theorem | |
| 9 | The Adjoint of an Operator | |
| 10 | Normal, Self-adjoint and Unitary Operators | |
| 11 | The Spectrum of an Operator | |
| 12 | Positive Operators and Projections | |
| 13 | Compact Operators | |
| 14 | Spectral Theory of Compact Operators | |

| RECOMMENDED SOURCES | |
|-----------------------------|--|
| Textbook | Linear Functional Analysis, Bryan Rynne, M.A. Youngson |
| Additional Resources | |

| MATERIAL SHARING | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

| ASSESSMENT | | |
|---|--------|------------|
| IN-TERM STUDIES | NUMBER | PERCENTAGE |
| Mid-terms | 2 | 100 |
| Quizzes | 0 | 0 |
| Assignments | 0 | 0 |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 60 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 40 |
| Total | | 100 |

| | |
|------------------------|-------------------------|
| COURSE CATEGORY | Expertise/Field Courses |
|------------------------|-------------------------|

| COURSE'S CONTRIBUTION TO PROGRAM | | | | | | |
|----------------------------------|--|--------------|---|---|---|---|
| N o | Program Learning Outcomes | Contribution | | | | |
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | | | X |

| | | | | | | |
|---|---|---|--|---|--|---|
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | X |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | X |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | X |
| 5 | Consciousness of professional ethics and responsibility | | | X | | |
| 6 | Ability to communicate actively | | | X | | |
| 7 | Ability of self-development in fields of interest | | | | | X |
| 8 | Ability to learn, choose and use necessary information technologies | X | | | | |
| 9 | Lifelong education | | | X | | |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|---|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 4 | 56 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 7 | 98 |
| Mid-terms (Including self study) | 2 | 23 | 46 |
| Quizzes | - | | |
| Assignments | - | | |
| Final examination (Including self study) | 1 | 25 | 25 |
| Total Work Load | | | 225 |
| Total Work Load / 25 (h) | | | 9 |
| ECTS Credit of the Course | | | 9 |

| COURSE INFORMATION | | | | | |
|----------------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| SENIOR PROJECT AND SEMINAR | MATH 491 | 8 | 3 + 0 | 3 | 7 |

| | |
|----------------------|---------------------------|
| Prerequisites | Consent of the instructor |
|----------------------|---------------------------|

| | |
|--------------------------------|--|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Compulsory |
| Course Coordinator | All Faculty Members |
| Instructors | All Faculty Members |
| Assistants | |
| Goals | Student's learning how to do research in a basic area, investigate a problem. Writing in suitable format, submitting and presenting the study. |
| Content | Presentation of project in a seminar and project reports written to publication standards. |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|---|---------------------------|------------------|--------------------|
| 1) Learns how to do literature search. | 3,6,7,8,9 | 1, 2 | D |
| 2) Can investigate a problem in an area. | 3,4,7 | 1, 2 | D |
| 3) Can learn new concepts. | 2,7 | 1,2 | D |
| 4) Can interpret what he/she has learned. | 3,7 | 2 | D |
| 5) Can prepare report. | 5,6,8 | 2 | D |
| 6) Can present the study. | 6,8 | 1,2 | D |

| | |
|----------------------------|-----------------------------|
| Teaching Methods: | 1: Lecture, 7: Face to face |
| Assessment Methods: | D: Presentation |

| COURSE CONTENT | | |
|----------------|--|-----------------|
| Week | Topics | Study Materials |
| 1 | Meeting of the student and the instructor, talking about topics and determining options. | |
| 2 | Deciding on a subject. General introduction to the subject. | |
| 3 | Read, research and study. | |
| 4 | Read, research and study. | |
| 5 | Read, research and study. | |
| 6 | Read, research and study. | |

| | | |
|----|--|--|
| 7 | Study. | |
| 8 | Study. | |
| 9 | Discussion about the work and plan for the future. | |
| 10 | Study. | |
| 11 | Discussion about the results. | |
| 12 | Preparation of the report. | |
| 13 | Writing the report. | |
| 14 | Finish the report and preparation of the presentation. | |

| RECOMMENDED SOURCES | |
|-----------------------------|---------------------------------|
| Textbook | |
| Additional Resources | Advised resources by instructor |

| MATERIAL SHARING | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

| ASSESSMENT | | |
|---|--------|------------|
| IN-TERM STUDIES | NUMBER | PERCENTAGE |
| Mid-terms | | |
| Quizzes | | |
| Assignments | | |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | |
| Total | | 100 |

| | |
|------------------------|-------------------------|
| COURSE CATEGORY | Expertise/Field Courses |
|------------------------|-------------------------|

| COURSE'S CONTRIBUTION TO PROGRAM | | | | | | |
|----------------------------------|--|--------------|---|---|---|---|
| No | Program Learning Outcomes | Contribution | | | | |
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | | | X |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | X |

| | | | | | | |
|---|---|--|--|--|---|---|
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | X |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | X |
| 5 | Consciousness of professional ethics and responsibility | | | | | X |
| 6 | Ability to communicate actively | | | | | X |
| 7 | Ability of self-development in fields of interest | | | | X | |
| 8 | Ability to learn, choose and use necessary information technologies | | | | | X |
| 9 | Lifelong education | | | | | X |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|---|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 3 | 42 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 5 | 70 |
| Mid-terms (Including self study) | | | |
| Quizzes | 7 | 4 | 28 |
| Assignments | 1 | 35 | 35 |
| Final examination (Including self study) | | | 175 |
| Total Work Load | | | 7 |
| Total Work Load / 25 (h) | | | 7 |
| ECTS Credit of the Course | 14 | 3 | 42 |

| COURSE INFORMATION | | | | | |
|-----------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| CALCULUS ON MANIFOLDS | MATH 311 | 1-2 | 3+0 | 3 | 7 |

| | |
|----------------------|--|
| Prerequisites | |
|----------------------|--|

| | |
|--------------------------------|--|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Elective |
| Course Coordinator | Mehmet Akif Erdal |
| Instructors | Mehmet Akif Erdal |
| Assistants | |
| Goals | To teach the theory of exterior differential forms and integration on smooth manifolds. |
| Content | Functions on Euclidean spaces. Differentiation. Inverse and implicit function theorems. Integration. Partitions of unity. Sard's theorem. Multilinear functions, tensors, fields and differential forms. Poincare lemma. Chains and integration over chains. Stokes' theorem. Differentiable manifolds. Fields and forms on manifolds. Orientation and volume. Applications. |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|--|---------------------------|------------------|--------------------|
| 1) Knows the properties of exterior algebra of a finite dimensional real vector space. | 2,3 | 1,4 | A,B |
| 2) Knows Stokes' theorem for a manifold with boundary. | 2,3 | 1,4 | A,B |

| | |
|----------------------------|---|
| Teaching Methods: | 1: Lecture, 2: Problem Solving, 3: Question-answer, 4: Homework |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|--|-----------------|
| Week | Topics | Study Materials |
| 1 | Point-set topology in \mathbb{R}^n | Textbook |
| 2 | Point-set topology in \mathbb{R}^n (continued) | Textbook |
| 3 | Differentiation | Textbook |
| 4 | Differentiation (continued) | Textbook |
| 5 | Integration | Textbook |
| 6 | Integration (continued) | Textbook |
| 7 | Integration (continued) | Textbook |
| 8 | Integration on chains | Textbook |
| 9 | Integration on chains (continued) | Textbook |
| 10 | Integration on chains (continued) | Textbook |

| | | |
|----|--------------------------------------|----------|
| 11 | Integration on chains (continued) | Textbook |
| 12 | Integration on manifolds | Textbook |
| 13 | Integration on manifolds (continued) | Textbook |
| 14 | Integration on manifolds (continued) | Textbook |

| RECOMMENDED SOURCES | |
|-----------------------------|--------------------------------------|
| Textbook | Calculus on Manifolds, by M. Spivak. |
| Additional Resources | |

| MATERIAL SHARING | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

| ASSESSMENT | | |
|---|--------|------------|
| IN-TERM STUDIES | NUMBER | PERCENTAGE |
| Mid-terms | 2 | 100 |
| Quizzes | - | - |
| Assignments | 0 | 0 |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 40 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 60 |
| Total | | 100 |

| | |
|------------------------|-------------------------|
| COURSE CATEGORY | Expertise/Field Courses |
|------------------------|-------------------------|

| COURSE'S CONTRIBUTION TO PROGRAM | | | | | | |
|----------------------------------|--|--------------|---|---|---|---|
| No | Program Learning Outcomes | Contribution | | | | |
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | x | | | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | x | |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | x | |
| 4 | Ability to define, formulate and solve mathematical problems | | | | x | |
| 5 | Consciousness of professional ethics and responsibilty | | | | x | |
| 6 | Ability to communicate actively | x | | | | |

| | | | | | | |
|---|---|---|--|---|---|--|
| 7 | Ability of self-development in fields of interest | | | | x | |
| 8 | Ability to learn, choose and use necessary information technologies | x | | | | |
| 9 | Lifelong education | | | x | | |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|---|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 3 | 42 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 5 | 70 |
| Mid-terms (Including self study) | 2 | 15 | 30 |
| Quizzes | - | - | - |
| Assignments | - | - | - |
| Final examination (Including self study) | 1 | 28 | 28 |
| Total Work Load | | | 170 |
| Total Work Load / 25 (h) | | | 6,8 |
| ECTS Credit of the Course | | | 7 |

| COURSE INFORMATION | | | | | |
|--------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| FOURIER ANALYSIS | MATH 344 | 1-2 | 3 | 3 | 7 |

| | |
|----------------------|---|
| Prerequisites | - |
|----------------------|---|

| | |
|--------------------------------|---|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Elective |
| Course Coordinator | Mustafa Polat |
| Instructors | Mustafa Polat |
| Assistants | |
| Goals | To teach the basic principles of elementary Fourier analysis. |
| Content | Functional sequences and series. Convergence. Cauchy-Schwarz inequality. Fourier series and its convergence. Orthogonal polynomials. Fourier series with respect to an orthogonal system. Bessel's inequality. Generalizations with weight. Completeness of orthogonal systems. Parseval's identity. Fourier integrals. Fourier transformations. Applications to boundary value problems, |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|---|---------------------------|------------------|--------------------|
| 1) Knows how to compute Fourier series of a function. | 2,3 | 1,4 | A |
| 2) Knows the basic terminology and results of inner product spaces, Hilbert spaces, L^2 spaces. | 2,3 | 1,4 | A |
| 3) Knows how to compute Fourier transform of a function. | 2,3 | 1,4 | A |
| 4) Knows some applications of Fourier series and Fourier transform. | 2,3,4 | 1,4 | A |

| | |
|----------------------------|---|
| Teaching Methods: | 1: Lecture, 2: Problem Solving, 3: Question-answer, 4: Homework |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|--|-----------------|
| Week | Topics | Study Materials |
| 1 | Fourier Series | Textbook |
| 2 | Fourier Series (continued) | Textbook |
| 3 | Fourier Series (continued) | Textbook |
| 4 | Orthogonal Sets of Functions | Textbook |
| 5 | Orthogonal Sets of Functions (continued) | Textbook |
| 6 | Orthogonal Sets of Functions (continued) | Textbook |
| 7 | Orthogonal Polynomials | Textbook |

| | | |
|----|--|----------|
| 8 | Orthogonal Polynomials (continued) | Textbook |
| 9 | Orthogonal Polynomials (continued) | Textbook |
| 10 | The Fourier Transform | Textbook |
| 11 | The Fourier Transform (continued) | Textbook |
| 12 | The Fourier Transform (continued) | Textbook |
| 13 | Some Boundary Value Problems | Textbook |
| 14 | Some Boundary Value Problems (continued) | Textbook |

RECOMMENDED SOURCES

| | |
|-----------------------------|---|
| Textbook | Fourier Analysis and Its Applications, by G. B. Folland |
| Additional Resources | Fourier Series and Boundary Value Problems, by J. W. Brown and R. V. Churchill. |

MATERIAL SHARING

| | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

ASSESSMENT

| IN-TERM STUDIES | NUMBER | PERCENTAGE |
|---|--------|------------|
| Mid-terms | 2 | 100 |
| Quizzes | - | - |
| Assignments | - | - |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 40 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 60 |
| Total | | 100 |

| | |
|------------------------|-------------------------|
| COURSE CATEGORY | Expertise/Field Courses |
|------------------------|-------------------------|

COURSE'S CONTRIBUTION TO PROGRAM

| No | Program Learning Outcomes | Contribution | | | | |
|----|--|--------------|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | x | | | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | x | |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | x | |

| | | | | | | |
|---|---|---|--|---|---|--|
| 4 | Ability to define, formulate and solve mathematical problems | | | | x | |
| 5 | Consciousness of professional ethics and responsibility | | | | x | |
| 6 | Ability to communicate actively | x | | | | |
| 7 | Ability of self-development in fields of interest | | | | x | |
| 8 | Ability to learn, choose and use necessary information technologies | x | | | | |
| 9 | Lifelong education | | | x | | |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|---|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 3 | 42 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 5 | 70 |
| Mid-terms (Including self study) | 2 | 14 | 28 |
| Quizzes | - | - | - |
| Assignments | 7 | 3 | 21 |
| Final examination (Including self study) | 1 | 14 | 14 |
| Total Work Load | | | 175 |
| Total Work Load / 25 (h) | | | 7 |
| ECTS Credit of the Course | | | 7 |

| COURSE INFORMATION | | | | | |
|---|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| QUALITATIVE THEORY OF ORDINARY DIFFERENTIAL EQUATIONS | MATH 346 | 2 | 3 + 0 | 3 | 7 |

| | |
|----------------------|----------------------|
| Prerequisites | MATH 241 or MATH 245 |
|----------------------|----------------------|

| | |
|--------------------------------|---|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Elective |
| Course Coordinator | Mustafa Polat |
| Instructors | Mustafa Polat |
| Assistants | |
| Goals | Main goals are to provide the properties of the systems of linear and nonlinear equations, the development of their general solutions, the linearization of nonlinear systems, adjoint equations, Green's functions and Sturm-Liouville equations. |
| Content | Self-adjoint second order equations, general theorems. Green's function. Spectral theory. Sturm-Liouville systems, Liouville normal forms. Orthogonal functions and their completeness. Stability of first order systems of equations. Autonomous systems, matrix exponential functions and general solutions of systems of equations with constant coefficients Autonomous, gradient and Hamiltonian systems, Lyapunov functions.. Linearization. Periodic solutions, Poincare-Bendixon theorem. |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|---|---------------------------|------------------|--------------------|
| 1) Knows the stability of systems of equations | 1, 2,7,8 | 1, 2 | A, B |
| 2) Knows matrix exponential functions | 2,3 | 1, 2 | A, B |
| 3) Knows the general solutions of systems of equations with constant coefficients | 2,4 | 1, 2 | A, B |
| 4) Has some information on Hamilton systems and Lyapunov functions | 3, 5, 6 | 1, 2 | A, B |
| 5) Uses Poincare-Bendixon theorem | 3, 4, 8, 9 | 1, 2 | A, B |
| 6) Knows Green's functions and orthogonal functions | 3, 4, 5, 8, 9 | 1, 2 | A, B |

| | |
|----------------------------|-------------------------------------|
| Teaching Methods: | 1: Lecture, 2: Problem Solving |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|-------------------------------------|-----------------|
| Week | Topics | Study Materials |
| 1 | Main results, linear phase diagram | 1.1, 1.2, 1.3 |
| 2 | Bifurcation, linear systems | 1.4, 2.1 |
| 3 | Linear systems, vectorial equations | 2.1, 2.2 |

| | | |
|----|---|----------|
| 4 | Matrix exponential systems, continuous systems | 2.3, 3.1 |
| 5 | Autonomous systems, plane phase diagrams | 3.1, 3.2 |
| 6 | Plane phase diagrams for linear systems | 3.3 |
| 7 | Plane phase diagrams for linear systems, stability of nonlinear systems | 3.3, 3.4 |
| 8 | Stability of nonlinear systems | 3.4 |
| 9 | Midterm | 3.5 |
| 10 | Linearizations of nonlinear systems | 3.5 |
| 11 | Self-adjoint second order equations | 5.1, 5.2 |
| 12 | Sturm-Liouville problems | 5.4 |
| 13 | Green's functions | 5.9 |
| 14 | Green's functions | 5.9 |

RECOMMENDED SOURCES

| | |
|-----------------------------|---|
| Textbook | Theory of Differential Equations Kelley-Peterson, Pearson |
| Additional Resources | |

