المملكة العربية السعودية
وزارة التعليم
جامعة جازان
كلية العلوم

Curriculum Overview and Study Plan

Mathematics Program

قسم الرياضيات

Department of Mathematics

College of Science,

Jazan University, Jazan, KSA

1. Table of Contents

1. About the Program

The Mathematics Program was established to prepare specialized qualified mathematicians in order to contribute and achieve the progress of the society of the Kingdom of Saudi Arabia in so numerous fields as general and higher education, health, agriculture and society employment.

The department of mathematics offers its students a distinct learning experience through coherent programs and benchmarked degrees. The self-study recommends investigating ways to support learning on mathematical skills of students. More effort is being exerted on attracting research funds for students to promote their knowledge and skills in research. Furthermore, the Department offers training services to students for the qualifying national exams through Calculus Cafe and Mathematics Clubs, also provide text training program for students

In addition, the Department takes the responsibility of mathematics courses required by other programs of the College of Science such as, Chemistry, Physics, and Biology. The department also teaches mathematics and statistics courses at the Computer Science, Engineering, Pharmacy and Business Administration Colleges.

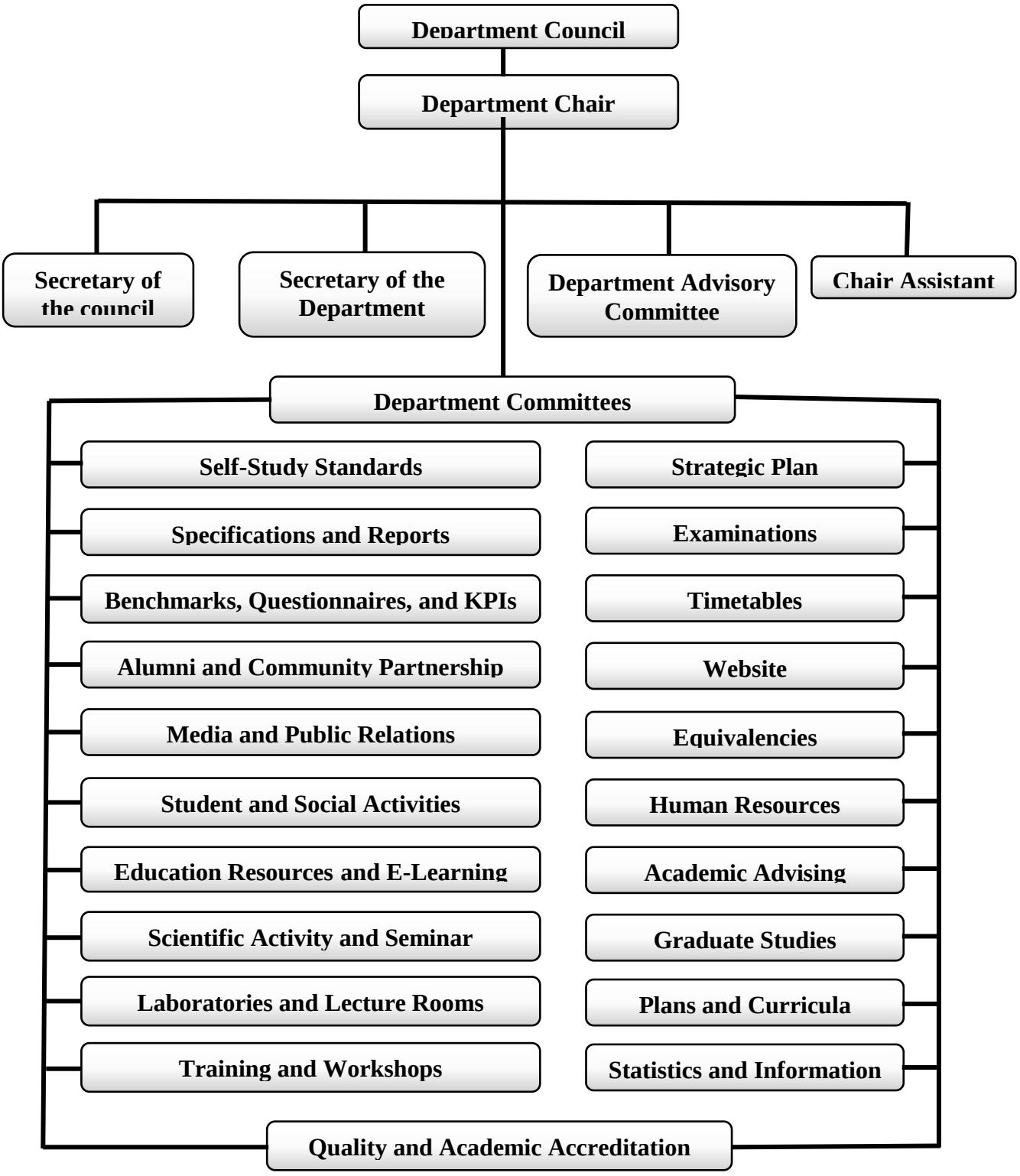
The educational objectives of the degree program in Mathematics reflect the mission, vision and values of Jazan University also consistent with the College of Science

The system of Higher Education Saudi requires at least 130 credit hours for Bachelor's degree (equivalent to **248.88** ECTS credit points). Jazan University regulates the education to enable the student to complete his/her bachelor degree in Mathematics in four years of full-time study.

1.1 Establishment

The Mathematics Degree program at the College of Science, Jazan University was established in 2006 after the approval letter from the Ministry of Higher Education on 08-08-1426H. It is continuously developing and improving in teaching and research. In 2018, the Master of Science program was started in the Department of Mathematics. Thus, the Department awards, B.Sc and M.Sc degrees in Mathematics.

The Mathematics Program Management System and Regulations Includes boards, councils, units, committees, etc. are shown in the following diagram.