MATERIAL SHARING

| | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

ASSESSMENT

| IN-TERM STUDIES | NUMBER | PERCENTAGE |
|---|--------|------------|
| Mid-terms | 2 | 100 |
| Quizzes | | |
| Assignments | | |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 50 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 50 |
| Total | | 100 |

| | |
|------------------------|-------------------------|
| COURSE CATEGORY | Expertise/Field Courses |
|------------------------|-------------------------|

COURSE'S CONTRIBUTION TO PROGRAM

| | | | | | | |
|--------|---------------------------|--------------|---|---|---|---|
| N o | Program Learning Outcomes | Contribution | | | | |
| | | 1 | 2 | 3 | 4 | 5 |

| | | | | | | |
|---|--|--|---|---|---|---|
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | | | x |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | x | |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | x | | |
| 4 | Ability to define, formulate and solve mathematical problems | | x | | | |
| 5 | Consciousness of professional ethics and responsibility | | | | x | |
| 6 | Ability to communicate actively | | | | x | |
| 7 | Ability of self-development in fields of interest | | | x | | |
| 8 | Ability to learn, choose and use necessary information technologies | | | x | | |
| 9 | Lifelong education | | | | x | |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|--|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 3 | 42 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 6 | 84 |
| Mid-terms (Including self study) | 2 | 14 | 28 |
| Quizzes | - | - | - |
| Assignments | - | - | - |
| Final examination (Including self study) | 1 | 20 | 20 |
| Total Work Load | | | 174 |
| Total Work Load / 25 (h) | | | 6,99 |
| ECTS Credit of the Course | | | 7 |

| COURSE INFORMATION | | | | | |
|------------------------|---------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| MATHEMATICAL MODELLING | MATH348 | 1-2 | 3 + 0 | 3 | 7 |

| | |
|----------------------|--|
| Prerequisites | |
|----------------------|--|

| | |
|--------------------------------|---|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Mathematics Elective |
| Course Coordinator | İlknur Kuşbeyzi Aybar |
| Instructors | İlknur Kuşbeyzi Aybar |
| Assistants | |
| Goals | Determining suitable mathematical models for problems in some areas. advancing closest solutions to the models and evaluating results |
| Content | Modeling of systems with one independent, one dependent variable and with several variables, Modelling of systems with difference equations, Applications to some examples; population, finance, epidemic problems. . Analytical and numerical solutions of the model equations. Linear, Nonlinear, Periodic Models, Continuous modelling with differential equations, Applications to some problems. |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|---|---------------------------|------------------|--------------------|
| 1) Determines variables and parameters of problem. | 1,4 | 1,2,4 | A |
| 2) Analyzes the problem which is modelled. | 2,3,4 | 1,2,4 | A |
| 3) Associates the solution of the model with the solution of the problem. | 2,3,4 | 1,2,4 | A |
| 4) Writes a discrete model equation of a problem. | 1,4 | 1,2,4 | A |
| 5) Writes a continuous model equation of a problem. | 1,4 | 1,2,4 | A |
| 6) Interests in modelling of some industrial, financial, social, health problems. | 2,3,4,6,7,9 | 1,2,4 | A |

| | |
|----------------------------|--|
| Teaching Methods: | 1: Lecture, 2: Problem Solving 4: Homework |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|--|-----------------|
| Week | Topics | Study Materials |
| 1 | Variables, parameters, setting up modelling materials. | |
| 2 | Setting up model with difference equations | |
| 3 | Examples in finance, population problems | |
| 4 | Fixed points and stability | |

| | | |
|----|--|--|
| 5 | Systems of difference equations | |
| 6 | Examples in epidemic problems and some industrial problems | |
| 7 | Linear, nonlinear, periodic models | |
| 8 | Midterm, Markov chain | |
| 9 | Markov Chain, Continuous modelling, differential equations | |
| 10 | Continuous modelling, basic models of particle dynamics | |
| 11 | Midterm, dimensionless equations | |
| 12 | Perturbation techniques for nonlinear models | |
| 13 | Examples in various areas. | |
| 14 | Examples in various areas | |

RECOMMENDED SOURCES

| | |
|-----------------------------|--|
| Textbook | |
| Additional Resources | Principles of Mathematical Modelling, C. Dym. Mathematical Modelling, J. N. Kapur |

MATERIAL SHARING

| | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

ASSESSMENT

| IN-TERM STUDIES | NUMBER | PERCENTAGE |
|---|--------|------------|
| Mid-terms | 2 | 70 |
| Quizzes | | |
| Assignments | 3 | 30 |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 50 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 50 |
| Total | | 100 |

| | |
|------------------------|--------------------------|
| COURSE CATEGORY | Expertise/ Field Courses |
|------------------------|--------------------------|

COURSE'S CONTRIBUTION TO PROGRAM

| No | Program Learning Outcomes | Contribution | | | | |
|----|--|--------------|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a | | | | | X |

| | | | | | | |
|---|---|--|---|--|---|---|
| | basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | X | | | |
| 3 | Ability form and interpret the relations between research topics in mathematics | | X | | | |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | X |
| 5 | Consciousness of professional ethics and responsibility | | | | X | |
| 6 | Ability to communicate actively | | | | X | |
| 7 | Ability of self-development in fields of interest | | | | X | |
| 8 | Ability to learn, choose and use necessary information technologies | | X | | | |
| 9 | Lifelong education | | | | | X |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|---|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 3 | 42 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 5 | 70 |
| Mid-terms (Including self study) | 2 | 14 | 28 |
| Quizzes | - | - | - |
| Assignments | 3 | 7 | 21 |
| Final examination (Including self study) | 1 | 14 | 14 |
| Total Work Load | | | 175 |
| Total Work Load / 25 (h) | | | 7 |
| ECTS Credit of the Course | | | 7 |

| COURSE INFORMATION | | | | | |
|--------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| REAL ANALYSIS II | MATH 353 | 1 | 3 + 0 | 3 | 6 |

| | |
|----------------------|--|
| Prerequisites | |
|----------------------|--|

| | |
|--------------------------------|--|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programs) |
| Course Type | Elective |
| Course Coordinator | Mehmet Akif Erdal |
| Instructors | Mehmet Akif Erdal |
| Assistants | |
| Goals | This course is the continuation of Real Analysis I and together with Real Analysis I they constitutes the pillar of many topics in mathematics such as complex analysis, differential equations, differential and integral calculus, and differential geometry. It is impossible to assimilate these areas of mathematics without having this basic knowledge of analysis. The aim of the course is to equip students with this basic knowledge. |
| Content | Riemann Integral. Riemann Integrable Functions. The Fundamental Theorem of Calculus. The Darboux Integral. Sequences of functions. Pointwise and Uniform Convergence. Interchange of Limits. The Exponential and Logarithmic Functions. The Trigonometric Functions |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|---|---------------------------|------------------|--------------------|
| 1) A sound understanding of Riemann integral | 2,3,4 | 1 | A,B |
| 2) Learn the class of Riemann integrable functions | 2,3,4 | 1 | A,B |
| 3) Master the fundamental theorem of calculus | 2,3,4 | 1 | A,B |
| 4) Acquire the knowledge of Darboux integral and its equivalence to Riemann integral of functions | 2,3,4 | 1 | A,B |
| 5) Learn sequences of functions. | 2,3,4 | 1 | A,B |
| 6) Apply these ideas to obtain rigorous definitions most important analytic functions | 2,3,4 | 1 | A,B |

| | |
|----------------------------|-------------------------------------|
| Teaching Methods: | 1: Lecture, 2: Problem Solving |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|--------|-----------------|
| Week | Topics | Study Materials |
| | | |

| | | |
|----|---|---|
| 1 | Partitions and Tagged Partitions, Riemann sum, Riemann integrability | Bartle, Sherbert Chapter 7-1 |
| 2 | Some Properties of the Integral, Boundedness Theorem | Bartle, Sherbert Chapter 7-1 |
| 3 | Riemann Integrable Functions, Cauchy Criterion, Squeeze Theorem | Bartle, Sherbert Chapter 7-2 |
| 4 | Classes of Riemann Integrable Functions | Bartle, Sherbert Chapter 7-2 |
| 5 | Additivity Theorem | Bartle, Sherbert Chapter 7-2 |
| 6 | The Fundamental Theorem of Calculus, Substitution Theorem | Bartle, Sherbert Chapter 7-3 |
| 7 | Lebesgue's Integrability Criterion, Composition Theorem, | Bartle, Sherbert Chapter 7-3 |
| 8 | The Product Theorem, Integration by Parts, Taylor's Theorem with the Remainder | Bartle, Sherbert Chapter 7-3 |
| 9 | The Darboux Integral, Upper and Lower Sums, Upper and Lower Integrals , | Bartle, Sherbert Chapter 7-4 |
| 10 | Darboux integrable functions Darboux Integrability Criterion, Continuous and Monotone Functions | Bartle, Sherbert Chapter 7-4 |
| 11 | Equivalence of Riemann and Darboux integrals, Sequences of Functions, Pointwise and Uniform Convergence | Bartle, Sherbert Chapter 7-4, Chapter 8 |
| 12 | Cauchy Criterion for Uniform Convergence | Bartle, Sherbert Chapter 8 |
| 13 | The Exponential and Logarithmic Functions | Bartle, Sherbert Chapter 8 |
| 14 | The Trigonometric Functions | Bartle, Sherbert Chapter 8 |

RECOMMENDED SOURCES

| | |
|-----------------------------|--|
| Textbook | Robert G. Bartle, Donald R. Sherbert, Introduction to Real Analysis , Fourth Edition, John Wiley & Sons, Inc. (2011), ISBN-13: 978-0471433316 ISBN-10: 9780471433316. https://sciencemathematicseducation.files.wordpress.com/2014/01/0471433314realanalysis4.pdf |
| Additional Resources | Stephen Abbott, Understanding Analysis, Springer, 2. Edition (2015) |

MATERIAL SHARING

| | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

ASSESSMENT

| IN-TERM STUDIES | NUMBER | PERCENTAGE |
|-----------------|--------|------------|
| Mid-terms | 2 | 70 |
| Quizzes | | - |
| Assignments | 3 | 30 |

| | | |
|---|--|------------|
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 40 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 60 |
| Total | | 100 |

| | |
|------------------------|-------------------------|
| COURSE CATEGORY | Expertise/Field Courses |
|------------------------|-------------------------|

| COURSE'S CONTRIBUTION TO PROGRAM | | | | | | |
|---|--|--------------|---|---|---|---|
| No | Program Learning Outcomes | Contribution | | | | |
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | | | x |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | x |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | x |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | x |
| 5 | Consciousness of professional ethics and responsibility | | | x | | |
| 6 | Ability to communicate actively | | | x | | |
| 7 | Ability of self-development in fields of interest | | | | x | |
| 8 | Ability to learn, choose and use necessary information technologies | | | x | | |
| 9 | Lifelong education | | | x | | |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|---|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 4 | 56 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 6 | 84 |
| Mid-terms (Including self-study) | 1 | 15 | 15 |
| Quizzes | - | - | 0 |
| Assignments | 3 | 1 | 3 |
| Final examination (Including self-study) | 1 | 20 | 20 |
| Total Work Load | | | 178 |
| Total Work Load / 25 (h) | | | 7,12 |
| ECTS Credit of the Course | | | 7 |

| COURSE INFORMATION | | | | | |
|----------------------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| CONVEX ANALYSIS AND OPTIMIZATION | MATH 355 | 1 | 3 + 0 | 3 | 7 |

| | |
|----------------------|--|
| Prerequisites | |
|----------------------|--|

| | |
|--------------------------------|---|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programs) |
| Course Type | Elective |
| Course Coordinator | İlker Savaş Yüce |
| Instructors | İlker Savaş Yüce |
| Assistants | |
| Goals | This course is intended to introduce basic concepts of convex analysis and optimization theory. First the convex subsets and its geometric properties are defined. Then convex functions and functions of several variables are studied. Finally the convex optimization theory is discussed. |
| Content | Affine subspaces, convex subsets, polyhedra, convex functions, differentiable functions of several variables, convex optimization theory |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|---|---------------------------|------------------|--------------------|
| 1) A sound understanding of convex subsets. | 1,4,6 | 1 | A,B |
| 2) Learn the class of convex functions. | 4,7 | 1 | A,B |
| 3) Learn differentiable functions of several variables. | 2,4,7 | 1 | A,B |
| 4) Acquire knowledge of convex optimization theory. | 1,2,4,7 | 1 | A,B |

| | |
|----------------------------|-------------------------------------|
| Teaching Methods: | 1: Lecture, 2: Problem Solving |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|---|-----------------|
| Week | Topics | Study Materials |
| 1 | Fourier-Motzkin Elimination | Ch.1 |
| 2 | Affine Subspaces | Ch.2 |
| 3 | Convex Subsets | Ch.3 |
| 4 | Polyhedra | Ch.4 |
| 5 | Computations with polyhedra | Ch.5 |
| 6 | Closed convex subsets and separating planes | Ch.6 |

| | | |
|----|---|------------------------|
| 7 | Convex Functions | 7.1, 7.2, 7.3, 7.4 |
| 8 | Convex Functions | 7.5, 7.6, 7.7, 7.8 |
| 9 | Differentiable functions of several variables | 8.1, 8.2 |
| 10 | Differentiable functions of several variables | 8.3, 8.4, 8.5 |
| 11 | Convex functions of several variables | Ch.9 |
| 12 | Convex optimization | 10.1, 10.2, 10.3, 10.4 |
| 13 | Convex optimization | 10.5, 10.6, 10.7 |
| 14 | Review | |

| RECOMMENDED SOURCES | |
|-----------------------------|--|
| Textbook | Undergraduate Convexity: From Fourier and Motzkin to Kuhn and Tucker, Niels Lauritzen, World Scientific Publishing, Illustrated Edition. |
| Additional Resources | |

| MATERIAL SHARING | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

| ASSESSMENT | | |
|---|--------|------------|
| IN-TERM STUDIES | NUMBER | PERCENTAGE |
| Mid-terms | 1 | 25 |
| Quizzes | | - |
| Assignments | 1 | 24 |
| Total | | 49 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 51 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 49 |
| Total | | 100 |

| | |
|------------------------|-------------------------|
| COURSE CATEGORY | Expertise/Field Courses |
|------------------------|-------------------------|

| COURSE'S CONTRIBUTION TO PROGRAM | | | | | | |
|----------------------------------|--|--------------|---|---|---|---|
| No | Program Learning Outcomes | Contribution | | | | |
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | | | x |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | x |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | x |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | x |
| 5 | Consciousness of professional ethics and responsibility | | | x | | |
| 6 | Ability to communicate actively | | | x | | |
| 7 | Ability of self-development in fields of interest | | | | x | |
| 8 | Ability to learn, choose and use necessary information technologies | | | x | | |
| 9 | Lifelong education | | | x | | |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|--|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 4 | 56 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 6 | 84 |
| Mid-terms (Including self-study) | 1 | 15 | 15 |
| Quizzes | - | - | 0 |
| Assignments | 3 | 1 | 3 |
| Final examination (Including self-study) | 1 | 20 | 20 |
| Total Work Load | | | 178 |
| Total Work Load / 25 (h) | | | 7,12 |
| ECTS Credit of the Course | | | 7 |

| COURSE INFORMATION | | | | | |
|--------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| NUMERICAL ANALYSIS | MATH 365 | 1-2 | 3 +0 | 3 | 7 |

| | |
|----------------------|--|
| Prerequisites | |
|----------------------|--|

| | |
|--------------------------------|---|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Elective |
| Course Coordinator | İlknur Kuşbeyzi Aybar |
| Instructors | İlknur Kuşbeyzi Aybar |
| Assistants | |
| Goals | Getting know and examine different numerical methods for various type of caluculations. |
| Content | Introduction and background. Iterative solution of non-linear equations, bisection method, fixed point iteration, Newton's and the secant method. Polynomial, divided differences and finite differences interpolations. Systems of linear equations, Gaussian elimination, LU decomposition, iterative methods. Numerical differentiation and integration. |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|---|---------------------------|------------------|--------------------|
| 1) can determine roots of higher order equations numerically. | 1,4 | 1,2,3,4 | A |
| 2) have a basic knowledge of numerical interpolation and approximation of functions | 1,2,4,7 | 1,2,3,4 | A |
| 3) have a basic knowledge of numerical integration and differentiation. | 1,2,4,7 | 1,2,3,4 | A |
| 4) is familiar with numerical solution of ordinary differential equations [| 1,2,4,7 | 1,2,3,4 | A |
| 5) can do error analysis | 1,2,4,7 | 1,2,3,4 | A |

| | |
|----------------------------|--|
| Teaching Methods: | 1: Lecture, 2: Problem Solving, 3:Question-answer, 4: Homework |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|--|-------------------------|
| Week | Topics | Study Materials |
| 1 | Basic definitions, Taylor polynomials, | Course book:Chapter 1,3 |
| 2 | Rootfinding, bisection method | 4.1 |
| 3 | Newton's method, fixed point iteration | 4.2, 4.4 |
| 4 | Polynomial interpolation, Divided differences, Error in polynomial interpolation | 5.1,5.2,5.3 |

| | | |
|----|--|-----------|
| 5 | Approximation problems, error | Chapter 6 |
| 6 | Numerical integration, the trapezoidal and Simpson rules, | 7.1 |
| 7 | error formulas. Gaussian numerical integration method. | 7.2,7.3 |
| 8 | Numerical differentiation, Differentiation by interpolation, | 7.4 |
| 9 | MIDTERM | |
| 10 | An introduction to numerical solutions to differential equations | 9.1 |
| 11 | Euler's method, convergence. | 9.2, 9.3 |
| 12 | Taylor and Runge-Kutta methods | 9.4 |
| 13 | Cont. | 9.4 |
| 14 | review | |

RECOMMENDED SOURCES

| | |
|-----------------------------|---|
| Textbook | K. E. Atkinson, W. Han, Elementary Numerical Analysis, 3Ed. John Wiley, 2004. |
| Additional Resources | |

MATERIAL SHARING

| | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

ASSESSMENT

| IN-TERM STUDIES | NUMBER | PERCENTAGE |
|---|--------|------------|
| Mid-terms | 1 | 60 |
| Quizzes | - | |
| Assignments | 4 | 40 |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 50 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 50 |
| Total | | 100 |

| | |
|------------------------|-------------------------|
| COURSE CATEGORY | Expertise/Field Courses |
|------------------------|-------------------------|

COURSE'S CONTRIBUTION TO PROGRAM

| No | Program Learning Outcomes | Contribution | | | | |
|----|--|--------------|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a | | | | | X |

| | | | | | | |
|---|---|---|---|---|---|---|
| | basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | X | | |
| 3 | Ability form and interpret the relations between research topics in mathematics | | X | | | |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | X |
| 5 | Consciousness of professional ethics and responsibility | | | X | | |
| 6 | Ability to communicate actively | X | | | | |
| 7 | Ability of self-development in fields of interest | | | | | X |
| 8 | Ability to learn, choose and use necessary information technologies | | | | X | |
| 9 | Lifelong education | | | | X | |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|---|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 3 | 42 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 5 | 70 |
| Mid-terms (Including self study) | 1 | 14 | 14 |
| Quizzes | | | |
| Assignments | 4 | 7 | 28 |
| Final examination (Including self study) | 1 | 21 | 21 |
| Total Work Load | | | 175 |
| Total Work Load / 25 (h) | | | 7 |
| ECTS Credit of the Course | | | 7 |

| COURSE INFORMATION | | | | | |
|--------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| GEOMETRIES | MATH 411 | 1-2 | 3 + 0 | 3 | 7 |

| | |
|----------------------|--|
| Prerequisites | |
|----------------------|--|

| | |
|--------------------------------|--|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Elective |
| Course Coordinator | İlker Savaş Yüce |
| Instructors | İlker Savaş Yüce |
| Assistants | |
| Goals | To provide information about the fundamental concepts of geometries defined by invariants of transformations on two dimensional spaces of constant curvature. |
| Content | Plane Euclidean geometry, Affine transformations in the Euclidean plane, Finite groups of isometries of Euclidean plane, Geometry on sphere, The projective plane, The hyperbolic plane. |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|---|---------------------------|------------------|--------------------|
| 1) Learns the geometry on plane | 1,2,3,4,7 | 1 | A |
| 2) Learns the geometry on sphere | 1,2,3,4,7 | 1 | A |
| 3) Learns the geometry on hyperbolic plane | 1,2,3,4,7 | 1 | A |
| 4) Learns the transformations on plane | 1,2,3,4,7,9 | 1 | A |
| 5) Learns the transformations on sphere | 1,2,3,4,7,9 | 1 | A |
| 6) Learns the transformations on hyperbolic plane | 1,2,3,4,7,9 | 1 | A |

| | |
|----------------------------|-------------------------------------|
| Teaching Methods: | 1: Lecture, 2: Problem Solving |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|---|-------------------------|
| Week | Topics | Study Materials |
| 1 | Plane Euclidean Geometry | From textbook Chapter 1 |
| 2 | Plane Euclidean Geometry | Chapter 1 |
| 3 | Plane Euclidean Geometry | Chapter 1 |
| 4 | Affine transformations in Euclidean Plane | Chapter 2 |
| 5 | Affine transformations in Euclidean Plane | Chapter 2 |

| | | |
|----|---|-----------|
| 6 | Finite Group of Isometries of Euclidean Plane | Chapter 3 |
| 7 | MIDTERM and discussion of solutions) | |
| 8 | Geometry on Sphere | Chapter 4 |
| 9 | Geometry on Sphere | Chapter 4 |
| 10 | Geometry on Sphere | Chapter 4 |
| 11 | The Projective plane | Chapter 5 |
| 12 | Distance geometry on Projective Plane | Chapter 6 |
| 13 | The Hyperbolic Plane | Chapter 7 |
| 14 | The Hyperbolic Plane | Chapter 7 |

RECOMMENDED SOURCES

| | |
|-----------------------------|--|
| Textbook | P. J. Ryan, Euclidean and Non-Euclidean Geometry An analytic Approach, Cambridge, 1997 |
| Additional Resources | |

MATERIAL SHARING

| | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

ASSESSMENT

| IN-TERM STUDIES | NUMBER | PERCENTAGE |
|---|--------|------------|
| Mid-terms | 1 | 100 |
| Quizzes | | |
| Assignments | | |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 40 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 60 |
| Total | | 100 |

| | |
|------------------------|--------------------------|
| COURSE CATEGORY | Expertise/ Field Courses |
|------------------------|--------------------------|

COURSE'S CONTRIBUTION TO PROGRAM

| No | Program Learning Outcomes | Contribution | | | | |
|----|--|--------------|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | x | | |

| | | | | | | |
|---|---|--|--|---|---|---|
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | x |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | x |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | x |
| 5 | Consciousness of professional ethics and responsibility | | | x | | |
| 6 | Ability to communicate actively | | | x | | |
| 7 | Ability of self-development in fields of interest | | | | x | |
| 8 | Ability to learn, choose and use necessary information technologies | | | x | | |
| 9 | Lifelong education | | | | | x |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|---|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 3 | 42 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 5 | 70 |
| Mid-terms (Including self study) | 1 | 24 | 24 |
| Final examination (Including self study) | 1 | 36 | 36 |
| Total Work Load | | | 172 |
| Total Work Load / 25 (h) | | | 6.88 |
| ECTS Credit of the Course | | | 7 |

| COURSE INFORMATION | | | | | |
|---------------------------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| CLASSICAL LIE GROUPS AND LIE ALGEBRAS | MATH 413 | 1-2 | 3 + 0 | 3 | 7 |

| | |
|----------------------|-----------------------|
| Prerequisites | Math 212 and Math 321 |
|----------------------|-----------------------|

| | |
|--------------------------------|---|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Elective |
| Course Coordinator | Mehmet Akif Erdal |
| Instructors | Mehmet Akif Erdal |
| Assistants | |
| Goals | To introduce the basics of the theory of Lie groups and Lie algebras within the framework of matrix groups. |
| Content | General linear groups, Matrix groups, example : orthogonal groups, Tangent space and the dimension of matrix groups, smooth homomorphisms, Exponential and the logarithm of a matrix, Center, Maximal tori, Clifford algebras, Normalizers, Weyl groups, Reflections and roots. |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|--|---------------------------|------------------|--------------------|
| 1) Applies linear algebraic methods | 1,2,5 | 1 | A,B |
| 2) Knows the basic properties and examples of matrix groups | 1,2,3,4,7,9 | 1 | A,B |
| 3) Determines the tangent space to a matrix group | 1,2,5 | 1 | A,B |
| 4) Computes the exponential and the logarithm of matrices | 1,2,3,5 | 1 | A,B |
| 5) Knows the definition and basic properties of a maximal torus in a matrix groups | 1,2,3,5,7,9 | 1 | A,B |
| 6) Knows the definition and very basic properties of general Lie groups and Lie algebras | 1,2,3,5,7,9 | 1 | A,B |

| | |
|----------------------------|-------------------------------------|
| Teaching Methods: | 1: Lecture, 2: Problem Solving |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|--|-----------------|
| Week | Topics | Study Materials |
| 1 | General linear groups | Textbook |
| 2 | Orthogonal groups | Textbook |
| 3 | Homomorphisms | Textbook |
| 4 | Exponential of a matrix, logarithm of a matrix | Textbook |
| 5 | Lie algebras | Textbook |

| | | |
|----|---------------------------|----------|
| 6 | Manifolds | Textbook |
| 7 | Maximal tori | Textbook |
| 8 | Covering by maximal tori | Textbook |
| 9 | Conjugacy of maximal tori | Textbook |
| 10 | Simply connected groups | Textbook |
| 11 | Spin(k) | Textbook |
| 12 | Normalizers, Weyl groups | Textbook |
| 13 | Lie groups | Textbook |
| 14 | Reflections, roots | Textbook |

RECOMMENDED SOURCES

| | |
|-----------------------------|--|
| Textbook | Matrix Groups, M. Curtis, 2nd. Ed., Springer-Verlag, 1984. |
| Additional Resources | |

MATERIAL SHARING

| | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

ASSESSMENT

| IN-TERM STUDIES | NUMBER | PERCENTAGE |
|---|--------|------------|
| Mid-terms | | |
| Quizzes | | |
| Assignments | 7 | 100 |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 40 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 60 |
| Total | | 100 |

| | |
|------------------------|--------------------------|
| COURSE CATEGORY | Expertise/ Field Courses |
|------------------------|--------------------------|

COURSE'S CONTRIBUTION TO PROGRAM

| No | Program Learning Outcomes | Contribution | | | | |
|----|--|--------------|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | x | | |

| | | | | | | |
|---|---|--|---|---|--|---|
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | x |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | x |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | x |
| 5 | Consciousness of professional ethics and responsibility | | | | | x |
| 6 | Ability to communicate actively | | | x | | |
| 7 | Ability of self-development in fields of interest | | | | | x |
| 8 | Ability to learn, choose and use necessary information technologies | | x | | | |
| 9 | Lifelong education | | | | | x |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|---|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 3 | 42 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 4 | 56 |
| Mid-terms (Including self study) | | | |
| Quizzes | | | |
| Assignements | 7 | 8 | 56 |
| Final examination (Including self study) | 1 | 20 | 20 |
| Total Work Load | | | 174 |
| Total Work Load / 25 (h) | | | 6.96 |
| ECTS Credit of the Course | | | 7.00 |

| COURSE INFORMATION | | | | | |
|----------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| READINGS IN GEOMETRY | MATH 416 | 1-2 | 3 | 3 | 7 |

| | |
|----------------------|---|
| Prerequisites | - |
|----------------------|---|

| | |
|--------------------------------|--|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Elective |
| Course Coordinator | İlker Savaş Yüce |
| Instructors | İlker Savaş Yüce |
| Assistants | |
| Goals | To teach selected topics in geometry preferably involving parts of advanced books or research articles |
| Content | selected topics in geometry |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|-----------------------------|---------------------------|------------------|--------------------|
| Solves problems in geometry | 1,2,3 | 1 | B |

| | |
|----------------------------|--|
| Teaching Methods: | 1: Lecture, 2: Problem Solving, 3:Question-answer, 4: Homework |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|----------------------|-----------------|
| Week | Topics | Study Materials |
| 1 | Problems in geometry | |
| 2 | Problems in geometry | |
| 3 | Problems in geometry | |
| 4 | Problems in geometry | |
| 5 | Problems in geometry | |
| 6 | Problems in geometry | |
| 7 | Problems in geometry | |
| 8 | Problems in geometry | |
| 9 | Problems in geometry | |
| 10 | Problems in geometry | |
| 11 | Problems in geometry | |
| 12 | Problems in geometry | |
| 13 | Problems in geometry | |

| | | |
|----|----------------------|--|
| 14 | Problems in geometry | |
|----|----------------------|--|

| RECOMMENDED SOURCES | |
|----------------------|--|
| Textbook | |
| Additional Resources | |

| MATERIAL SHARING | |
|------------------|--|
| Documents | |
| Assignments | |
| Exams | |

| ASSESSMENT | | |
|---|--------|------------|
| IN-TERM STUDIES | NUMBER | PERCENTAGE |
| Mid-terms | | |
| Quizzes | | |
| Assignments | | |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | 1 | 100 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | |
| Total | | 100 |

| | |
|------------------------|-------------------------|
| COURSE CATEGORY | Expertise/Field Courses |
|------------------------|-------------------------|

| COURSE'S CONTRIBUTION TO PROGRAM | | | | | | |
|----------------------------------|--|--------------|---|---|---|---|
| N o | Program Learning Outcomes | Contribution | | | | |
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | x | | | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | x |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | x |
| 4 | Ability to define, formulate and solve mathematical problems | | | | x | |
| 5 | Consciousness of professional ethics and responsibilty | | | | x | |
| 6 | Ability to communicate actively | | | | x | |
| 7 | Ability of self-development in fields of interest | | | | | x |
| 8 | Ability to learn, choose and use necessary information technologies | x | | | | |
| 9 | Lifelong education | | | | | x |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|---|-----------------|------------------------|------------------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 3 | 42 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 8 | 112 |
| Mid-terms (Including self study) | | | |
| Quizzes | | | |
| Assignments | | | |
| Final examination (Including self study) | 1 | 21 | 21 |
| Total Work Load | | | 175 |
| Total Work Load / 25 (h) | | | 7 |
| ECTS Credit of the Course | | | 7 |

| COURSE INFORMATION | | | | | |
|--------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| GALOIS THEORY | MATH 422 | 1-2 | 3 + 0 | 3 | 7 |

| | |
|----------------------|---------------------------|
| Prerequisites | Consent of the instructor |
|----------------------|---------------------------|

| | |
|--------------------------------|---|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Elective |
| Course Coordinator | Meltem Özgül |
| Instructors | Meltem Özgül |
| Assistants | |
| Goals | To introduce the basic facts about field extensions, Galois theory and its applications. |
| Content | Algebraic extensions, Algebraic Closure, Splitting Fields, Normal Extensions, Separable Extensions, Finite Fields, Fundamental Theorem of Galois Theory, Cyclic Extensions, Solvability by Radicals, Solvability of Algebraic Equations, Construction with Ruler and Compass. |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|---|---------------------------|------------------|--------------------|
| 1) Applies irreducibility criterions to decide if a given polynomial is irreducible or not. Computes the minimal polynomial of a given element algebraic over a base field. | 1,2,4,7 | 1 | A,B |
| 2) Computes the splitting field of a given polynomial | 1,2,4 | 1 | A,B |
| 3) Decides if a given polynomial is separable or not. | 1,2,4 | 1 | A,B |
| 4) Decides if a given extension is Galois or not. Compute the Galois group of a given Galois extension. | 1,2,3,4,7,9 | 1 | A,B |
| 5) Applies Fundamental Theorem of Galois Theory in concrete examples | 1,2,3,4,7,9 | 1 | A,B |
| 6) Analyses particular polynomials – computes their Galois groups and assesses their solvability by radicals. | 1,2,3,4,7,9 | 1 | A,B |

| | |
|----------------------------|-------------------------------------|
| Teaching Methods: | 1: Lecture, 2: Problem Solving |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|--|-----------------|
| Week | Topics | Study Materials |
| 1 | Rings and homomorphisms Ideals and quotient rings | Textbook |
| 2 | Polynomial rings Vector spaces | Textbook |
| 3 | Algebraic extensions | Textbook |
| 4 | Algebraic extensions continued | Textbook |

| | | |
|----|--|----------|
| 5 | Algebraic Closure | Textbook |
| 6 | Splitting Fields, Normal Extensions | Textbook |
| 7 | Separable Extensions | Textbook |
| 8 | Finite Fields | Textbook |
| 9 | Fundamental Theorem of Galois Theory | Textbook |
| 10 | Fundamental Theorem of Galois Theory continued | Textbook |
| 11 | Cyclic Extensions | Textbook |
| 12 | Solvability by Radicals | Textbook |
| 13 | Solvability of Algebraic Equations | Textbook |
| 14 | Construction with Ruler and Compass | Textbook |

RECOMMENDED SOURCES

| | |
|-----------------------------|--|
| Textbook | Galois Theory, M. P. Murthy, K.G. Ramanathan, C.S. Seshadri, U. Shukla, R. Sridharan, Tata Inst. of Fund. Research, Bombay, 1965 |
| Additional Resources | Algebra, Serge Lang, 3rd. ed., Addison-Wesley, 1994 |