1.2 Vision Statement

Mathematics Program Vision
Excellence in different fields of mathematics science to achieve competitiveness at the level of the Kingdom and the region through its research, teaching and community service

1.3 Mission Statement

Mathematics Program Mission
To produce competent graduates in mathematics and motivate scientific research to enrich and serve the surrounding society in view of KSA vision-2030

1.4 Goals and Objectives.

No.	Mathematics Program Goals
1	To use a variety of models and methods in order to define, represent and solve mathematical problems
2	To communicate mathematical reasoning symbolically, verbally and in writing
3	Use critical thinking and problem solving skills to analyze and assess the validity of mathematical information
4	Effectively use technology to communicate, collect, display and analyze information
5	To provide with the skills required to succeed in a mathematics work or related field
6	To perform effectively, individually or within group

The main objectives of the program to fulfill the department six goals are as follows;

No.	Mathematics Program Objectives
1	Understand mathematical concepts and definitions, and to extend and generalize them to new situations
2	Good understanding of a few major realms of pure and applied mathematics. Gain admittance to a graduate program in mathematics
3	To enrich the scientific research in specialty areas, that has positive impact on updating student knowledge
4	To read and explain mathematics journal articles orally or in writing
5	To encourage research programs and participation in specialized scientific conferences using appropriate presentation tools to support the communication of mathematical documents
6	Be able to teach mathematics in primary or secondary schools; obtain employment in math-related fields
7	Develop skills to oral presentations to mathematics peers and professors

1.5 Values.

Jazan University Values	
Citizenship	Cherishing national identity and sensing social responsibility
Affiliation	A sense of commitment and initiative towards the goals and objectives of the university
Responsibility	Adherence to ethical standards and business values
Excellence	Application of standard practices and provision of quality services
Building competences	Investing in Human Capital
Teamwork	Devoting the principle of cooperation and work in the spirit of one team

Mathematics Program Values	
Mathematical Attitude	Cultivate a fine mathematical taste
Affiliation	Assess the impact of Mathematics in sustainable development of society
Teamwork & Responsibility	Sense of self-awareness, teamwork, emotional intelligence, social and ethical responsibilities in practicing Mathematics and its applications
Excellence	Skills in managing knowledge and ability to solve variety of problems in sciences and technical specialty courses
Building competences	Relevant academic and scientific competencies

1.6 Degree Offered.

The Department of Mathematics awards, Bachelor of Science (B.Sc) and Master of Science (M.Sc) degrees in Mathematics/ College of Science / Jazan University

No.	Mathematics Degree Programs
1	Bachelor of Science (B.Sc.)
2	Master of Science (M.Sc.)

2. Program General Information

2.1 Branches and Locations.

The Department of Mathematics, College of Science is located in the main campus of Jazan University on the heart of the Red sea whereas the other branches of Mathematics Departments are in Al-Darb and Al-Dayer as shown in the Table.

Program Mathematics		
	Main Campuses	**Locations**
1	Male Campus in Jazan	College of Science, Jazan University, New Campus, Jazan
2	Female Campus in Jazan	College of Science, Mahaliya, Jazan
	Branches	**Locations**
1	University College in Al-Darb	College of Science and Arts, Al-Darb
2	University College in Al-Dayer	College of Science and Arts, Al-Dayer

2.2 Teaching Facilities (Classes, Laboratories, Library)

2.2.1 Classes

A full-time study is conducted over five days/week (Sunday-Thursday). Courses conduct for two or three semesters per year, including the summer semester. The summer courses are offered only for special cases. The mandatory attendance for students is 75% at least, for each course in the program. Variable teaching methodologies are applicable as using traditional classes, smart classes as well as e-learning which help in self-study and also distance education.

The duration of each lecture is 50 minutes and scheduled two to three lectures per week. An instructor is responsible to conduct the classes and all teaching activities in a group of 10-40 students. All the outlines and details belong to the courses in programs are displayed in Section-6: Study plan and Course Description

2.2.2 Laboratories

The department has well equipped laboratories to meet the academic and research requirements of students and teachers. It has four computer labs equipped with modern computers and required software that are important in teaching many of the subjects. The laboratories are allocated according to specialization pure mathematics, applied mathematics, statistics as shown in the table

2.2.3 Library

The Library facilities provided by the **Deanship of Library affairs** at Jazan University can be seen in three different parts. First is the library facility available in the College of sciences, second is the main central library of the university and third is Saudi digital library. We will give small details for all of them.

The Library of College of science is inside the College of science building and therefore provides the easiest access for the teaching staff and students to the available books and related materials. There are two different College of Science libraries, one in male and the other in female campus. The library at College of science contains mostly targeted set of books which covers the list of recommended books offered in various discipline of sciences including Mathematics. Further details on the College of science library including timings and library rules are available in (**Appendix Math4.8)**. For the detailed list of available books in the College library to support Mathematics program can be seen in (**Appendix Math4.9)**.

The *Central Library* at Jazan University was established in year 2006 to support for science and culture, and to provide required academic services to the students and staffs of Jazan University. The new central library is located after moving to its new building on the north side of the university administration headquarters and it consists of three floors consisting of its estimated area about 1218 square meters, distributed over the sections of the library and the headquarters of the library affairs. The central library is divided in five different administrative sections. Namely, the department of Arabic books, the department of foreign books, the university theses department, the periodicals department and the manuscripts center.

The list of available books related to Mathematics in the central library is given in (**Appendix Math4.10)**. For further details related to Central library, one can see library handbook in (**Appendix Math4.11**).

The Saudi digital Library (SDL) is an integrated digital library source managed by the Ministry of Higher Education of Saudi Arabia. The SDL is the largest academic cluster of updated information sources in the Arab world, with more than (310,000) scientific sources that covers all academic areas or disciplines. The SDL has contracts with more than 300 best global publishers. The library won the award for the Arab Federation for Libraries and Information 'know' for outstanding projects in the Arab world in 2010. The library provides one set of information to all the universities and research organizations in the Kingdom of Saudi Arabia through digital environment to ensure standard facilities. Any further relevant detail can be found on SDL official website. In Jazan University, any staff member or student can access SDL by using their secure ID and password on the dedicated website link (https://sdl.jazanu.edu.sa).

2.3 Teaching Strategies

Mathematics program learning outcomes (PLOs) are designed according to the National Qualification Framework (NQF) provides three learning domains; Knowledge and Understanding, Skills and Values (SAQF-2020).

Program Learning Outcomes (PLO) and Teaching Strategies			
Code	**Program Learning Outcomes**	**Teaching Strategies**	**Assessment Methods**
Knowledge and Understanding			
K1	Distinguish mathematical concepts relevant to pure and applied mathematics.	Lectures, Classroom discussions	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
K2	Identify background science, features and structure of mathematical problem.	Lectures, Classroom discussions	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
K3	Explain notations and concepts required for the solution of Mathematical problem.	Lectures, Classroom discussions	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
Skills			
S1	Apply theoretical, computational or practical aspect relevant to course Content.	Lectures, problem solving, Classroom discussions	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
S2	Compute numerical quantities for various parameters to approximate the solution.	Lectures, problem solving, Classroom discussions	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
S3	Apply various mathematical rules, techniques and theorems in Application.	Lectures, problem solving, Classroom discussions	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
S4	Solve mathematical problem using critical thinking.	Lectures, problem solving, Classroom discussions.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
Values			
V1	Cultivate a mathematical attitude and nurture the interest.	Micro-Project Teamwork Small Presentation Extempore	Similarity Group Assignment Observation Group Discussion
V2	Realize the importance of responsibilities through different modes of practice, competition and related activities		
V3	Inculcating values and ethics in thought, expression and deed.		

The program learning outcomes were established by a process that involved extension discussions with faculty members, students, Alumni and the quality assurance and accreditation committee. The program learning outcomes support program educational objectives.

The overall learning outcome is measured by the continual student's assessment, quizzes, tutorial participation, and presentations delivery, active participation during classes, small group discussions midterm exams and final exams. Although all courses have goals and objectives included in course descriptions, the achievement of these goals is assessed through a rigorous evaluation process. This evolution process is done through surveys and normally carried out at the end of each semester.

2.4 Other Facilities (IT, Students Campus Facilities, etc…).

2.4.1 Information Technology

The Deanship of e-learning and distance education in the Jazan University is responsible to provide integrated administrative and educational e-services for all stakeholders at the university. These customized services are provided for the teaching Staff, Students and employees of the university through the University website and mobile applications that can be accessed with a dedicated ID and password.

Following is a brief summary of some important e-services provided by Jazan University:

- E-learning: Each teaching staff and each student has access to the world-renowned distance learning management system “Blackboard Learn”, where teaching staff can manage complete online teaching process irrespective of on-campus or distance learning courses. The learning management system is kept integrated and updated with respect to students, teachers, and courses in the respective program. It is worth mentioning that the pre-existence of this service was the reason for the smooth distance learning transition for all courses during the COVID-19 crises.
- Email: The Jazan University provides an email system for all stake-holders that is powered by Microsoft with the domain “username@jazanu.edu.sa”.
- The Edugate Portal: A secured and advanced integrated online environment to manage attendance, marks, surveys, class and faculty schedules, and several other necessary services required for educational processes.
- Employee Affairs services: These services provide detailed information of employee, his/ her job status, salaries, and other financial affairs. It is also a gateway to provide administrative letters and financial statements to all employees.

The other key services are free access to Microsoft office 365, Saudi digital library, all application forms, and a strong application management system.

2.4.2 Students Campus Facilities

The Department ensures all necessary and sufficient Equipment for all stakeholders in the department. In the male campus, each classroom at the Department is equipped with smart board, projector, including ordinary white board in case the smart board is malfunctions. All of the staff offices contain an office chair, two guest chairs, office table, computer table, a small coffee table, and a set of cabinet to ensure required comfort. There is a general cafeteria area for the faculty and students to spend some refreshing time with each other and discuss problems. Also, two designated praying areas are assigned for teachers and students. Each faculty member is provided with a personal laptop and/ or office desktops, a printing facility and a photocopy machine for academic purposes. The Department has also provided 4 computer labs facility for students and teachers; it contains all necessary software for scientific learning and research.

For the detailed list of available classrooms, labs and included facilities please see the updated list of available resources and report of Classroom and Lab committee of the department in (**Appendix Math4.7)**.

The Departments security is monitored through 24 hours on campus security guards and security cameras, provided by College of science. Adequate cleaning facilities are also available in the department to maintain high-quality hygiene standards.

Some general facilities are provided by the college of science such as cafeteria, Mosque, book store, library, gym and indoor games for exertion. The VPN network and Wi-Fi internet is available for all employees and students in the College of science building. These facilities are comparable with other College program at any university inside the Kingdom.

2.5 Student Advising Policy

Academic advising & counseling service is an assistant educational system, where the faculty members introduce the students to the university and college systems and inform them by their roles, responsibilities and rights (**Appendix Math2.6**). Academic advising & counseling service provides guidance and support for students to overcome any academic problems or personal difficulties that may hamper student's academic progress, as well as develops the students' capacities and potentials, that enhances their academic performance. Academic advising and counseling services are basic steps that guarantee a collaborative relationship between faculty members and students. The intent of this collaboration is to facilitate learning by providing opportunities for students to achieve their goals and uphold the academic standards of the college. Each student at the Department of Mathematics is assigned a faculty advisor at the time of his initial enrolment. The faculty advisor is available to solve any problem that might arise during the student program. The University considers student advising by faculty as an important teaching-related activity. The faculty advisor is expected to advise students in planning their

academic programs during early registration, and throughout their academic year. The faculty advisor has the following main roles: (**Appendix Math2.2**)

- Assign Teaching staff member as academic advisor to a group of students
- Announce reminder about the meeting between advisor and the student
- Monitor student attendance record.
- The academic advisor helps his students examine the course offerings in their major and understand their graduation requirements.
- The academic advisor helps the student explore the career fields within his/her major, and obtain related career information and survey job opportunities.
- The academic advisor serves as a link between the student and the administration by counseling the student on matters of failure, on the procedures for dropping and adding courses, course scheduling, and academic progress.
- The academic advisor must alarm students of the exclusion procedure well in advance and of any subsequent changes that might be enforced during the course of their studies.

In the department of Mathematics and the College of Science there are academic guidance units which aim to:

- Provide accurate and up-to-date information.
- Clarify the requirements, policies and procedures of the Programs being offered.
- Approve students' Programs of study and assist them in identifying appropriate resources.
- Facilitate relationships between the student and others within the University who may also be able to provide relevant assistance.
- Advise on and help in realizing educational and career options.
- Uphold the standards of the University.

The Deanship of Admission & Registration offers non-academic services which in turn make the learning and education processes more enjoyable. Some of these services are as follows: (**Appendix Math2.2 & JU2.3**)

- Issuing Student IDs
- Housing
- Students Fund
- Catering Service
- Scholarships

2.6 Attendance and Exam Policies

2.6.1 Attendance

Mathematics Study Program activities carried out with the number of students around 30-35 per class (regular classes), with the rule of student attendance of at least 75%. Response activities are carried out by the lecturer concerned or by the teaching assistant. The design of developing the academic climate is to include some of the above facilities as a structured meeting that must be conducted by students.

In addition, there is a planned work agenda for each study group or institution.

(a) The development of academic atmosphere in learning is carried out by providing facilities and infrastructure to support learning activities such as the use of multimedia projectors, provision of dictates, construction/ investment of laboratories, provision of scientific journals and provision of internet access. Then the application of active learning methods, prevention and application of disciplinary action sanctions, and transparency in the assessment system.

(b) The development of an academic atmosphere in research is carried out by conducting internal seminars, holding seminars/ public lectures by inviting researchers from domestic and abroad.

Development of an academic atmosphere in community service is done by involving students in community service activities. The development of scientific personality has been applied to students and lecturers since they first entered the Mathematics This scientific personality is also instilled in the learning methods used in each course, where a lecturer always uses the discussion method to develop scientific interactions between lecturers and students in the classroom. Lecture activities and other campus activities that are conducive produce excellent students.