MATERIAL SHARING

| | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

ASSESSMENT

| IN-TERM STUDIES | NUMBER | PERCENTAGE |
|---|--------|------------|
| Mid-terms | | |
| Quizzes | | |
| Assignments | 7 | 100 |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 40 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 60 |
| Total | | 100 |

COURSE CATEGORY

Expertise/ Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

| No | Program Learning Outcomes | Contribution | | | | |
|----|--|--------------|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis | | | x | | |

| | | | | | | |
|---|---|--|---|---|--|---|
| | for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | x |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | x |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | x |
| 5 | Consciousness of professional ethics and responsibility | | | | | x |
| 6 | Ability to communicate actively | | | x | | |
| 7 | Ability of self-development in fields of interest | | | | | x |
| 8 | Ability to learn, choose and use necessary information technologies | | x | | | |
| 9 | Lifelong education | | | | | x |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|---|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 3 | 42 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 4 | 56 |
| Mid-terms (Including self study) | | | |
| Quizzes | | | |
| Assignments | 7 | 8 | 56 |
| Final examination (Including self study) | 1 | 20 | 20 |
| Total Work Load | | | 174 |
| Total Work Load / 25 (h) | | | 6.96 |
| ECTS Credit of the Course | | | 7.00 |

| COURSE INFORMATION | | | | | |
|---------------------------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| INTRODUCTION TO REPRESENTATION THEORY | MATH 423 | 1 | 3+0 | 3 | 7 |

| | |
|----------------------|-----------------------|
| Prerequisites | MATH 321 AND MATH 322 |
|----------------------|-----------------------|

| | |
|--------------------------------|---|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Elective |
| Course Coordinator | İlker Savaş Yüce |
| Instructors | İlker Savaş Yüce |
| Assistants | |
| Goals | To introduce basic facts about representation theory of groups and to find a representation of a group as a group of matrices in order to have a concrete description of this group. |
| Content | Generalities and basic definitions. Sums, quotients, tensor products, characters and decompositions of representations. Group algebra. Generalities on algebras and modules, semi-simple modules. Invertible and nilpotent elements. Idempotents. The Jacobson radical. Semi-simple and local algebras. Projective modules. Primitive decompositions and points. Blocks of an algebra. Duality. Symmetric algebras. |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|---|---------------------------|------------------|--------------------|
| 1) Visualizes groups as matrices | 1,2,4 | 1,2 | A |
| 2) Uses group algebra to construct the regular representation of a group | 1,2,4,7 | 1,2 | A |
| 3) Uses FG-modules to obtain information about representations of a group G over a field F | 1,2,4,7 | 1,2 | A |
| 4) Computes the character table of a group | 1,2,3,4,7,9 | 1,2 | A |
| 5) Applies tensor products to find all the irreducible characters of a direct product of groups | 1,2,3,4,7,9 | 1,2 | A |
| 6) Uses blocks of an algebra to get information about its modules | 1,2,3,4,7,9 | 1,2 | A |

| | |
|----------------------------|-------------------------------------|
| Teaching Methods: | 1: Lecture, 2: Problem Solving |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|--|-----------------|
| Week | Topics | Study Materials |
| 1 | Generalities and basic definitions | Textbook |
| 2 | Sums, quotients, tensor products, characters | Textbook |
| 3 | Decompositions of representations | Textbook |
| 4 | Group algebra | Textbook |

| | | |
|----|---|----------|
| 5 | Generalities on algebras and modules, semi-simple modules | Textbook |
| 6 | Invertible and nilpotent elements | Textbook |
| 7 | Idempotents | Textbook |
| 8 | The Jacobson radical | Textbook |
| 9 | Semi-simple and local algebras | Textbook |
| 10 | Projective modules | Textbook |
| 11 | Primitive decompositions and points | Textbook |
| 12 | Blocks of an algebra | Textbook |
| 13 | Duality | Textbook |
| 14 | Symmetric algebras | Textbook |

RECOMMENDED SOURCES

| | |
|-----------------------------|--|
| Textbook | Representations and characters of groups. Gordon James, Martin Liebeck. |
| Additional Resources | Representations of finite groups and associative algebras. C.W. Curtis, I. Reiner. |

MATERIAL SHARING

| | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

ASSESSMENT

| IN-TERM STUDIES | NUMBER | PERCENTAGE |
|---|--------|------------|
| Mid-terms | 2 | 100 |
| Quizzes | | |
| Assignments | | |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 40 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 60 |
| Total | | 100 |

COURSE CATEGORY

Expertise/ Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

| No | Program Learning Outcomes | Contribution | | | | |
|----|--|--------------|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis | | | x | | |

| | | | | | | |
|---|---|--|---|---|--|---|
| | for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | x |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | x |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | X |
| 5 | Consciousness of professional ethics and responsibility | | | | | x |
| 6 | Ability to communicate actively | | x | | | |
| 7 | Ability of self-development in fields of interest | | | | | x |
| 8 | Ability to learn, choose and use necessary information technologies | | | x | | |
| 9 | Lifelong education | | | | | x |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|---|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 3 | 42 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 6 | 84 |
| Mid-terms (Including self study) | 2 | 15 | 30 |
| Quizzes | - | - | - |
| Assignments | - | - | - |
| Final examination (Including self study) | 1 | 20 | 20 |
| Total Work Load | | | 176 |
| Total Work Load / 25 (h) | | | 7.04 |
| ECTS Credit of the Course | | | 7 |

| COURSE INFORMATION | | | | | |
|--------------------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| CATEGORY THEORY IN COMPUTATION | MATH 424 | 1 | 3 + 0 | 3 | 7 |

| | |
|----------------------|--|
| Prerequisites | MATH321 Abstract Algebra, MATH101 Set Theory and Logic |
|----------------------|--|

| | |
|--------------------------------|---|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programs) |
| Course Type | Elective |
| Course Coordinator | Mehmet Akif Erdal |
| Instructors | Mehmet Akif Erdal |
| Assistants | |
| Goals | This course aims to equip students with knowledge of fundamentals of category theory and applications in computing sciences. |
| Content | Some preliminaries for categories, Sets, functions. Definitions of categories, functors, natural transformations. Functional programming languages as categories. Category of sets. Categories of sets with extra structure. Yoneda Lemma. Universal properties. Initial and Terminal objects. Adjoint functors. Monads/Lawvere theories. Finitary algebraic theories. Universal Algebra and Programming Languages. |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|--|---------------------------|------------------|--------------------|
| 1) Learn categories, functors and natural transformations. | 1,2,4 | 1 | A,B |
| 2) Learn Yoneda lemma and its consequences. | 1,2,4,7 | 1 | A,B |
| 3) Learn universal algebra through monads and Lawvere theories | 1,2,4,7 | 1 | A,B |
| 4) Understand the link between universal algebra and programming | 1,2,3,4,7,9 | 1 | A,B |
| 5) Master categorical constructions. | 1,2,3,4,7,9 | 1 | A,B |

| | |
|----------------------------|-------------------------------------|
| Teaching Methods: | 1: Lecture, 2: Problem Solving |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|--|-----------------|
| Week | Topics | Study Materials |
| 1 | Preliminaries | |
| 2 | Categories, functors and natural transformations | |
| 3 | Mathematical structures and functional programming languages as categories | |

| | | |
|----|--|--|
| 4 | Categories of sets | |
| 5 | Categories of sets with extra structures | |
| 6 | Representable functors and Yoneda lemma. | |
| 7 | Universal properties: Initial and terminal objects | |
| 8 | Categorical products, coproducts | |
| 9 | Categorical limits and colimits | |
| 10 | Adjoint functors | |
| 11 | Lawvere theories/Monads: Definitions and Examples | |
| 12 | Universal algebra via Lawvere theories/Monads | |
| 13 | Lawvere theories/Monads in Computer Science | |
| 14 | Universal algebra and programming | |

RECOMMENDED SOURCES

| | |
|-----------------------------|---|
| Textbook | Barr, Michael, and Charles Wells. <i>Category theory for computing science</i> . Vol. 49. New York: Prentice Hall, 1990. http://www.tac.mta.ca/tac/reprints/articles/22/tr22.pdf |
| Additional Resources | Mac Lane, Saunders. <i>Categories for the working mathematician</i> . Vol. 5. Springer Science & Business Media, 2013. Leinster, Tom. <i>Basic category theory</i> . Vol. 143. Cambridge University Press, 2014. Milewski, Bartosz. <i>Category theory for programmers</i> . Blurb, 2018. |

MATERIAL SHARING

| | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

ASSESSMENT

| IN-TERM STUDIES | NUMBER | PERCENTAGE |
|---|--------|------------|
| Mid-terms | 1 | 60 |
| Quizzes | | - |
| Assignments | 3 | 40 |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 40 |

| | | |
|---|--|------------|
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 60 |
| Total | | 100 |

| | |
|------------------------|-------------------------|
| COURSE CATEGORY | Expertise/Field Courses |
|------------------------|-------------------------|

| COURSE'S CONTRIBUTION TO PROGRAM | | | | | | |
|---|--|--------------|---|---|---|---|
| No | Program Learning Outcomes | Contribution | | | | |
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | | x | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | x |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | x |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | x |
| 5 | Consciousness of professional ethics and responsibility | | | x | | |
| 6 | Ability to communicate actively | | | x | | |
| 7 | Ability of self-development in fields of interest | | | | x | |
| 8 | Ability to learn, choose and use necessary information technologies | | | x | | |
| 9 | Lifelong education | | | x | | |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|---|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 5 | 70 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 3 | 42 |
| Mid-terms (Including self-study) | 2 | 10 | 20 |
| Quizzes | - | - | 0 |
| Assignments | 3 | 8 | 24 |
| Final examination (Including self-study) | 1 | 19 | 19 |
| Total Work Load | | | 175 |
| Total Work Load / 25 (h) | | | 7 |
| ECTS Credit of the Course | | | 7 |

| COURSE INFORMATION | | | | | |
|---------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| READINGS IN ALGEBRA | MATH 425 | 1-2 | 3+0 | 3 | 7 |

| | |
|----------------------|---|
| Prerequisites | - |
|----------------------|---|

| | |
|--------------------------------|---|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Elective |
| Course Coordinator | Meltem Özgül |
| Instructors | Meltem Özgül |
| Assistants | |
| Goals | To teach selected topics in algebra preferably involving parts of advanced books or research articles |
| Content | selected topics in algebra |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|----------------------------|---------------------------|------------------|--------------------|
| Solves problems in algebra | 1,2,3 | 1 | B |

| | |
|----------------------------|--|
| Teaching Methods: | 1: Lecture, 2: Problem Solving, 3:Question-answer, 4: Homework |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|---------------------|-----------------|
| Week | Topics | Study Materials |
| 1 | Problems in algebra | |
| 2 | Problems in algebra | |
| 3 | Problems in algebra | |
| 4 | Problems in algebra | |
| 5 | Problems in algebra | |
| 6 | Problems in algebra | |
| 7 | Problems in algebra | |
| 8 | Problems in algebra | |
| 9 | Problems in algebra | |
| 10 | Problems in algebra | |
| 11 | Problems in algebra | |
| 12 | Problems in algebra | |
| 13 | Problems in algebra | |

| | | |
|----|---------------------|--|
| 14 | Problems in algebra | |
|----|---------------------|--|

| RECOMMENDED SOURCES | |
|-----------------------------|--|
| Textbook | |
| Additional Resources | |

| MATERIAL SHARING | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

| ASSESSMENT | | |
|---|--------|------------|
| IN-TERM STUDIES | NUMBER | PERCENTAGE |
| Mid-terms | | |
| Quizzes | | |
| Assignments | | |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | 1 | 100 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | |
| Total | | 100 |

| | |
|------------------------|-------------------------|
| COURSE CATEGORY | Expertise/Field Courses |
|------------------------|-------------------------|

| COURSE'S CONTRIBUTION TO PROGRAM | | | | | | |
|----------------------------------|--|--------------|---|---|---|---|
| N o | Program Learning Outcomes | Contribution | | | | |
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | x | | | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | x |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | x |
| 4 | Ability to define, formulate and solve mathematical problems | | | | x | |
| 5 | Consciousness of professional ethics and responsibilty | | | | x | |
| 6 | Ability to communicate actively | | | | x | |
| 7 | Ability of self-development in fields of interest | | | | | x |
| 8 | Ability to learn, choose and use necessary information technologies | x | | | | |
| 9 | Lifelong education | | | | | x |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|---|-----------------|------------------------|------------------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 3 | 42 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 8 | 112 |
| Mid-terms (Including self study) | | | |
| Quizzes | | | |
| Assignments | | | |
| Final examination (Including self study) | 1 | 21 | 21 |
| Total Work Load | | | 175 |
| Total Work Load / 25 (h) | | | 7 |
| ECTS Credit of the Course | | | 7 |

| COURSE INFORMATION | | | | | |
|----------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| Ideals and Varieties | MATH 426 | 1 | 3 + 0 | 3 | 6 |

| | |
|----------------------|--------------------------|
| Prerequisites | MATH322 Abstract Algebra |
|----------------------|--------------------------|

| | |
|--------------------------------|---|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programs) |
| Course Type | Elective |
| Course Coordinator | Mehmet Akif Erdal |
| Instructors | Mehmet Akif Erdal |
| Assistants | |
| Goals | The aim of this course is to introduce students to the preliminary concepts for classical algebraic geometry and understand the links between geometry and algebra. |
| Content | Polynomial rings, ideals and varieties. Monomial orderings. Monomial ideals and Dickson's lemma. The Hilbert Basis Theorem and Gröbner Bases. Properties of Groebner bases. Buchberger's algorithm. Applications of Groebner bases. Elimination and Extension theorems. Resultants and the extension theorem. |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|--|---------------------------|------------------|--------------------|
| 1) Learn ideals of polynomial rings and varieties. | 1,2,3 | 1 | A,B |
| 2) Learn monomial ordering and monomial ideals. | 1,2,3 | 1 | A,B |
| 3) Learn Hilbert Basis Theorem and Gröbner Bases | 1,2,3 | 1 | A,B |
| 4) Understand Buchberger's algorithm. | 1,2,3 | 1 | A,B |
| 5) Understand the link between basic geometric shapes and polynomial ideals. | 1,2,3 | 1 | A,B |

| | |
|----------------------------|-------------------------------------|
| Teaching Methods: | 1: Lecture, 2: Problem Solving |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|------------------------------|-----------------|
| Week | Topics | Study Materials |
| 1 | Polynomials and Affine Space | |

| | | |
|----|--|--|
| 2 | Affine Varieties | |
| 3 | Parametrizations of Affine Varieties | |
| 4 | Ideals | |
| 5 | Polynomials of One Variable | |
| 6 | Orderings on the Monomials in $k[x_1, \dots, x_n]$. | |
| 7 | A Division Algorithm in $k[x_1, \dots, x_n]$ | |
| 8 | Monomial Ideals and Dickson's Lemma | |
| 9 | the Hilbert Basis Theorem and Gröbner Bases | |
| 10 | Properties of Gröbner Bases, Buchberger's Algorithm | |
| 11 | First Applications of Gröbner Bases | |
| 12 | Refinements of the Buchberger Criterion | |
| 13 | Improvements on Buchberger's Algorithm | |
| 14 | Elimination Theory, The Elimination and Extension Theorems | |

| RECOMMENDED SOURCES | |
|-----------------------------|--|
| Textbook | Cox, Little and O'Shea - Ideals, Varieties and Algorithms |
| Additional Resources | |

| MATERIAL SHARING | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

| ASSESSMENT | | |
|---|--------|------------|
| IN-TERM STUDIES | NUMBER | PERCENTAGE |
| Mid-terms | 1 | 60 |
| Quizzes | | - |
| Assignments | 3 | 40 |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 40 |

| | | |
|---|--|------------|
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 60 |
| Total | | 100 |

| | |
|------------------------|-------------------------|
| COURSE CATEGORY | Expertise/Field Courses |
|------------------------|-------------------------|

| COURSE'S CONTRIBUTION TO PROGRAM | | | | | | |
|---|--|--------------|---|---|---|---|
| No | Program Learning Outcomes | Contribution | | | | |
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | | x | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | x |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | x |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | x |
| 5 | Consciousness of professional ethics and responsibility | | | x | | |
| 6 | Ability to communicate actively | | | x | | |
| 7 | Ability of self-development in fields of interest | | | | x | |
| 8 | Ability to learn, choose and use necessary information technologies | | | x | | |
| 9 | Lifelong education | | | x | | |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|---|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 3 | 42 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 5 | 70 |
| Mid-terms (Including self-study) | 2 | 17.5 | 35 |
| Quizzes | - | - | 0 |
| Assignments | 3 | 7 | 21 |
| Final examination (Including self-study) | 1 | 20 | 20 |
| Total Work Load | | | 188 |
| Total Work Load / 25 (h) | | | 7.52 |
| ECTS Credit of the Course | | | 7.52 |