To sit in exam Jazan University requires 75% attendance of the total number of lectures, labs and tutorials. Students failing to meet this requirement in any of the courses are prohibited from attending the final examination of that course and earn a DN (Denied) grade in that course. A student who is absent in the final examination of a course(s) for a valid reason accepted by the department council and the Dean of the College is allowed to take the examination at a later date.

75% attendance is mandatory to appear in Exams. If any student fails to avail 75% attendance of the total lecture then he/she will not be allowed to sit in final exam and shall get DN grade that is denied entry in that respective course.
The Edugate Portal is a secured and advanced integrated online environment to manage attendance, marks, surveys, class and faculty schedules, and several other necessary services required for educational processes.

Mathematics Study Program activities carried out with the number of students around 30-35 per class (regular classes), with the rule of student attendance of at least 75%. Response activities are carried out by the lecturer concerned or by the teaching assistant. The design of developing the academic climate is to include some of the above facilities as a structured meeting that must be conducted by students.

2.6.2 Exam Policies

Student's achievements or success are based on many things in which exam are the key point with the learning outcomes of the course plan on the syllabus. The syllabus is actually a reflection of blueprint of the course, which determines the learning method and strategy to assist the students in achieving the best results to perceive their goals. The undergraduate program in the mathematics department of the College of Science, Jazan University, Jazan, has specific objectives aligned with the learning outcomes of the courses. The exams in the undergraduate program in the mathematics department are aimed based on learning outcomes planned on the syllabus of the course and is based on many other methods for example midterm exam-1, midterm exam-2, quizzes, home works, assignments, students participation, attendance and their final exam at the end of the semester. These methods are utilized to ensure that the desired program outcomes are achieved. The grades are direct reflection of the course outcomes. Each course in the department of mathematics has a total of 100 points. Final Grade Breakdown of the course shown in the Table given below.

Final Grade Breakdown of the Course		
No	**Assessment task**	**Proportion of Total Assessment**
1-	Assignments & Quizzes	**10%**
2-	First Mid-Term Exam	**20%**
3-	Second Mid-Term Exam	**20%**
4-	Final Exam	**50%**
	Total	**100%**

The exam as an assessment of learning outcomes is carried out in an aimed, unified, and ongoing method that can function as a competent evaluator to describe the development of student learning thoroughly and be able to motivate student learning better. In order to organize the academic activities of the undergraduate program, the college of science gives guidelines for each department. Before the new semester started, the mathematics department declares planning and schedule together with the syllabus comprising information about course learning objectives, prerequisites, description, content, assignments, textbook, readings, evaluation procedures, teaching methods, grading standard, office hours to the Faculty. When the semester ends, instructors should submit the grades and copies of their midterm exams-1, midterm exam

2, final exam, quizzes, assignments, home works and sample solutions copies of students with sample solution copies of each entity on a Google drive folder link provided by the quality unit in the department to all the faculty members to submit all e-files therein. All documents summited are essential for controlling the quality of the study program.

After completion of exam the instructor has to submit the result within 48 hours from the exam time on Edugate system https://edugate.jazanu.edu.sa/jazan/init. Before submitting the results the following documents stated in the following Table has to be submitted first to the departmental quality unit.

Semester Time Plan for Submitting the Course Quality File	
#	**Documents (Print &Soft)**
1	Instructor C.V. (if not provided before to the related course)
2	Teaching plan of present Semester
3	Quizzes & Homework's + 2 student answer samples
4	1st Midterm exam sheet + model answer +3 students samples (High/ Average /Low)
5	2nd Midterm exam sheet + model answer +3 students samples (High/ Average /Low)
6	Practical Quiz+ Practical Quiz model answer
7	Practical final exam+ instructor model answer + 3 students samples (High/ Average /Low)
8	Final exam sheet+ model answer + 3 students samples (High/ Average /Low)
9	Print copy of CES Edugate + CES excel page
10	LO assessment results-(excel and print all excel sheets)
11	NCAAA course report based on final version 2020 (mail, Female, Combined M & F, Combined M & F + Aldarb + Alddayer)
12	last absence record of students on Edugate system
13	Exam Cross Check Form of Examination Committee

The schedule of exam is as follows: Midterm Examination: Midterm-1 holds in week six/seven and Midterm-2 in week twelve/thirteen of the semester. Final Examination: week fifteen/sixteen of the semester. The University arranges examinations schedule for courses following the academic calendar. Examination dates and times for each department can be accessed in the College web site. Therefore, the exam schedule is always up-to-date. For both the midterm and final exams, the students who are unable to take these exams are required to apply for re-examination. About transparency after the assessment, students have the right to receive a duplicate of the paper assessed. After finishing Mid 1 and Mid 2 exams they can see their grades

on university black board system https://lms.jazanu.edu.sa/webapps/login/?action=login. The students have right to obtain information about the application of examination criteria to their study attainments. They shall be allowed to see the assessed study attainment. At the beginning of the semester, students get all information related to the courses and evaluation from their academic advisor. Students also can get information from the College website. At the end of the semester, students can access their grades from the University Academic System (https://edugate.jazanu.edu.sa/jazan/init). It contains two papers for midterm and final examination the correlation between the exam and PLO can be explained as follow:

To sit in exam Jazan University requires 75% attendance of the total number of lectures, labs and tutorials. Students failing to meet this requirement in any of the courses are prohibited from attending the final examination of that course and earn a DN (Denied) grade in that course. A student who is absent in the final examination of a course(s) for a valid reason accepted by the department council and the Dean of the College is allowed to take the examination at a later date.

3. Employment Outlook

Student graduating from the mathematics program comply regulations education of the KSA Universities defined by the Ministry of Education. The content of the Bachelor's Degree Program in Mathematics is determined on the basis of the general requirements concerning the teaching of Mathematics, and the needs and expectations of the Schools and Banking sectors.

The number of employees within the Mathematics field is likely to increase in the next decade. The proportion of University graduates will also increase, because of an increasing demand for Mathematics knowledge and skills in the industries within the application field. The most important fields our graduates can work in Teaching, Different Industries, Banking sectors, etc.

The KPIs showing in Table below is about the percentage of graduates from the program who within a year of graduation are employed during the first year of their graduation to the total number of graduates in the same year. It is clear that from the last year Alumni data around half of the graduates were employed in various sectors.

KPI: Graduates' Employability					
Actual Benchmark		**Target Benchmark**	**Internal Benchmark***	**External Benchmark****	**New Target Benchmark**
Overall	29%	40%	40%	45%	40%
Girls	8.9%				
Boys	49%				

3.1 Program Graduates Features.

The Mathematics Program was established to prepare specialized qualified mathematicians in order to contribute and achieve the progress of the society of the Kingdom of Saudi Arabia in so numerous fields as general and higher education, health, agriculture and society employment.

The department of mathematics offers its students a distinct learning experience through coherent programs and benchmarked degrees. The self-study recommends investigating ways to support learning on mathematical skills of students. More effort is being exerted on attracting research funds for students to promote their knowledge and skills in research.

No.	Mathematics Program Graduates Attributes
1	Deep discipline knowledge
2	Critical thinking and problem solving
3	Teamwork and communication skills
4	Career and leadership readiness
5	Self-awareness and emotional intelligence

3.2 Program Graduates and University Graduates Features.

JU has a clear academic structure to support the curriculum design, based on levels. The levels' structure also establishes the basis upon which each student's achievement can be measured and upon which progression through the program can be approved.

An undergraduate program comprises a minimum of eight levels, and is delivered in a semester system. The exact number of levels for any program is specified in the study plans and program specifications. Two main semesters of 15 weeks and a summer semester or term of not more than eight weeks duration are the building blocks of the academic year, against which each college designs the study plan of every program offered. The periods of registration and final examination are not considered as a part of this period which defines a semester.

The credit hour formula is based on a numbering system in which a full-time student load is 15 to 18 credit hours in a semester and 120 to 138 credit hours in a four-year degree. The credit hour formula is used as a substitute for estimates of the amount of learning achieved. If a program has a high number of contact hours this formula can result in an unrealistically high number which does not accurately represent the amount of learning that can reasonably be expected.

Jazan University agreed to a number of revisions to its Graduate Attributes in 2021. These are incorporated into the list below.

No.	University Graduates Attributes	
1	Research and knowledge inquisitiveness and practical application of knowledge:	Graduates show a comprehensive and extensive knowledge of specialization and an understanding of the link of specialization with other areas through the practical application of knowledge and continuous self-learning
2	The ability to solve problems and make decisions:	Identifying problems by critical analytical thinking and solutions using creative thinking, and is able to evaluate opinions and make informed decisions.
3	Commitment to values, ethics and responsibility:	Committed to professional ethics, Islamic and community values, social responsibility through good citizenship and community service as well as responsibility, appreciation of cultural diversity and respect for other cultures
4	Effective communication:	Graduates can communicate effectively verbally and in writing.
5	Digital communication	The graduate is able to access, evaluate and use information effectively and efficiently and creatively in sustainable learning, scientific research and effective communication
6	Leadership and teamwork:	Graduates can lead teams and guide them towards achieving the desired goals, and work to develop entrepreneurial ideas and projects in self-determination and in cooperation with others.

4. Learning Outcomes.

4.0 Institute Learning Outcomes (ILO's).

The below mentioned eight learning outcomes represent the educational values of Jazan University, as a whole, that allow all students, regardless of their course of study, the opportunity to share in a collective academic culture and environment

Code	Institute Learning Outcomes (ILOs)
1	Analyze and explain theories, concepts, principles, skills and practices in different disciplines. **(Knowledge and understanding)**
2	Demonstrate leadership qualities and skills needed to communicate effectively with others orally and in writing in a sound language **(skills and values)**
3	Commit to professional and ethical behaviors and show team spirit **(values)**
4	Apply independent and critical thinking innovatively to solve complex problems **(skills).**
5	Apply sustainable learning skills in all scientific and community aspects on environmental, economic and social issues **(values)**
6	Promote the concept of community responsibility towards scientific and life issues. **(Values)**
7	Apply the skills and ethics of scientific research, innovation and creativity efficiently. **(Skills)**
8	Apply knowledge by accomplishing practical skills brilliantly (practical skills)

4.1 Program Learning Outcomes (PLO's).

Mathematics program learning outcomes (PLOs) are designed according to the National Qualification Framework (NQF) provides three learning domains; Knowledge and Understanding, Skills and Values (SAQF-2020.

Code	Program Learning Outcomes
Knowledge and Understanding	
K1	Distinguish mathematical concepts relevant to pure and applied mathematics.
K2	Identify background science, features and structure of mathematical problem.
K3	Explain notations and concepts required for the solution of Mathematical problem.
Skills	

Code	Program Learning Outcomes
Knowledge and Understanding	
S1	Apply theoretical, computational or practical aspect relevant to course Content.
S2	Compute numerical quantities for various parameters to approximate the solution.
S3	Apply various mathematical rules, techniques and theorems in Application.
S4	Solve mathematical problem using critical thinking.
Values	
V1	Cultivate a mathematical attitude and nurture the interest.
V2	Realize the importance of responsibilities through different modes of practice, competition and related activities
V3	Inculcating values and ethics in thought, expression and deed.

4.2 Consistency of PLO's with the University Learning Outcomes.

Code	Program Learning Outcomes	Institute Learning Outcomes	Code
K1	Distinguish mathematical concepts relevant to pure and applied mathematics.	Analyze and explain theories, concepts, principles, skills and practices in different disciplines. (Knowledge and understanding)	**1**
K2	Identify background science, features and structure of mathematical problem.		
K3	Explain notations and concepts required for the solution of Mathematical problem.		
S1	Apply theoretical, computational or practical aspect relevant to course Content.	Apply knowledge by accomplishing practical skills brilliantly (practical skills)	**8**
S2	Compute numerical quantities for various parameters to approximate the solution.	Apply the skills and ethics of scientific research, innovation and creativity efficiently. (Skills)	**7**
S3	Apply various mathematical rules, techniques and theorems in Application.		
S4	Solve mathematical problem using critical thinking.	Apply independent and critical thinking innovatively to solve complex problems (skills).	**4**
V1	Cultivate a mathematical attitude and nurture the interest.		
V2	Realize the importance of responsibilities through different modes of practice, competition and related activities	Demonstrate leadership qualities and skills needed to communicate effectively with others orally and in writing in a sound language (skills and values)	**2**
		Apply sustainable learning skills in all scientific and community aspects on environmental, economic and social issues (values)	**5**
		Promote the concept of community responsibility towards scientific and life issues. (Values)	**6**
V3	Inculcating values and ethics in thought, expression and deed.	Commit to professional and ethical behaviors and show team spirit (values)	**3**

5 Program Structural

5.1 General View (total hours and list of requirements)

The Department of Mathematics runs undergraduate and postgraduate programs. The undergraduate students in the Department of Mathematics spend four years spread over eight semesters and they earn a degree of Bachelor of Science in Mathematics after completing 130 credit hours of studies (=**248.88** ECTS; "European Credit Transfer System). The study program begins with general studies which include, for example, Mathematics, Physics, Biology, Basic Computer Science, English language and Islamic culture. The Mathematics Program is one of the most important programs in the College of science. It includes theoretical courses, exercise sessions and laboratory work. The study program includes the core courses (the requirement of the university, the requirement of the college of science and the requirement of the department and specialization).