| COURSE INFORMATION | | | | | |
|-----------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| COMPUTATIONAL ALGEBRA | MATH 427 | 7-8 | 3 + 0 | 3 | 7 |

| | |
|----------------------|---|
| Prerequisites | - |
|----------------------|---|

| | |
|--------------------------------|---|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Elective |
| Course Coordinator | İlknur Kuşbeyzi Aybar |
| Instructors | İlknur Kuşbeyzi Aybar |
| Assistants | |
| Goals | The aim of this course is to provide students with a knowledge and understanding of basic results of computational algebra and basic algorithmic approaches to algebra and their implementations. |
| Content | The Elimination and Extension Theorems, The Geometry of Elimination, Implicitization, Singular Points and Envelopes, Gröbner Bases and the Extension Theorem, Hilbert's Nullstellensatz, Radical Ideals and the Ideal-Variety Correspondence, Sums, Products and Intersections of Ideals, Zariski Closure and Quotients of Ideals, Irreducible Varieties, Decomposition of a Variety, Polynomial Mappings, Quotients of Polynomial Rings, Algorithmic Computations in $k[x_1, \dots, x_n]/I$, The Coordinate Ring of an Affine Variety, Primary Decomposition of Ideals, The Variety of a Monomial Ideal |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|---|---------------------------|------------------|--------------------|
| 1) Knows about algebraic geometry and commutative algebra. | 1,2,3 | 1,2 | A,B |
| 2) Knows about Gröbner basis theory and understands the relevant algorithms and their analysis. | 1,2,3 | 1,2 | A,B |
| 3) Knows how to use computational algorithms in commutative algebra and Gröbner basis theory to solve various problems. | 1,2,3 | 1,2 | A,B |
| 4) Participates in research and scientific discussions and is able to learn new topics in computational algebra. | 1,2,3 | 1,2 | A,B |

| | |
|----------------------------|-------------------------------------|
| Teaching Methods: | 1: Lecture, 2: Problem Solving |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|---|-------------------|
| Week | Topics | Study Materials |
| 1 | The Elimination and Extension Theorems, The Geometry of Elimination | Textbook 3.1, 3.2 |
| 2 | Implicitization | Textbook 3.3 |
| 3 | Singular Points and Envelopes | Textbook 3.4 |
| 4 | Gröbner Bases and the Extension Theorem | Textbook 3.5 |

| | | |
|----|---|-------------------|
| 5 | Hilbert's Nullstellensatz | Textbook 4.1 |
| 6 | Radical Ideals and the Ideal-Variety Correspondence | Textbook 4.2 |
| 7 | Sums, Products and Intersections of Ideals | Textbook 4.3 |
| 8 | Zariski Closure and Quotients of Ideals | Textbook 4.4 |
| 9 | Irreducible Varieties, Decomposition of a Variety | Textbook 4.5 |
| 10 | Decomposition of a Variety into Irreducibles | Textbook 4.6 |
| 11 | Primary Decomposition of Ideals | Textbook 4.8 |
| 12 | Polynomial Mappings, Quotients of Polynomial Rings | Textbook 5.1, 5.2 |
| 13 | Algorithmic Computations in $k[x_1, \dots, x_n]/I$ | Textbook 5.3 |
| 14 | The Coordinate Ring of an Affine Variety | Textbook 5.4 |

RECOMMENDED SOURCES

| | |
|-----------------------------|--|
| Textbook | D. A. Cox, J. Little, D. O'Shea, Ideals, Varieties, and Algorithms, Springer, Fourth Edition, 2015. |
| Additional Resources | G.-M. Greuel, G. Pfister, A Singular introduction to commutative algebra, Springer, 2002. D. Shafer, V. Romanovski, The center and cyclicity problems: a computational algebra approach, Birkhäuser Basel, 2009. V.G. Romanovski, M. Presern, An approach to solving systems of polynomials via modular arithmetics with applications, Journal of Computational and Applied Mathematics, 236, 196–208, 2011. |

MATERIAL SHARING

| | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

ASSESSMENT

| IN-TERM STUDIES | NUMBER | PERCENTAGE |
|---|--------|------------|
| Mid-terms | 1 | 70 |
| Quizzes | 0 | 0 |
| Assignments | 5 | 30 |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | 1 | 50 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 50 |
| Total | | 100 |

| | |
|------------------------|--|
| COURSE CATEGORY | |
|------------------------|--|

COURSE'S CONTRIBUTION TO PROGRAM

| |
|--|
| |
|--|

| No | Program Learning Outcomes | Contribution | | | | |
|----|--|--------------|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | | | x |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | x |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | x |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | x |
| 5 | Consciousness of professional ethics and responsibility | | | | x | |
| 6 | Ability to communicate actively | | | x | | |
| 7 | Ability of self-development in fields of interest | | | | | x |
| 8 | Ability to learn, choose and use necessary information technologies | | | | | x |
| 9 | Lifelong education | | | x | | |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|--|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 3 | 42 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 5 | 70 |
| Mid-terms (Including self study) | 1 | 10 | 10 |
| Quizzes | | | |
| Assignments | 5 | 5 | 25 |
| Final examination (Including self study) | 1 | 20 | 20 |
| Total Work Load | | | 167 |
| Total Work Load / 25 (h) | | | 6.68 |
| ECTS Credit of the Course | | | 7 |

| COURSE INFORMATION | | | | | |
|------------------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| INTRODUCTION TO GRAPH THEORY | MATH 440 | 1-2 | 3 + 0 | 3 | 7 |

| | |
|----------------------|--|
| Prerequisites | |
|----------------------|--|

| | |
|--------------------------------|--|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Elective |
| Course Coordinator | Melike İşim Efe |
| Instructors | Melike İşim Efe |
| Assistants | |
| Goals | Çizgeler, bilimdeki, işletmedeki ve endüstrideki pek çok problemde model olarak kullanılır. Bu dersin amacı, öğrencilere grafikler, yönlendirilmiş grafikler ve ağaçlar gibi çizgelerin temel bilgileriyle birlikte, çizgelerin gerçek hayat uygulamalarını ve çok bilinen bazı algoritmalarını tanıtmaktır. |
| Content | Fundamental concepts of graphs and digraphs. Trees and distance. Matching and factorization. Connectivity, networks. Graph coloring. Planar. |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|---|---------------------------|------------------|--------------------|
| 1) Manipulate the basic concepts associated with graphs such as paths, cycles, vertex degrees, and counting. Directed graphs. Use these definitions in proofs, and calculate specific values. | 1,2 | 1,2 | A |
| 2) The concept of tree, spanning trees, optimization. | 1,2 | 1,2 | A |
| 3) Cuts and connectivity. Network Flow problems and algorithms | 1,2 | 1,2 | A |
| 4) Matching and Covers. Algorithms and Applications | 1,2 | 1,2 | A |
| 5) Vertex Colorings | 1,2 | 1,2 | A |
| 6) Characterization of Planar Graphs. Parameters of Planarity. | 1,2 | 1,2 | A |

| | |
|----------------------------|-------------------------------------|
| Teaching Methods: | 1: Lecture, 2: Problem Solving |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|--|-----------------|
| Week | Topics | Study Materials |
| 1 | What Is a Graph? Paths, Cycles, and Trails. Vertex Degrees | |
| 2 | Counting. Directed Graphs | |
| 3 | Basic Properties of Trees. Spanning Trees and Enumeration | |
| 4 | Optimization and Trees | |

| | | |
|----|--|--|
| 5 | Matching and Covers. Algorithms and Applications. | |
| 6 | Matching in General Graphs. | |
| 7 | Cuts and Connectivity. K-connected Graphs. | |
| 8 | Network Flow Problems | |
| 9 | Vertex Colorings and Upper Bounds | |
| 10 | Structure of k-chromatic Graphs. Enumerative Aspects. | |
| 11 | Embeddings and Euler's Formula. Characterization of Planar Graphs. | |
| 12 | Parameters of Planarity. | |
| 13 | Line Graphs and Edge-Coloring. Hamiltonian Cycles. | |
| 14 | Planarity, Coloring, and Cycles. | |

RECOMMENDED SOURCES

| | |
|-----------------------------|---|
| Textbook | 1. Douglas B. West - Introduction to Graph Theory (Pearson) 2. Wilson RJ - Introduction to Graph Theory (Longmans) |
| Additional Resources | |

MATERIAL SHARING

| | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

ASSESSMENT

| IN-TERM STUDIES | NUMBER | PERCENTAGE |
|---|--------|------------|
| Mid-terms | 1 | 100 |
| Quizzes | | |
| Assignments | | |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 60 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 40 |
| Total | | 100 |

COURSE CATEGORY

Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

| No | Program Learning Outcomes | Contribution | | | | |
|----|--|--------------|---|---|---|----------|
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a | | | | | X |

| | | | | | | |
|---|---|--|--|---|--|---|
| | basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | X |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | X |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | X |
| 5 | Consciousness of professional ethics and responsibility | | | X | | |
| 6 | Ability to communicate actively | | | X | | |
| 7 | Ability of self-development in fields of interest | | | | | X |
| 8 | Ability to learn, choose and use necessary information technologies | | | X | | |
| 9 | Lifelong education | | | X | | |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|---|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 3 | 42 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 6 | 84 |
| Mid-terms (Including self study) | 2 | 10 | 20 |
| Quizzes | - | | |
| Assignments | - | | |
| Final examination (Including self study) | 1 | 20 | 20 |
| Total Work Load | | | 166 |
| Total Work Load / 25 (h) | | | 6.64 |
| ECTS Credit of the Course | | | 7 |

| COURSE INFORMATION | | | | | |
|------------------------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| READINGS IN DIFFERENTIAL EQUATIONS | MATH 441 | 1-2 | 3+0 | 3 | 7 |

| | |
|----------------------|---|
| Prerequisites | - |
|----------------------|---|

| | |
|--------------------------------|--|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Elective |
| Course Coordinator | İlknur Kuşbeyzi Aybar |
| Instructors | İlknur Kuşbeyzi Aybar |
| Assistants | |
| Goals | To teach selected topics in differential equations preferably involving parts of advanced books or research articles |
| Content | selected topics in differential equations |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|---|---------------------------|------------------|--------------------|
| Solves problems in differential equations | 1,2,3 | 1 | B |

| | |
|----------------------------|--|
| Teaching Methods: | 1: Lecture, 2: Problem Solving, 3:Question-answer, 4: Homework |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|------------------------------------|-----------------|
| Week | Topics | Study Materials |
| 1 | Problems in differential equations | |
| 2 | Problems in differential equations | |
| 3 | Problems in differential equations | |
| 4 | Problems in differential equations | |
| 5 | Problems in differential equations | |
| 6 | Problems in differential equations | |
| 7 | Problems in differential equations | |
| 8 | Problems in differential equations | |
| 9 | Problems in differential equations | |
| 10 | Problems in differential equations | |
| 11 | Problems in differential equations | |
| 12 | Problems in differential equations | |

| | | |
|----|------------------------------------|--|
| 13 | Problems in differential equations | |
| 14 | Problems in differential equations | |

| RECOMMENDED SOURCES | |
|-----------------------------|--|
| Textbook | |
| Additional Resources | |

| MATERIAL SHARING | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

| ASSESSMENT | | |
|---|--------|------------|
| IN-TERM STUDIES | NUMBER | PERCENTAGE |
| Mid-terms | | |
| Quizzes | | |
| Assignments | | |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | 1 | 100 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | |
| Total | | 100 |

| | |
|------------------------|-------------------------|
| COURSE CATEGORY | Expertise/Field Courses |
|------------------------|-------------------------|

| COURSE'S CONTRIBUTION TO PROGRAM | | | | | | |
|----------------------------------|--|--------------|---|---|---|---|
| N o | Program Learning Outcomes | Contribution | | | | |
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | x | | | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | x |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | x |
| 4 | Ability to define, formulate and solve mathematical problems | | | | x | |
| 5 | Consciousness of professional ethics and responsibility | | | | x | |
| 6 | Ability to communicate actively | | | | x | |
| 7 | Ability of self-development in fields of interest | | | | | x |
| 8 | Ability to learn, choose and use necessary information technologies | x | | | | |

| | | | | | | | |
|---|--------------------|--|--|--|--|--|---|
| 9 | Lifelong education | | | | | | x |
|---|--------------------|--|--|--|--|--|---|

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|---|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 3 | 42 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 8 | 112 |
| Mid-terms (Including self study) | | | |
| Quizzes | | | |
| Assignments | | | |
| Final examination (Including self study) | 1 | 21 | 21 |
| Total Work Load | | | 175 |
| Total Work Load / 25 (h) | | | 7 |
| ECTS Credit of the Course | | | 7 |

| COURSE INFORMATION | | | | | |
|----------------------|----------|----------|-------------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| READINGS IN ANALYSIS | MATH 453 | 1-2 | 3 | 3 | 7 |

| | |
|----------------------|---|
| Prerequisites | - |
|----------------------|---|

| | |
|--------------------------------|--|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Elective |
| Course Coordinator | Bariş Efe |
| Instructors | Bariş Efe |
| Assistants | |
| Goals | To teach selected topics in analysis preferably involving parts of advanced books or research articles |
| Content | selected topics in analysis |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|-----------------------------|---------------------------|------------------|--------------------|
| Solves problems in analysis | 1,2,3 | 1 | B |

| | |
|----------------------------|--|
| Teaching Methods: | 1: Lecture, 2: Problem Solving, 3:Question-answer, 4: Homework |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|----------------------|-----------------|
| Week | Topics | Study Materials |
| 1 | Problems in analysis | |
| 2 | Problems in analysis | |
| 3 | Problems in analysis | |
| 4 | Problems in analysis | |
| 5 | Problems in analysis | |
| 6 | Problems in analysis | |
| 7 | Problems in analysis | |
| 8 | Problems in analysis | |
| 9 | Problems in analysis | |
| 10 | Problems in analysis | |
| 11 | Problems in analysis | |
| 12 | Problems in analysis | |

| | | |
|----|----------------------|--|
| 13 | Problems in analysis | |
| 14 | Problems in analysis | |

| RECOMMENDED SOURCES | |
|-----------------------------|--|
| Textbook | |
| Additional Resources | |

| MATERIAL SHARING | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

| ASSESSMENT | | |
|---|--------|------------|
| IN-TERM STUDIES | NUMBER | PERCENTAGE |
| Mid-terms | | |
| Quizzes | | |
| Assignments | | |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | 1 | 100 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | |
| Total | | 100 |

| | |
|------------------------|-------------------------|
| COURSE CATEGORY | Expertise/Field Courses |
|------------------------|-------------------------|

| COURSE'S CONTRIBUTION TO PROGRAM | | | | | | |
|----------------------------------|--|--------------|---|---|---|---|
| N o | Program Learning Outcomes | Contribution | | | | |
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | x | | | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | x |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | x |
| 4 | Ability to define, formulate and solve mathematical problems | | | | x | |
| 5 | Consciousness of professional ethics and responsibility | | | | x | |
| 6 | Ability to communicate actively | | | | x | |
| 7 | Ability of self-development in fields of interest | | | | | x |
| 8 | Ability to learn, choose and use necessary information technologies | x | | | | |

| | | | | | | | |
|---|--------------------|--|--|--|--|--|---|
| 9 | Lifelong education | | | | | | x |
|---|--------------------|--|--|--|--|--|---|

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|---|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 3 | 42 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 8 | 112 |
| Mid-terms (Including self study) | | | |
| Quizzes | | | |
| Assignments | | | |
| Final examination (Including self study) | 1 | 21 | 21 |
| Total Work Load | | | 175 |
| Total Work Load / 25 (h) | | | 7 |
| ECTS Credit of the Course | | | 7 |

| COURSE INFORMATION | | | | | |
|------------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| CALCULUS OF VARIATIONS | MATH 454 | 1-2 | 3+0 | 3 | 7 |

| | |
|----------------------|----------|
| Prerequisites | MATH 343 |
|----------------------|----------|

| | |
|--------------------------------|---|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Elective |
| Course Coordinator | İlknur Kuşbeyzi Aybar |
| Instructors | İlknur Kuşbeyzi Aybar |
| Assistants | |
| Goals | To understand the problems of Pyhsics and engineering better and find their solutions |
| Content | Euler-Lagrange equations and generalizations.Hamiltonian functions. Invariant integrals. Noether theorem. Second variation and Jacobi fields. Constraint variational problems. Isoperimetric problems. Non-holonomic systems. |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|--|---------------------------|------------------|--------------------|
| 1) Knows variations and their properties | 3,4,5,7,8,9 | 1,2 | A |
| 2) Derives Euler equation | 3,4,5,7,8,9 | 1,2 | A |
| 3) Can perform generalizations | 3,4,5,7,8,9 | 1,2 | A |
| 4) Investigates moving boundary value problems | 3,4,5,7,8,9 | 1,2 | A |
| 5) Knows the direct method and Ritz method | 3,4,5,7,8,9 | 1,2 | A |
| 6) Can investigate the multiple independent variables case | 3,4,5,7,8,9 | 1,2 | A |

| | |
|----------------------------|--|
| Teaching Methods: | 1: Lecture, 2: Problem Solving, 3:Question-answer, 4: Homework |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|--|-----------------|
| Week | Topics | Study Materials |
| 1 | Minima and maxima of differentiable functions | |
| 2 | Variations and its properties | |
| 3 | Euler equation | |
| 4 | Some generalizations | |
| 5 | Parametric representations of variation problems | |
| 6 | Variation problems with moving boundaries | |

| | | |
|----|--|--|
| 7 | Variation problems with moving boundaries (continued) | |
| 8 | Sufficiency for an extremum | |
| 9 | Problems with constrained extrema | |
| 10 | Problems with constrained extrema (continued) | |
| 11 | Direct methods | |
| 12 | Ritz's method | |
| 13 | Generalizations to more than one independent variables | |
| 14 | Generalizations to more than one independent variables | |

| RECOMMENDED SOURCES | |
|-----------------------------|--|
| Textbook | L. E. Elsgolc; Calculus of Variations |
| Additional Resources | F. B. Hildebrand; Methods of Applied Mathematics |

| MATERIAL SHARING | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

| ASSESSMENT | | |
|---|--------|------------|
| IN-TERM STUDIES | NUMBER | PERCENTAGE |
| Mid-terms | 2 | 100 |
| Quizzes | - | |
| Assignments | - | |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 40 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 60 |
| Total | | 100 |

| | |
|------------------------|-------------------------|
| COURSE CATEGORY | Expertise/Field Courses |
|------------------------|-------------------------|

| COURSE'S CONTRIBUTION TO PROGRAM | | | | | | |
|----------------------------------|--|--------------|---|---|---|---|
| N o | Program Learning Outcomes | Contribution | | | | |
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | | X | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | X | | |

| | | | | | | |
|---|---|--|--|---|--|---|
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | X |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | X |
| 5 | Consciousness of professional ethics and responsibility | | | X | | |
| 6 | Ability to communicate actively | | | X | | |
| 7 | Ability of self-development in fields of interest | | | | | X |
| 8 | Ability to learn, choose and use necessary information technologies | | | X | | |
| 9 | Lifelong education | | | X | | |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|---|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 3 | 42 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 5 | 70 |
| Mid-terms (Including self study) | 2 | 15 | 30 |
| Quizzes | 0 | 0 | 0 |
| Assignments | 0 | 0 | 0 |
| Final examination (Including self study) | 1 | 30 | 30 |
| Total Work Load | | | 172 |
| Total Work Load / 25 (h) | | | 6.88 |
| ECTS Credit of the Course | | | 7 |

| COURSE INFORMATION | | | | | |
|-------------------------|------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| MATHEMATICAL STATISTICS | 462 | 1-2 | 3+0 | 3 | 7 |

| | |
|----------------------|--|
| Prerequisites | |
|----------------------|--|

| | |
|--------------------------------|---|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Elective |
| Course Coordinator | Gülce Curan |
| Instructors | Gülce Curan |
| Assistants | |
| Goals | To prepare students for a career in actuarial science, graduate studies in financial engineering/mathematics and high school teachers to teach probability and statistics in high schools. |
| Content | Introduction and background. Populations and samples. Measures of the center of a set of observations. Measurement of variability. Sampling, sampling distributions. Estimations. Hypothesis testing. Statistical decision theory. Contingency Tables. Regression and correlation analysis. |

| Learning Outcomes | Program Learning Outcomes | Teaching Methods | Assessment Methods |
|--|---------------------------|------------------|--------------------|
| 1) Compute measures of central tendency | 3,4,5,6,7,8,9 | 1,2 | A,B |
| 2) Compute measures of variability | 3,4,5,6,7,8,9 | 1,2 | A,B |
| 3) Estimate parameters of a distribution | 3,4,5,6,7,8,9 | 1,2 | A,B |
| 4) Perform hypothesis testing | 3,4,5,6,7,8,9 | 1,2 | A,B |
| 5) Apply contingency tables | 3,4,5,6,7,8,9 | 1,2 | A,B |
| 6) Use regression equations | 3,4,5,6,7,8,9 | 1,2 | A,B |

| | |
|----------------------------|-------------------------------------|
| Teaching Methods: | 1: Lecture, 2: Problem Solving |
| Assessment Methods: | A: Written examination, B: Homework |

| COURSE CONTENT | | |
|----------------|---|-----------------|
| Week | Topics | Study Materials |
| 1 | Descriptive Statistics. Histograms, measures of Central Tendency and Dispersion. | |
| 2 | Estimating Parameters: the method of Maximum Likelihood and the Method of Moments. | |
| 3 | Properties of Estimators: Unbiased, Minimum Variance Estimators | |
| 4 | The Rao- Cramer Inequality. Efficiency, Sufficiency, Consistency. | |
| 5 | Hypothesis testing concerning the Mean of the Normal Distribution. Null and Alternative Hypothesis. Type I and II Errors. | |

| | | |
|----|---|--|
| 6 | Critical Point, Test Statistic, One Tail and Two Tail Tests when σ is Known. | |
| 7 | P-value. Small sample T-test. Power of Test. | |
| 8 | Relation between Type I error, Type II error and sample size. Test concerning the parameter p of the Binomial distribution. | |
| 9 | Confidence intervals concerning μ and p . Determining the sample size. | |
| 10 | Paired t-test, tests concerning the means of two populations. Test concerning a single variance. Test concerning two variances. | |
| 11 | Hypothesis testing concerning non-normal data. The likelihood ratio test. | |
| 12 | The Multinomial Distribution Goodness-of-Fit Tests: All Parameters Known. | |
| 13 | Contingency Tables. Regression Analysis | |
| 14 | Regressions Analysis. The Method of Least Squares. The Linear Model. Covariance and Correlation. | |

RECOMMENDED SOURCES

| | |
|-----------------------------|--|
| Textbook | Mathematical Statistics with Applicatins. Wackerly, Mendenhall, Scheaffer. Brooks/Cole |
| Additional Resources | |

MATERIAL SHARING

| | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

ASSESSMENT

| IN-TERM STUDIES | NUMBER | PERCENTAGE |
|---|--------|------------|
| Mid-terms | 2 | 70 |
| Quizzes | | |
| Assignments | 3 | 30 |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 40 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 60 |
| Total | | 100 |

COURSE CATEGORY

| | |
|--|--|
| | |
|--|--|

COURSE'S CONTRIBUTION TO PROGRAM

| No | Program Learning Outcomes | Contribution | | | | |
|----|--|--------------|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamenral research fields in mathematics (i.e., analysis, algebra, differential | | | | | x |

| | | | | | | | |
|---|---|--|---|---|---|---|--|
| | equations and geometry) | | | | | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | x | |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | x | | | |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | x | |
| 5 | Consciousness of professional ethics and responsibility | | x | | | | |
| 6 | Ability to communicate actively | | | x | | | |
| 7 | Ability of self-development in fields of interest | | | x | | | |
| 8 | Ability to learn, choose and use necessary information technologies | | | x | | | |
| 9 | Lifelong education | | | | x | | |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|--|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 14 | 3 | 42 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 5 | 70 |
| Mid-terms (Including self study) | 2 | 14 | 28 |
| Quizzes | - | - | - |
| Assignments | 3 | 5 | 15 |
| Final examination (Including self study) | 1 | 20 | 20 |
| Total Work Load | | | 175 |
| Total Work Load / 25 (h) | | | 7 |
| ECTS Credit of the Course | | | 7 |

| COURSE INFORMATION | | | | | |
|--------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| PHYSICS I | PHYS 101 | 1 | 3 +1+2 | 3 | 6 |

| | |
|----------------------|---|
| Prerequisites | - |
|----------------------|---|

| | |
|--------------------------------|--|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Compulsory |
| Course Coordinator | Faculty Members of the Physics Department |
| Instructors | Faculty Members of the Physics Department |
| Assistants | |
| Goals | The aim of this course is to teach concepts of mechanics. |
| Content | Measurement and Unit, Vectors, Motion in one and two dimensions, Newton's Laws of Motion, Work, Power, Energy, Momentum and Collisions, Rotational Motion, Torque and Angular Momentum, Universal Gravitational Law. |

| Learning Outcomes | Teaching Methods | Assessment Methods |
|--|------------------|--------------------|
| 1) Relates units and their conversion | 1,2,3 | A,B,I |
| 2) Calculates the operations with vectors | 1,2,3 | A,B,I |
| 3) Analysis the translational motion | 1,2,3 | A,B,I |
| 4) Writes down the equations of motion for the systems with and without friction | 1,2,3 | A,B,I |
| 5) Applies the work-energy principle | 1,2,3 | A,B,I |
| 6) Applies the momentum and center of mass information to various cases | 1,2,3 | A,B,I |
| 7) Analysis the cases about rotation and angular momentum. | 1,2,3 | A,B,I |
| 8) Knows the universal gravitational law | 1,2,3 | A,B,I |

| | |
|----------------------------|--|
| Teaching Methods: | 1: Lecture, 2: Question-Answer, 3: Discussion, |
| Assessment Methods: | A: Testing, B: Final, I:Lab |

| COURSE CONTENT | | |
|----------------|--------------------------------------|-------------------------|
| Week | Topics | Study Materials |
| 1 | Measurement | Units |
| 2 | Motion in one dimension | Kinematic equations |
| 3 | Motion in two dimensions and vectors | Operations with vectors |

| | | |
|----|---|----------------------------------|
| 4 | Dynamics: Newton's Laws of Motion | Laws of dynamics |
| 5 | Dynamics: Newton's Laws of Motion | Newton's Laws |
| 6 | Further Applications of Newton's Laws of Motion | Newton's Laws |
| 7 | Work, Power, Energy – Midterm I | Revision |
| 8 | Conservation of Energy | What is energy? |
| 9 | Linear Momentum and Collisions | Linear Momentum and vectors |
| 10 | Linear Momentum and Collisions | Linear Momentum and vectors |
| 11 | Rotational Motion | Circular motion |
| 12 | Rotational Motion – Midterm II | Rotational kinematics |
| 13 | Conservation of Angular Momentum | Angular momentum |
| 14 | Universal Gravitational Law | What is the gravitational field? |

RECOMMENDED SOURCES

| | |
|-----------------------------|---|
| Textbook | Douglas C. GIANCOLI, Physics for Scientists & Engineers , 4th Edition, Pearson |
| Additional Resources | Halliday, Resnick, Walker: Fundamentals of Physics, 6th Edition-Serway, Jewett, Physics for Scientists and Engineers with Modern Physics, 8th Edition |

MATERIAL SHARING

| | |
|--------------------|------------------------------------|
| Documents | Mechanics Lab Experiments Handouts |
| Assignments | |
| Exams | |

ASSESSMENT

| IN-TERM STUDIES | NUMBER | PERCENTAGE |
|---|--------|------------|
| Mid-terms | 2 | 50 |
| Lab | 12 | 20 |
| Final | 1 | 30 |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 30 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 70 |
| Total | | 100 |

| | |
|------------------------|-----------------|
| COURSE CATEGORY | Support courses |
|------------------------|-----------------|

COURSE'S CONTRIBUTION TO PROGRAM

| N o | Program Learning Outcomes | Contribution | | | | |
|--------|---------------------------|--------------|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |

| | | | | | |
|---|--|--|--|--|--|
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | |
| 4 | Ability to define, formulate and solve mathematical problems | | | | |
| 5 | Consciousness of professional ethics and responsibility | | | | |
| 6 | Ability to communicate actively | | | | |
| 7 | Ability of self-development in fields of interest | | | | |
| 8 | Ability to learn, choose and use necessary information technologies | | | | |
| 9 | Lifelong education | | | | |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|--|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (Including the exam week: 14x Total course hours) | 14 | 4 | 56 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 4 | 56 |
| Mid-terms | 2 | 2 | 4 |
| Lab | 12 | 2 | 24 |
| Final examination | 1 | 3 | 3 |
| Total Work Load | | | 143 |
| Total Work Load / 25 (h) | | | 5.72 |
| ECTS Credit of the Course | | | 6 |

| COURSE INFORMATION | | | | | |
|--------------------|----------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| PHYSICS II | PHYS 102 | 2 | 3 +(1+2) | 4 | 6 |

| | |
|----------------------|------------------|
| Prerequisites | PHYS101, MATH151 |
|----------------------|------------------|

| | |
|--------------------------------|---|
| Language of Instruction | English |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Compulsory |
| Course Coordinator | Faculty Members of the Physics Department |
| Instructors | Faculty Members of the Physics Department |
| Assistants | |
| Goals | The aim of this course is to teach basic concepts of electricity and magnetism and in particular, to have students learn for themselves how physics as a discipline can be used to obtain a deep understanding of how the world works. |
| Content | Electric Charge, Electric Fields, Gauss' Law, Electric Potential, Capacitance, Current and Resistance, Circuits, Magnetic Fields, Magnetic Field Due to Currents, Induction and Inductance, Magnetism of Matter, Maxwell's Equations, Electromagnetic Oscillations and Alternating Current, LC oscillator, RLC Phase diagrams |

| Learning Outcomes | Teaching Methods | Assessment Methods |
|---|------------------|--------------------|
| 1) Expresses the basic (theoretical and experimental) concepts of electricity and magnetism. | 1,2,5,14,15 | A,B,I |
| 2) Identifies, formulates and solves physical problems regarding the electricity and magnetism. | 1,2,5,14,15 | A,B,I |
| 3) Relates the physics of electricity and magnetism and other branches of physics, and learns how physics as a discipline can be used to obtain a deep understanding of how the world works. | 1,2,5,14,15 | A,B,I |
| 4) Gets prepared for the advanced physics lectures regarding electricity and magnetism and learns a range of methods for applying these understandings and problems toward solving a broad range of physical problems . | 1,2,5,14,15 | A,B,I |

| | |
|----------------------------|--|
| Teaching Methods: | 1: Lecture, 2: Question-Answer, 5: Problem Solving, 14: Laboratory ; 15:Homework |
| Assessment Methods: | A: Testing, B: Final, I:Laboratory |

| COURSE CONTENT | | |
|----------------|----------------------------------|-----------------|
| Week | Topics | Study Materials |
| 1 | ELECTRIC CHARGE, ELECTRIC FIELDS | electric charge |
| 2 | GAUSS'S LAW | Electric field |
| 3 | ELECTRIC POTENTIAL | Potential |
| 4 | CAPACITANCE | Capacitors |
| 5 | Midterm Exam | |

| | | |
|----|--|---|
| 6 | CURRENT AND RESISTANCE | Current, circuit elements |
| 7 | CIRCUITS | Electric circuits |
| 8 | MAGNETIC FIELDS | Magnetic field |
| 9 | MAGNETIC FIELD DUE TO CURRENTS | Sources of magnetic fields |
| 10 | Midterm Exam | |
| 11 | INDUCTION AND INDUCTANCE | Faraday's Law of Induction |
| 12 | MAGNETISM OF MATTER | Magnetism |
| 13 | MAXWELL'S EQUATIONS | Maxwell |
| 14 | ELECTROMAGNETIC OSCILLATIONS, LC OSCILLATOR, RLC | Electromagnetic oscillations in the electric circuits |

RECOMMENDED SOURCES

| | |
|-----------------------------|---|
| Textbook | "PHYSICS FOR SCIENTISTS AND ENGINEERS" GIANCOLI, 4 TH EDITION, PRENTICE HALL |
| Additional Resources | FUNDAMENTALS OF PHYSICS" HALLIDAY RESNICK, "PHYSICS", SERWAY. |

MATERIAL SHARING

| | |
|--------------------|--|
| Documents | "FIRST YEAR PHYSICS LABORATORY EXPERIMENTS" YEDITEPE UNIVERSITY- DEPARTMENT OF PHYSICS (2002-2013) |
| Assignments | |
| Exams | |

ASSESSMENT

| IN-TERM STUDIES | NUMBER | PERCENTAGE |
|---|--------|------------|
| Mid-terms | 2 | 71 |
| Laboratory | 12 | 29 |
| Assignment | 10 | 0 |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 30 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 70 |
| Total | | 100 |

| | |
|------------------------|-----------------|
| COURSE CATEGORY | Support courses |
|------------------------|-----------------|