Total Hours and List of Requirements						
Program Structure	**Required/ Elective**	**No. of courses**	**Credit Hours**	**ECTS**	Total Work load	**Percentage**
Institution Requirements	**Required**	**7**	**15**	**27.7**	**776**	**11.14%**
	Elective	-	-			
College Requirements	**Required**	**6**	**24**	**45.96**	**1287**	**18.48%**
	Elective	-	-			
Program Requirements	Required	**31**	**91**	**167.22**	**4682**	**67.24%**
	Elective	-	-			
Capstone Course/Project	Required	**1**	**4**	**8**	**219**	**3.14%**
Field Experience/ Internship						
Others						
Total		**45**	**134**	**248.88**	**6964**	**100.00%**

5.2 European Credit Transfer and Accumulation System (ECTS) Points

Students complete 248.88 ECTS points after completing the program

ECTS is a standard for comparing the study attainment and performance of students across the European Higher Education Area (EHEA) and making studies and courses more transparent. It helps students to move between countries and to have their academic qualifications and study periods abroad recognized.

ECTS credits express the accumulated load based on the defined learning outcomes and their associated workload. 60 ECTS credits are allocated to the learning outcomes and

associated workload of a full-time academic year or its equivalent, which normally comprises a number of educational components to which credits (on the basis of the learning outcomes and workload) are allocated. ECTS credits are generally expressed in whole numbers.

Workload is an estimation of the time the individual typically needs to complete all learning activities such as lectures, seminars, projects, practical work, work placements and individual study required to achieve the defined learning outcomes in formal learning environments. The correspondence of the full-time workload of an academic year to 60 credits is often formalised by national legal provisions. In most cases, workload ranges from 1,500 to 1,800 hours for an academic year, which means that one credit corresponds to 25 to 30 hours of work. It should be recognised that this represents the typical workload and that for individual students the actual time to achieve the learning outcomes will vary.

Awarding credits in ECTS is the act of formally granting students and other learners the credits that are assigned to the qualification and/or its components if they achieve the defined learning outcomes. National authorities should indicate which institutions have the right to award ECTS

Accumulation of credits in ECTS is the process of collecting credits awarded for achieving the learning outcomes of educational components in formal contexts and for other learning activities carried out in informal and non-formal contexts. A student2 can accumulate credits in order to:

- Obtain qualifications, as required by the degree-awarding institution;
- Document personal achievements for lifelong learning purposes.

Approach to allocating credit in Science Programs

1. Based on learning outcomes of each program component, teaching staff describes the learning activities, and estimates the workload typically needed for a student to complete these activities. Proposals are collected, analyzed, and synthesized and the estimated workload is expressed in credits.

2. Faculty may decide from the start to standardize the size of educational components, giving each one the same credit value.
3. Considering the average of each ECTS credit is equal to 28 learning hour.

Self-Learning Calculation

For University Requirements

ECTS for all university requirement courses were calculated **based on opinion of students through survey** and found to be in consistent with standard ECTS calculation equation as

No. of ECTS points = {credit unit *60 (ECTS for 2 Semesters) * 4 years}/ 130 (total credit of the program)

For Program Requirements

1. Each CH will be multiplied by 15 (official week number of a semester) to get the contact Hours
2. Every contact Hour is considered as 50 Min as per the University rule
3. For all program courses, it has been found **through surveying students opinion** that each Contact Hours requires a minimum of **two** Learning Hour.
4. Add all together the contact hours with preparation times for exam, HWs, lab reporting and case studies, etc. to get the total Hours of Learning that the student spend for the course
5. Divide the learning hours by 28 to get the ECTS points:

Equivalent ECTS points=Total LH/28

5.3 University Requirements (Course list, Credit hours/week, and Actual hours/week).

University requirements is studied by all students of the University and involved 15 credit units to contribute and prepare students academically and provide them with multiple skills such as English language and principles for dealing with the computer needed for further study in coming years.

5.4 College Requirements (Course list, Credit hours/week, and Actual hours/week).

The College requirements is studied by all college students in the first year of preparation and goes to 24 credit hours to contribute and prepare students academically and providing them with basic skills of natural sciences (Mathematics, Physics, Chemistry and Biology).

5.5 Program Requirements (Course list, Credit hours/week, and Actual hours/week).

The Section requirement is studied all compulsory courses by students during the years of study and involved 91credit hours to contribute and prepare student scientifically and academically.

The curriculum shown in Table below is reviewed periodically to fulfill the program goals and learning outcomes, and the educational, scientific, technical and professional development in the field of specialization. The objectives of degree programs and courses are defined as learning outcomes. The learning outcomes of courses are based on the mission of a given degree program.

Level	Course Code	Course Title	Required or Elective	Pre-Requisite Courses	Credit Hours			workloads	ECTS Points	Type of requirements (Institution, College or Department)
					Theory	Practical	Total			
Level 1	101SLM-2	Islamic Culture I	R	---	2	-	2	104	3.7	Institution
	105ENGL-6	Intensive Course in English Language	R	---	12	3	6	311	11.1	College
	101BIO-4	General Biology	R	---	3	2	4	222	7.93	College
	101MATH-3	General Mathematics	R	---	3	-	3	156	5.57	College
	101CSC-3	Introduction to Computer	R	---	2	2	3	154	5.5	Institution
Level 2	102SLM-2	Islamic Culture II	R	---	2	-	2	104	3.7	Institution
	101ARB-2	Arabic Language Skills	R	---	2	-	2	104	3.7	Institution
	101PHYS-4	General Physics	R	---	3	2	4	222	7.93	College