COURSE'S CONTRIBUTION TO PROGRAM

| No | Program Learning Outcomes | Contribution | | | | |
|----|--|--------------|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a | | | | | |

| | | | | | | |
|---|---|--|--|--|--|--|
| | basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | |
| 5 | Consciousness of professional ethics and responsibility | | | | | |
| 6 | Ability to communicate actively | | | | | |
| 7 | Ability of self-development in fields of interest | | | | | |
| 8 | Ability to learn, choose and use necessary information technologies | | | | | |
| 9 | Lifelong education | | | | | |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|---|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (Including the exam week: 14x Total course hours) | 14 | 4 | 56 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 4 | 56 |
| Mid-terms | 2 | 2 | 4 |
| Lab | 12 | 2 | 24 |
| Final examination | 1 | 3 | 3 |
| Total Work Load | | | |
| Total Work Load / 25 (h) | | | 143 |
| ECTS Credit of the Course | | | 5.72 |
| ECTS Credit of the Course | | | 6 |

| HUM 103 - COURSE INFORMATION | | | | | |
|------------------------------|------------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| HUMANITIES | HUM 103 | | 2+0 | 2 | 3 |

| GENERAL INFORMATION | |
|--|--|
| This course is mandatory for ALL undergraduate students of Yeditepe University. Each student takes this course in line with the academic program of his/her Faculty. | |
| Prerequisites | None |
| Coordination Office | GSF Building 708, Monday 9-18 |
| Attendance (Lectures) | Students are required to attend to at least %80 of the classes. |
| Language of Instruction | Turkish |
| Course Level | Undergraduate |
| Course Type | Compulsory |
| Course Coordinator | Dr. Ferzan Durul ferzan.durul@yeditepe.edu.tr |
| Goals | This course aims to provide: a comprehensive review of the history of civilization; an understanding of the role of multiple disciplines (philosophy, arts, literature, science) as they progressed within various civilizations around the globe throughout history; how these humanities disciplines contributed to the formation of the value system of our contemporary civilization; to develop the ability to analyze contemporary social movements. Particular emphasis is given to the fields of science, philosophy, arts and literature. |
| Content | The start of civilization on earth, the Neolithic age; Turkish, Indian and Chinese civilizations and their interactions; the developments in the Mediterranean cultural basin; the elements of civilization in the middle ages; the examination of eastern and Eurasian civilizations with a particular focus on the formation in arts, social sciences, technology, science; The renaissance; the enlightenment, the American and the French revolution; modernization phases in the Turkish civilization; the new world order; the study of civilizations in the 21 st century. |

| COURSE LEARNING OUTCOMES | | |
|--|-------------------------------|--------------------|
| Students who take this course will | Teaching Methods | Assessment Methods |
| gain an understanding of the evolution of science and the scientific approach throughout history, and the appreciation of scientific thinking as the most important dimension of the value systems of contemporary human civilization. | 1,2,3 | A,B |
| be able to interpret and appreciate the diversity of the cultures and the dynamics of nations throughout history in their geographical and historical context. | 1,2,3 | A,B |
| be able to understand the formation and evolution of the concepts of equality, ethics and justice, and the importance of their application in today's global environment. | 1,2,3 | A,B |
| be able to understand the formation, evolution and the passing among nations and subsequent generations of the arts, esthetics and literature throughout history. | | |
| gain an appreciation of the development of the methods of inquiry and the importance of critical thinking in today's global environment. | 1,2,3 | A,B |
| understand the eastern roots of civilizations (as opposed to only western), gain a multi-centered civilization appreciation, and realize the value of conceptual frames such as the Turkish World and the Eastern World. | 1,2,3 | A,B |
| Teaching Methods: | 1: Lecture, 2: Q-A, 3: Debate | |
| Assessment Methods: | A: Exam , B: Paper | |

| COURSE CONTENT | | |
|----------------|------------------|--|
| Week | Topics | Study Materials |
| 1 | What is "Human"? | İnsanın Tarih Yolculuğu, Bölüm 1 İnsan Nedir? Sorusu Düşünce |

| | | |
|---|---|--|
| | | Dünyasında Yerini Alıyor (Syf: 21-42) |
| 2 | Culture and Civilization | İnsanın Tarih Yolculuğu, Bölüm 2 İnsanın Kültürel Özne'ye Dönüşüm Hikayesi (Syf: 43-60) |
| 3 | Cultural Phases I: Paleolithic-Mesolithic Period | İnsanın Tarih Yolculuğu, Bölüm 3 Kültürel Evreler: Avcılıktan Yerleşik hayata Geçiş (Syf: 61-83) |
| 4 | Cultural Phases II: Neolithic Period | İnsanın Tarih Yolculuğu, Bölüm 3 Kültürel Evreler: Avcılıktan Yerleşik hayata Geçiş (Syf: 61-83) |
| 5 | Early Age Civilizations I: Mesopotamia | İnsanın Tarih Yolculuğu, Bölüm 4 Bereketli Hilal'in Uygarlıkları: Mezopotamya ve Mısır (Syf: 85-114) |
| 6 | Early Age Civilizations II: Indian, Chinese, Turkish | İnsanın Tarih Yolculuğu, Bölüm 4 Bereketli Hilal'in Uygarlıkları: Mezopotamya ve Mısır (Syf: 85-114) |
| 7 | Mediterranean Cultural Basin I: Signs of Greek, Turkish and Roman | İnsanın Tarih Yolculuğu, Bölüm 6 Eski Yunan Medeniyeti (Syf: 145-166) Bölüm 7, Roma Tarihi (167-193) |
| 8 | Mid-term exam | |

| | | |
|----|--|---|
| 9 | Mediterranean Cultural Basin I: Signs of Greek, Turkish and Roman | İnsanın Tarih Yolculuğu, Bölüm 6 Eski Yunan Medeniyeti (Syf: 145-166) Bölüm 7, Roma Tarihi (167-193) |
| 10 | Middle Ages and feudality | İnsanın Tarih Yolculuğu, Bölüm 9 Orta Çağda Avrupa ve Feodalizm (Syf: 219-242) |
| 11 | Eastern Cultural World: The First Civilizations of the Muslim Turkish States | İnsanın Tarih Yolculuğu, Bölüm 10 İlk Müslüman Türk Devletleri (Syf: 243-268) |
| 12 | Renaissance Reform | İnsanın Tarih Yolculuğu, Bölüm 11 Rönesans Nedir? (Syf: 269-286) Bölüm 12 Reform: Dinsel Yorumların Çoğullaşması (Syf: 287-302) |
| 13 | Age of Revolutions; English Revolution; American Revolution; The Enlightenment; French Revolution; Modernization in Turkish Civilization | İnsanın Tarih yolculuğu Bölüm 13 Aydınlanma (Syf: 303-323) Bölüm 14 Sanayi Devrimi (Syf: 329-347) |
| 14 | Evaluation and review | |

| COURSE MATERIALS | |
|-------------------|--|
| Text Books | İnsanın Tarih Yolculuğu, Yeditepe Üniversitesi Yayınevi, 2020, ISBN: 978-975-307-109-3 |

| ASSESSMENT | | |
|--------------|--------|------------|
| | NUMBER | PERCENTAGE |
| Midterm | 1 | 40 |
| Final | 1 | 60 |
| Total | | 100 |

| ECTS ALLOCATION | | | |
|--|----------|------------------|------------------------|
| Activity | Quantity | Duration (Hours) | Total Workload (Hours) |
| Duration (Total of exam and class hours) | 14 | 2 | 28 |
| Out of class study time | 14 | 3 | 42 |
| Mid-term exam | 1 | 1 | 1 |
| Final | 1 | 1 | 1 |
| Reading | 1 | 3 | 3 |
| Total Work Load | | | 75 |
| Total Work Load / 25 (h) | | | 3 |


ECTS Credits

3

| CONTRIBUTION TO PROGRAM OUTCOMES | | | | | | |
|----------------------------------|---|--------------|---|---|---|---|
| No | Program Learning Outcomes | Contribution | | | | |
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | Understands the basic concepts and analysis methods required to be successful in academic studies in the field of philosophy. | | x | | | |
| 2 | Gain the critical view, analytical approach, problem solving, versatile view, interpretation and inference skills required for a successful philosophy career. | | | x | | |
| 3 | Communicates effectively, is successful especially in a written and oral presentation, can do teamwork and interdisciplinary work, has an entrepreneurial spirit, a sense of responsibility has developed, produces original ideas in the field of philosophy, adheres to ethical principles. | | | | x | |
| 4 | With a lifelong learning approach, they reach the competence to continue their professional and personal development by using all kinds of information sources. | | | | x | |
| 5 | Gains awareness of professional and social ethics. | | | | | x |
| 6 | Gains the ability to choose and develop contemporary tools required for applications in the field of philosophy and to use information technologies effectively. | x | | | | |
| 7 | Gains the basic information about the history of philosophy. | | x | | | |
| 8 | Have enough knowledge of the classical language and at least one modern language to follow the texts of the history of philosophy in their original | x | | | | |
| 9 | Identifies, recognizes, grasps, and discusses the problems in the field of philosophy within their place in the history of philosophy. | | | | | x |
| 10 | Develops competence in reading, understanding, and analyzing texts from different languages in the field of philosophy. | x | | | | |

| COURSE INFORMATION | | | | | |
|--------------------|---------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| Turkish Language 1 | TKL 201 | 1 | 2+0 | 2 | 2 |

| | |
|----------------------|--|
| Prerequisites | |
|----------------------|--|

| | |
|--------------------------------|--|
| Language of Instruction | Turkish  |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Compulsory |
| Course Coordinator | Emrah Pelvanoğlu |
| Instructors | Emrah Pelvanoğlu |
| Assistants | - |
| Goals | The course aims at helping students improve their skill in written and oral narration, by teaching them features and rules of the language. |
| Content | A general information about language in general and world languages, the historical evolution of Turkish and its relationship with other languages, phonetical and morphological characteristics of Modern Turkish, applying/practicing rules of orthography and punctuation |

| Learning Outcomes | Teaching Methods | Assessment Methods |
|---|------------------|--------------------|
| 1-Aims at helping students use punctuation marks and orthography correctly | 1, 3,4 | A |
| 2-Aims at helping students understand basic features of language and criteria for classifying languages | 1, 3,4 | A |
| 3-Aims at helping students remember the evolution of Turkish | 1,3,4 | A |
| 4-Aims at teaching students features of Turkish and how to apply them | 1,3,4 | A |
| 5-Aims at improving students' skills in written and oral narration | 1,3,4 | A |

| | |
|----------------------------|--|
| Teaching Methods: | 1. Lecture 2. Case study 3. Discussion 4. Demonstration 5. Group work 6. Microteaching 7. Problem solving |
| Assessment Methods: | A. Classical exam B. Multiple-choice test C. Incomplete D. True-False E. Oral exam F. Portfolio G. Performance type H. Report |

| COURSE CONTENT | | |
|----------------|--|------------------|
| Week | Topics | Study Materials |
| 1 | Introduction/orientation: Giving students information about the content of the course and how the material will be covered | Related readings |
| 2 | Punctuation, general rules of spelling | Related readings |
| 3 | Definition and basic features of, language, relationship /parallel between language and culture | Related readings |
| 4 | Types of languages | Related readings |

| | | |
|----|---|------------------|
| 5 | Morphological classification of world languages | Related readings |
| 6 | Language Families | Related readings |
| 7 | Information about Short story-which is one of the genres of written narrative | Related readings |
| 8 | Midterm Exam | Related readings |
| 9 | Historical evolution of Turkish-alphabets used by Turks | Related readings |
| 10 | Phonetical characteristics and features of Turkish | Related readings |
| 11 | Clichés | Related readings |
| 12 | Ungrammatical sentences-examples(wrong word use) | Related readings |
| 13 | Ungrammatical sentences-examples (badly constructed sentences) | Related readings |
| 14 | Information about Essay-which is one of the genres of written narrative | Related readings |

RECOMMENDED SOURCES

| | |
|-----------------------------|--|
| Textbook | <p>Aksan, Doğan(1975), "Anadili", <u>Türk Dili</u>,31/285,s. 423-434</p> <p>Aksan, Doğan(1987), <u>Her Yönüyle Dil. Ana Çizgileriyle Dilbilim</u>,3 cilt , Ankara</p> <p>Aksan, Doğan (2000), <u>Türkiye Türkçesinin Dünü, Bugünü, Yarını</u>, Ankara, Bilgi yayınevi</p> <p>Ali, Sabahattin (2005), <u>Yeni Dünya</u>, İstanbul, YKY</p> <p>Ataç, Nurullah (2010), <u>Günlerin Getirdiği-Sözden Söze</u>, 7.b., İstanbul, YKY</p> <p>Atay, Oğuz (2000), <u>Korkuyu Beklerken</u>, İstanbul, İletişim Yayınları</p> <p>Çotuksöken, Yusuf (2007), <u>Uygulamalı Türk Dili</u>, İstanbul,Papatya Yayıncılık</p> <p>Hepçilingirler, Feyza (2013),<u>Türkçe "Off"</u>, 43.b.,İstanbul, Everest Yayınları</p> <p>Korkmaz, Zeynep ve diğerleri (1995), <u>Türk Dili ve Kompozisyon Bilgileri</u>, Ankara, Yüksek Öğretim Kurulu Matbaası</p> <p>Montaigne (1991),<u>Denemeler</u>,(Türkçesi: Sabahattin Eyüboğlu), İstanbul,Cem Yayınevi</p> <p>Özdemir, Emin (2008), <u>Sözlü Yazılı Anlatım Sanatı Kompozisyon</u>, İstanbul, Remzi Kitabevi</p> <p>Taner, Haldun(1995), <u>Çok Güzelsin Gitme Dur</u>, İstanbul, Bilgi Yayınevi</p> <p>Taner, Haldun (2005), <u>Şişhane'ye Yağmur Yağıyordu/Ayışığında "Çalışkur"</u>, Ankara, Bilgi Yayınevi</p> <p><u>Türkçe Ders Notları -TKL 201</u> (Haz. Bedri Selimhocaoğlu)</p> <p><u>Türk Dili,Yazılı Anlatım-Sözlü Anlatım</u> (2009), (Ed.Nurettin Demir, Emine Yılmaz),Ankara, Nobel Yayın Dağıtım</p> <p><u>Türkçe Sözlük</u> (2011), Türk Dil Kurumu Yayınları, 11. b., Ankara</p> <p><u>Yazım Kılavuzu</u> (2009), Türk Dil Kurumu Yayınları, 26. b., Ankara</p> |
| Additional Resources | |

MATERIAL SHARING

| | |
|--------------------|--|
| Documents | Xerox copies given to students before class. |
| Assignments | |
| Exams | |