Level	Course Code	Course Title	Required or Elective	Pre-Requisite Courses	Credit Hours			workloads	ECTS Points	Type of requirements (Institution, College or Department)
					Theory	Practical	Total			
	101CHEM-4	General Chemistry	R	---	3	2	4	222	7.93	College
	106ENGL-3	English for Science	R	---	3	-	3	154	5.5	College
Level3	**103SLM-2**	Islamic Culture III	R		2	-	2	104	3.7	Institution
	211MATH-3	Calculus (1)	R	101MATH	3	-	3	120	4.29	Department
	261MATH-3	Static	R		3	-	3	156	5.57	Department
	241MATH-3	Analytic Geometry	R		3	-	3	156	5.57	Department
	221MATH-3	Foundation of Mathematics	R	101MATH	3	-	3	156	5.57	Department
	102ARB-2	Arabic Writing	R	---	2	-	2	104	3.7	Institution
Level4	**104SLM-2**	Islamic Culture IV	R	---	2	-	2	104	3.7	Institution
	251STAT-3	Mathematical statistics	R	101MATH	3	-	3	156	5.57	Department
	222MATH-3	Abstract algebra (1)	R	221MATH	3	-	3	156	5.57	Department
	212MATH-3	Calculus (2)	R	211MATH	3	-	3	156	5.57	Department
	281COMP-3	Algorithmic and programming	R	101COMP	2	2	3	159	5.68	Department
Level5	**313MATH-3**	Calculus (3)	R	212MATH	3	-	3	156	5.57	Department
	323MATH-3	Abstract algebra (2)	R	222MATH	3	-	3	156	5.57	Department
	362MATH-3	Dynamics	R	212 MATH	3	-	3	156	5.57	Department
	331MATH-3	Differential Equations (1)	R	212MATH	3	-	3	156	5.57	Department
	352STAT-3	Probability theory	R	251STAT	3	-	3	156	5.57	Department
Level6	**363MATH-3**	Analytical Mechanics	R	362MATH	3	-	3	156	5.57	Department
	314MATH -3	Complex Analysis	R	313MATH	3	-	3	156	5.57	Department
	324MATH-3	Linear Algebra	R	323MATH	3	-	3	156	5.57	Department
	315MATH-3	Real Analysis(1)	R	212MATH	3	-	3	102	3.64	Department
	316MATH-3	Numerical Analysis (1)	R	212MATH	3	-	3	156	5.57	Department

Level	Course Code	Course Title	Required or Elective	Pre-Requisite Courses	Credit Hours			workloads	ECTS Points	Type of requirements (Institution, College or Department)
					Theory	Practical	Total			
	332MATH-3	Differential Equations (2)	R	331MATH	3	-	3	156	5.57	Department
Level7	**442MATH-3**	Topology	R	315MATH	3	-	3	156	5.57	Department
	425MATH-3	Discrete Mathematic	R	221MATH	3	-	3	156	5.57	Department
	434MATH-3	Partial Differential Equations	R	332MATH	3	-	3	156	5.57	Department
	453STAT-3	Applied statistics	R	251 STAT	2	2	3	159	5.68	Department
	417MATH-2	Real Analysis(2)	R	315MATH	2	-	2	156	5.57	Department
	433MATH-3	Mathematical Methods	R	313MATH	3	-	3	156	5.57	Department
	480MATH-4	Graduation Project		Complete more than 92 Credit Hours	3	1	4	219	8	Department
Level8	**443MATH-3**	Differential Geometry	R	331MATH	3	-	3	156	5.57	Department
	472MATH-3	Mathematical modeling	R	332MATH	3	-	3	156	5.57	Department
	418MATH-2	Functional Analysis	R	417MATH	2	-	2	102	3.64	Department
	473MATH-3	Operation research	R	324MATH	3	-	3	156	5.57	Department
	464MATH-3	Fluid Mechanics	R	434MATH	3	-	3	141	5.04	Department
	419MATH-3	Numerical Analysis (2)	R	434MATH	3	-	3	156	5.57	Department

5.6 Courses and Program Learning Outcomes Mapping.

Each course has a set of outcomes called Course Learning Outcomes (CLOs). The CLOs of a course describe the abilities to be attained at the end of the course. The CLOs for each course is specified so that they are non-overlapping and are as few as possible still covering the specified syllabus of the course. The curriculum committee is responsible for updating and revising the CLOs are based on the recommendations of the course coordinators. For each course, the CLOs

are linked to the PLOs that are attained as a result of attaining the CLOs. JU uses credit hour system. The program learning outcomes are classified into the three NQF learning domains. Each program learning outcome is verified by using appropriate assessment method, and supporting teaching strategies that fit and align with the assessment methods and intended learning outcomes. After the completion of the Bachelor's Degree Program in Mathematics, program learning outcomes require that our graduate will demonstrate the following outcomes:

The Mapping between Courses and the Program Learning Outcomes
(I = Introduced, P = Practiced, M = Mastered)

Course code & No.	Program Learning Outcomes									
	Knowledge and understanding			Skills				Values		
	K1	K2	K3	S1	S2	S3	S4	V1	V2	V3
101 MATH	I	I	I	I	I	I	I	I	I	I
211 MATH	I	I	I	I	I	I	I	I	I	I
212 MATH	I	I	I	I	I	I	I	I	I	I
221 MATH	I	I		I		I	I		I	I
222 MATH	I	I	I	I	I	I	I	I	I	I
241 MATH	I	I	I	I	I	I	I	I	I	I
251 STAT	I		I	I	I	I	I	I	I	I
261 MATH	I	I	I	I	I	I	I	I	I	I
313 MATH	P	P	P	P	P	P	P	P	P	P
314 MATH	P	P	P	P	P	P	P	P	P	P
315 MATH	P	P	P	P	P	P	P	P	P	P
316 MATH	P	P	P	P	P	P	P	P	P	P
323 MATH	P	P		P		P	P		P	P
324 MATH	P	P		P		P	P		P	P
331 MATH	P	P	P	P	P	P	P	P	P	P
332 MATH	P	P	P	P	P	P	P	P	P	P
352 STAT	P	P	P	P	P		P	P	P	P
362 MATH	P	P	P	P	P	P	P	P	P	P
363 MATH	P	P	P	P	P	P	P	P	P	P
417 MATH	M	M	M	M	M	M	M	M	M	M
418 MATH	M	M	M	M	M	M	M	M	M	M
419 MATH	M	M	M	M	M	M	M	M	M	M
425 MATH	M	M	M	M	M	M	M	M	M	M
433 MATH	M	M	M	M	M	M	M	M	M	M
434 MATH	M	M	M	M	M	M	M	M	M	M
442 MATH	M	M	M	M	M	M	M	M	M	M
443 MATH	M	M	M	M	M	M	M	M	M	M
453 STAT	M		M	M	M		M	M	M	M
464 MATH	M	M	M	M	M	M	M	M	M	M
472 MATH	M	M	M	M	M	M	M	M	M	M
473 MATH	M	M	M	M	M	M	M	M	M	M

5.7 Assessments of LO's.

Each course has a series of findings called "Course Learning Outcomes" or CLOs, which are the base of all direct PLO evaluations. A course's CLOs identify the skills that are to be achieved at the completion of the course. The curriculum committee is responsible for updating and revising the CLOs based on the recommendations of the Course Coordinators. For Mathematics Program, the CLOs are part of the syllabus and are published for students in the student handbook. PLOs are linked to the CLOs of various courses through the CLO-PLO mapping, therefore, if the CLOs are attained to the required level of satisfaction, the relevant PLOs are assumed to be attained to the required level of satisfaction.