ASSESSMENT

| IN-TERM STUDIES | NUMBER | PERCENTAGE |
|-----------------|--------|------------|
| Mid-terms | 1 | 100 |
| Laboratory | | |

| | | |
|---|--|------------|
| Assignment | | |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 50 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 50 |
| Total | | 100 |


| | |
|------------------------|---|
| COURSE CATEGORY | Humanities, Communication and Management Skills Courses |
|------------------------|---|

| COURSE'S CONTRIBUTION TO PROGRAM | | | | | | |
|---|--|--------------|---|---|---|---|
| No | Program Learning Outcomes | Contribution | | | | |
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | |
| 5 | Consciousness of professional ethics and responsibility | | | | | |
| 6 | Ability to communicate actively | | | | | |
| 7 | Ability of self-development in fields of interest | | | | | |
| 8 | Ability to learn, choose and use necessary information technologies | | | | | |
| 9 | Lifelong education | | | | | |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|---|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 15 | 2 | 30 |
| Hours for off-the-classroom study (Pre-study, practice) | 15 | 1 | 15 |
| Mid-terms (Including self study) | 1 | 2 | 2 |
| Quizzes | | | |
| Assignments (Term Paper) | 1 | 1 | 1 |
| Final examination (Including self study) | 1 | 2 | 2 |
| Total Work Load | | | 50 |
| Total Work Load / 25 (h) | | | 2 |
| ECTS Credit of the Course | | | 2 |

| COURSE INFORMATION | | | | | |
|--------------------|---------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| Turkish Language 2 | TKL 202 | 2 | 2 + 0 | 2 | 2 |

| | |
|----------------------|--|
| Prerequisites | |
|----------------------|--|

| | |
|--------------------------------|---|
| Language of Instruction | Turkish  |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Compulsory |
| Course Coordinator | Emrah Pelvanoğlu |
| Instructors | Emrah Pelvanoğlu |
| Assistants | |
| Goals | The course aims at helping students improve their skill in written and oral narration, by teaching them characteristics and rules of the language |
| Content | Lexicon of Turkish, study of literary texts, rules for formal correspondence, format and rules for scientific research writing and genres of oral narration |

| Learning Outcomes | Teaching Methods | Assessment Methods |
|--|------------------|--------------------|
| 1-Aims at helping students understand the subject, point of view and the main theme in fiction and informative texts | 1, 3,4 | A |
| 2-Aims at helping students understand the means and possibilities of Turkish narration | 1, 3,4 | A |
| 3-Aims at helping students understand, interpret and apply fiction and informative texts? | 1,3,4 | A |
| 4-Aims at teaching how to write a petition, report, minutes, business letters | 1,3,4 | A |
| 5-Aims at improving the students' skills in written and oral narration | 1,3,4 | A |

| | |
|----------------------------|--|
| Teaching Methods: | 1. Lecture 2. Case study 3. Discussion 4. Demonstration 5. Group work 6. Microteaching 7. Problem solving |
| Assessment Methods: | A. Classical exam B. Multiple-choice test C. Incomplete D. True-False E. Oral exam F. Portfolio G. Performance type H. Report |

| COURSE CONTENT | | |
|----------------|--|------------------|
| Week | Topics | Study Materials |
| 1 | Introduction/orientation: Giving students information about the content of the course and how the material will be covered | Related readings |
| 2 | Informative texts, fiction , subject / topic, point of view, main theme of the text. | Related readings |
| 3 | Kinds of vocabulary,(what)a paraphrase (is),genres of narrative | Related readings |
| 4 | how to write a petition, ,preparing a CV | Related readings |
| 5 | Written narrative genres: memoirs, travel, diary and letter | Related readings |
| 6 | Written narrative genres :article, essay, newspaper article / column, critique | Related readings |

| | | |
|----|---|------------------|
| 7 | (writing) reports, minutes (of a meeting) | Related readings |
| 8 | Midterm Exam | Related readings |
| 9 | Scientific research, writing summary, taking notes, bibliography and rules for footnote writing | Related readings |
| 10 | Lexicon of Turkish of Turkish(native words, loan words, idioms) | Related readings |
| 11 | Turkish Lexicon (proverbs, cliches, reduplication of words) | Related readings |
| 12 | Syntax of Turkish and semantics | Related readings |
| 13 | Fiction (novel, poetry, theatre) | Related readings |
| 14 | Genres of oral narrative | Related readings |

RECOMMENDED SOURCES

| | |
|-----------------------------|---|
| Textbook | <p>Aksan, Doğan (1999), <u>Anlambilim</u>, Ankara, Engin yayınevi</p> <p>Aksan, Doğan(1987), <u>Her Yönüyle Dil. Ana Çizgileriyle Dilbilim</u>,3 cilt , Ankara</p> <p>Aksan, Doğan(1996), <u>Türkçenin Sözcüğü</u>, Ankara, Engin Yayınevi</p> <p>Aksan, Doğan (2000), <u>Türkiye Türkçesinin Dünü, Bugünü, Yarını</u>, Ankara, Bilgi yayınevi</p> <p>Atay, Falih Rıfkı (2004), <u>Çankaya</u>, İstanbul, Pozitif yayınları</p> <p>Atay, Oğuz (2012), <u>Bir Bilim Adamının Romanı Mustafa İnan</u>,36.b., İstanbul,İletişim Yay.</p> <p>Atay, Oğuz(2013), <u>Günlük</u>,16. b., İstanbul, İletişim Yay.</p> <p>Boysan, Aydın(1997), Yollarda, Dünyadan Gezi Yazıları, 2. b., Ankara, Bilgi Yayınevi</p> <p>Çotuksöken, Yusuf (2007), <u>Uygulamalı Türk Dili</u>, İstanbul,Papatya Yayıncılık</p> <p>Kongar, Emre (2008), <u>Kızlarıma Mektuplar Yaşamdan Satırbaşları</u>, 45.b., İstanbul, Remzi Kitabevi</p> <p>Korkmaz, Zeynep ve diğerleri (1995), <u>Türk Dili ve Kompozisyon Bilgileri</u>, Ankara, Yüksek Öğretim Kurulu Matbaası</p> <p>Özdemir, Emin (2008), <u>Sözlü Yazılı Anlatım Sanatı Kompozisyon</u>, İstanbul, Remzi Kitabevi</p> <p>Özdemir, Emin (1994), <u>Yazınsal Türler</u>, 2. b.,Ankara, Ümit Yayıncılık</p> <p>Tanpınar, Ahmet Hamdi (2004), <u>Saatleri Ayarlama Enstitüsü</u>, İstanbul, Dergah Yayınları</p> <p><u>Türkçe Ders Notları -TKL 202</u> (Haz. Bedri Selimhocaoğlu)</p> <p><u>Türk Dili.Yazılı Anlatım-Sözlü Anlatım</u> (2009), (Ed.Nurettin Demir, Emine Yılmaz),Ankara, Nobel Yayın Dağıtım</p> <p><u>Türkçe Sözlük</u> (2011), Türk Dil Kurumu Yayınları, 11. b., Ankara</p> <p><u>Yazım Kılavuzu</u> (2009), Türk Dil Kurumu Yayınları, 26. b., Ankara</p> |
| Additional Resources | |

MATERIAL SHARING

| | |
|--------------------|--|
| Documents | Xerox copies given to students before class. |
| Assignments | |
| Exams | |

ASSESSMENT

| IN-TERM STUDIES | NUMBER | PERCENTAGE |
|-----------------|--------|------------|
| Mid-terms | 1 | 100 |
| Laboratory | | |
| Assignment | | |

| | | |
|---|--|------------|
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 50 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 50 |
| Total | | 100 |


| | |
|------------------------|---|
| COURSE CATEGORY | Humanities, Communication and Management Skills Courses |
|------------------------|---|

| COURSE'S CONTRIBUTION TO PROGRAM | | | | | | |
|---|--|--------------|---|---|---|---|
| No | Program Learning Outcomes | Contribution | | | | |
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | |
| 5 | Consciousness of professional ethics and responsibility | | | | | |
| 6 | Ability to communicate actively | | | | | |
| 7 | Ability of self-development in fields of interest | | | | | |
| 8 | Ability to learn, choose and use necessary information technologies | | | | | |
| 9 | Lifelong education | | | | | |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|---|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 15 | 2 | 30 |
| Hours for off-the-classroom study (Pre-study, practice) | 15 | 1 | 15 |
| Mid-terms (Including self study) | 1 | 2 | 2 |
| Quizzes | | | |
| Assignments (Term Paper) | 1 | 1 | 1 |
| Final examination (Including self study) | 1 | 2 | 2 |
| Total Work Load | | | 50 |
| Total Work Load / 25 (h) | | | 2 |
| ECTS Credit of the Course | | | 2 |

| COURSE INFORMATION | | | | | |
|-------------------------------|---------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| History of Turkish Revolution | HTR 301 | 1 | 2+0 | 2 | 2 |

| | |
|----------------------|--|
| Prerequisites | |
|----------------------|--|

| | |
|--------------------------------|--|
| Language of Instruction | Turkish  |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Compulsory |
| Course Coordinator | |
| Instructors | |
| Assistants | |
| Goals | The basic purpose of the programme is to provide the students with a common understanding on the usefulness and the effective methods of studying history, on the importance of revolutionary history of Turkey and on the role of Ataturk, |
| Content | The fields of study of the programme are the Ottoman history, war of independence, achievements and leadership values of Mustafa Kemal Ataturk the process of founding the Turkish Republic, social and political history of the 20th century. |

| Learning Outcomes | Teaching Methods | Assessment Methods |
|--|------------------|--------------------|
| 1) Expresses the historical background of Republic of Turkey | 1,2,3 | A |
| 2) Analyzes Turkish War of Independence after the First World War, | 1,2,3 | A |
| 3) Relates National Movement and its aims. | 1,2,3 | A |
| 4) Explains the foundation philosophy of The Grand National Assembly of Turkey | 1,2,3 | A |
| 5) Interprets the fully independence of a new Turkish state | 1,2,3 | A |
| 6) Teaches the basic principles of Republic | 1,2,3 | A |

| | |
|----------------------------|--|
| Teaching Methods: | 1: Lecture, 2: Question-Answer, 3: Discussion, |
| Assessment Methods: | A: Exam ,B; Test C: Homework |

| COURSE CONTENT | | |
|----------------|--|-----------------|
| Week | Topics | Study Materials |
| 1 | The Enlightenment Period | |
| 2 | Industrial and French Revolutions | |
| 3 | The Europe in 19th century and the processes which caused to the First World War | |
| 4 | Trials for the modernization in Ottoman state | |
| 5 | Tanzimat - Islahat Reforms and Constitutionalism | |

| | | |
|----|--|--|
| 6 | The war of Trablusgarp and Balkans and their results | |
| 7 | The First World War and Armistice | |
| 8 | Midterm Exam | |
| 9 | The developments after Armistice and Mustafa Kemal's departure to Samsun | |
| 10 | The Aim of National Movement, Methods and the period of Congress | |
| 11 | National Ant, the period of Grand National Assembly of Turkey | |
| 12 | The Fronts and final treaties which closed the Fronts | |
| 13 | Sakarya War, Battle of Dumlupınar, Armistice of Mudanya and the treaty of Lausanne, Abolishment of Sultanate | |
| 14 | General Revision | |

RECOMMENDED SOURCES

| | |
|-----------------------------|---|
| Textbook | |
| Additional Resources | <p>- İmparatorluktan Ulus Devlete Türk İnkılap Tarihi, Öztürk, Cemil (Prof.Dr.) (Editör) Yazarlar : Tülay Alim BARAN (Prof.Dr.),Edip Başer (Dr.), Süleyman Beyoğlu(Prof.Dr.), Handan Diker(Dr.), Vahdettin Engin (Prof.Dr.), Cezmi Eraslan (Prof.Dr.), Arzu M.Erdoğan (Dr.), Cemil Öztürk (Prof.Dr.) - Nutuk</p> |

MATERIAL SHARING

| | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

ASSESSMENT

| IN-TERM STUDIES | NUMBER | PERCENTAGE |
|---|--------|------------|
| Mid-terms | 1 | 100 |
| Laboratory | | |
| Assignment | | |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 50 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 50 |
| Total | | 100 |


| | |
|------------------------|---|
| COURSE CATEGORY | Humanities, Communication and Management Skills Courses |
|------------------------|---|

| COURSE'S CONTRIBUTION TO PROGRAM | | | | | | |
|----------------------------------|--|--------------|---|---|---|---|
| No | Program Learning Outcomes | Contribution | | | | |
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | |
| 5 | Consciousness of professional ethics and responsibility | | | | | |
| 6 | Ability to communicate actively | | | | | |
| 7 | Ability of self-development in fields of interest | | | | | |
| 8 | Ability to learn, choose and use necessary information technologies | | | | | |
| 9 | Lifelong education | | | | | |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|--|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 16 | 2 | 32 |
| Hours for off-the-classroom study (Pre-study, practice) | 16 | 1 | 16 |
| Mid-terms (Including self study) | 1 | 1 | 1 |
| Quizzes | | | |
| Assignments | | | |
| Final examination (Including self study) | 1 | 1 | 1 |
| Total Work Load | | | 50 |
| Total Work Load / 25 (h) | | | 2 |
| ECTS Credit of the Course | | | 2 |

| COURSE INFORMATION | | | | | |
|-------------------------------|---------|----------|----------|---------|------|
| Course Title | Code | Semester | L+P Hour | Credits | ECTS |
| History of Turkish Revolution | HTR 302 | 2 | 2+0 | 2 | 2 |

| | |
|----------------------|--|
| Prerequisites | |
|----------------------|--|

| | |
|--------------------------------|--|
| Language of Instruction | Turkish  |
| Course Level | Bachelor's Degree (First Cycle Programmes) |
| Course Type | Compulsory |
| Course Coordinator | |
| Instructors | |
| Assistants | |
| Goals | The basic purpose of the programme is to provide the students with a common understanding on the usefulness and the effective methods of studying history, on the importance of revolutionary history of Turkey and on the role of Ataturk, |
| Content | The fields of the programme are to study the external and internal events in the new state after Laussane Treaty. Moreover following Ataturk's period, it is discussed the Turkish Foreign Policy in the new period which was particularly established after the Second World War.(Turkey's joining to security pacts and the relations with European Union) |

| Learning Outcomes | Teaching Methods | Assessment Methods |
|---|------------------|--------------------|
| 1) Expresses Republic of Turkey's position in International arena after Lausanne treaty | 1,2,3 | A |
| 2) Analyzes Social and Political reforms | 1,2,3 | A |
| 3) Relates Ataturk's Principles and Revolutions | 1,2,3 | A |
| 4) Explains Ataturk's Foreign Policy notion | 1,2,3 | A |
| 5) Interprets Turkey's position in the 21 st century | 1,2,3 | A |

| | |
|----------------------------|--|
| Teaching Methods: | 1: Lecture, 2: Question-Answer, 3: Discussion, |
| Assessment Methods: | A: Exam ,B; Test C: Homework |

| COURSE CONTENT | | |
|----------------|---|-----------------|
| Week | Topics | Study Materials |
| 1 | Lausanne Peace Treaty (compare to treaty of Sevres) | |
| 2 | The reforms in political areas (abolition of Sultanate-the establishment of Republic) | |
| 3 | The reactions against Political reforms and trial for Multi-Party system | |
| 4 | Social and Cultural Reforms | |
| 5 | Economic Developments | |

| | | |
|----|---|--|
| 6 | The developments in Science and Education systems | |
| 7 | Midterm Exam | |
| 8 | Turkish Foreign Policy in 1939-1945 | |
| 9 | Economic and Law developments after 1938 | |
| 10 | The Second World War, Turkish Foreign Policy in the Second World War | |
| 11 | The developments after Second World War, the membership for European Union, the relations between Turkey and the United States, National Security | |
| 12 | Atatürk's Principles | |
| 13 | General Review | |
| 14 | General Revision | |

RECOMMENDED SOURCES

| | |
|-----------------------------|---|
| Textbook | |
| Additional Resources | <p>- İmparatorluktan Ulus Devlete Türk İnkılap Tarihi, Öztürk, Cemil (Prof.Dr.) (Editör) Yazarlar : Tülay Alim BARAN (Prof.Dr.),Edip Başer (Dr.), Süleyman Beyoğlu(Prof.Dr.), Handan Diker(Dr.), Vahdettin Engin (Prof.Dr.), Cezmi Eraslan (Prof.Dr.), Arzu M.Erdoğan (Dr.), Cemil Öztürk (Prof.Dr.)</p> <p>- Nutuk</p> |

MATERIAL SHARING

| | |
|--------------------|--|
| Documents | |
| Assignments | |
| Exams | |

ASSESSMENT

| IN-TERM STUDIES | NUMBER | PERCENTAGE |
|---|--------|------------|
| Mid-terms | 1 | 100 |
| Laboratory | | |
| Assignment | | |
| Total | | 100 |
| CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE | | 50 |
| CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE | | 50 |
| Total | | 100 |

| | |
|------------------------|---|
| COURSE CATEGORY | Humanities, Communication and Management Skills Courses |
|------------------------|---|

| COURSE'S CONTRIBUTION TO PROGRAM | | | | | | |
|----------------------------------|--|--------------|---|---|---|---|
| No | Program Learning Outcomes | Contribution | | | | |
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | The ability to make computation on the basic topics of mathematics such as limit, derivative, integral, logic, linear algebra and discrete mathematics which provide a basis for the fundamental research fields in mathematics (i.e., analysis, algebra, differential equations and geometry) | | | | | |
| 2 | Acquiring fundamental knowledge on fundamental research fields in mathematics | | | | | |
| 3 | Ability form and interpret the relations between research topics in mathematics | | | | | |
| 4 | Ability to define, formulate and solve mathematical problems | | | | | |
| 5 | Consciousness of professional ethics and responsibility | | | | | |
| 6 | Ability to communicate actively | | | | | |
| 7 | Ability of self-development in fields of interest | | | | | |
| 8 | Ability to learn, choose and use necessary information technologies | | | | | |
| 9 | Lifelong education | | | | | |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
|--|----------|-----------------|-----------------------|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (14x Total course hours) | 16 | 2 | 32 |
| Hours for off-the-classroom study (Pre-study, practice) | 16 | 1 | 16 |
| Mid-terms (Including self study) | 1 | 1 | 1 |
| Quizzes | | | |
| Assignments | | | |
| Final examination (Including self study) | 1 | 1 | 1 |
| Total Work Load | | | 50 |
| Total Work Load / 25 (h) | | | 2 |
| ECTS Credit of the Course | | | 2 |