The process for preparing and approving assessment of course learning outcomes will involve the following steps:

1. A couple of weeks before the beginning of the semester the instructor of each course being informed by sending a reminder message about the need to carry out an assessment that semester. This message includes simple instructions for the assessment process (direct and indirect methods).

2. Each instructor carries out the assessment plan during the semester.

3. At the end of the semester, each instructor is sent a reminder message to prepare a course report. This message includes a template of course report.

4. Course report and results are archived electronically and/or in hardcopy and a copy is added to the course folder.

5. Course report should contain both direct assessment (using quizzes, exams, assignments, etc.) and indirect assessment (through surveys).

6. In addition to the raw assessment data, Course report includes analysis and interpretation of the results.

7. All Faculty members are required to maintain the record of the students' data (marks of the student in every assessment method, what percentage of outcome has every student achieved in that assessment method etc.) in the form of a matrix in the provided Excel sheet template.

8. Assessment is to be based mainly on the percentage of students achieving the satisfactory-exemplary levels for a specific program learning outcome instead of the average score of all students in a specific outcome.

The following is a brief description of the process used in assessing and evaluating Mathematics Program PLOs:

- Direct assessment

Assessment Tools: The actual attainment levels of students in a course through exams, quizzes and assignments.

Evaluation method:

- Define Levels of attainment of PLOs for evaluating student's direct assessment results.
- Tabulate and Display PLOs Achievement based on student's direct assessment results
- Comment on PLOs assessment

- Indirect assessment

Assessment Tools: Course Evaluation Survey

Evaluation method:

- Define Levels of Attainment of PLOs for evaluating indirect assessment survey.
- Tabulate and Display PLOs Achievement based on Indirect Surveys
- Comment on PLOs assessment.

6. Program Study Plan

The Mathematics program has a demanding curriculum that students must cope with challenging workloads as part of their education. In Jazan University, the undergraduate Mathematics program has 130 credit hours and is designed to provide high quality Mathematics education to produce competent Mathematics graduates. It corresponds to the specific learning outcomes for Mathematics program outlined in the NCAAA Guidelines for Program Development and Review. The program also matches and in alignment with the vision and mission of the college of science and Jazan University.

6.1 Complete Study Plan (Courses List per Semester).

The Mathematics program has been prepared according to the institutional policies, standards and procedures. Subsequently, the program adapted these descriptions to the forms of NCAAA in which teaching and assessment strategies and methods are specified in detail. All courses have been specified in terms of ILOs, teaching and assessment methods using NCAAA forms and guidelines. Course-level ILOs have been mapped and linked to their respective programs. Curriculum committee evaluates new proposal for program establishment or modification based on selected criteria.

The study plan of Mathematics program ensures the balance between the general and specialty requirements, and between theoretical and applied aspects. The Q & AA committee reviews the study plan and course descriptions for every semester annually. The quality of the process is evaluated by examining the curriculum and the degree program development. The quality indicators for the curriculum process are: continuous development and professional relevance of curricula and degree structures, true-to-life course descriptions that follow guidelines and the publication of the study guide on schedule.

The Vice Dean of academic affairs in the college of science facilitates the academic development of students. This is performed through various ways such as promoting the students and giving them opportunities for pursuing their interests and developing/refining their talents in the field of extracurricular activities. It provides facilities for games, sports and organizes competitions and tournaments in different types of indoor and outdoor sports and games. The Board provides coaching and training facilities to students in several types of sports and games.

First Level								
#	Course Name	Course Code	Number of hours of study		Credit Hours	Workloads	ECTS	Prerequisite
			Lectures	Sec./Lab				
1	Islamic Culture I	101SLM-2	2	-	2	103	3.7	-
2	General Mathematics	101MATH-3	3	-	3	156	5.57	-
3	General Biology	101BIO-4	3	2	4	222	7.93	-
4	Introduction to Computer	101CSC-3	2	2	3	154	5.5	-
5	Intensive Course in English Language	105ENGL-6	12	3	6	311	11.1	-
	Total		**22**	**7**	**18**	**843**	**30.1**	

Second Level								
#	Course Name	Course Code	Contact Hours		Credit Hours	Workloads	ECTS	Prerequisite
			Lectures	Sec./Lab				
1	Islamic Culture II	102SLM-2	2	-	2	104	3.7	-
2	General Chemistry	101CHEM-4	3	2	4	222	7.93	-
3	General Physics	101PHYS-4	3	2	4	222	7.93	-
4	Arabic Language Skills	101ARB-2	2		2	104	3.7	-
5	English for Science	106ENGL-3	3		3	154	5.5	-
	Total		**13**	**4**	**15**	**702**	**25.06**	

Third Level								
#	Course Name	Course Code	Contact Hours		Credit Hours	Workloads	ECTS	Prerequisite
			Lectures	Sec./Lab				
1	Islamic Culture III	103SLM-2	2	-	2	104	3.7	-
2	Arabic Writing	102ARB-2	2	-	2	104	3.7	-
3	Calculus1	211MATH-3	3	-	3	120	4.29	101MATH-3
4	Statics	261MATH-3	3		3	156	5.57	-
5	Analytical Geometry	241MATH-3	3	-	3	156	5.57	-
6	Foundation of Mathematics	221MATH-3	3		3	156	5.57	101MATH-3
	Total		16	-	16	692	24.7	

Fourth Level								
#	Course Name	Course Code	Contact Hours		Credit Hours	Workloads	ECTS	Prerequisite
			Lectures	Sec./Lab				
1	Islamic Culture IV	104SLM-2	2	-	2	104	3.7	-
2	Mathematical Statistics	251STAT-3	3		3	156	5.57	101MATH-3
3	Abstract Algebra 1	222MATH -3	3		3	156	5.57	211MATH-3
4	Calculus 2	212MATH -3	3		3	156	5.57	211MATH-3
5	Algorithms and Programming	281COMP -3	2	2	3	159	5.68	101CSC-3
	Total		13	2	14	627	22.39	

Fifth Level								
#	Course Name	Course Code	Contact Hours		Credit Hours	Workloads	ECTS	Prerequisite
			Lectures	Sec./Lab				
1	Calculus 3	313MATH-3	3	-	3	156	5.57	212MATH -3
2	Abstract Algebra 2	323MATH-3	3	-	3	156	5.57	212MATH -3
3	Probability Theory	352STAT-3	3	-	3	156	5.57	251STAT-3
4	Differential Equations 1	331MATH-3	3	-	3	156	5.57	212MATH -3
5	Dynamics	362MATH-3	3	-	3	156	5.57	212MATH -3
	Total		15	-	15	624	22.28	

Sixth Level								
#	Course Name	Course Code	Contact Hours		Credit Hours	Workloads	ECTS	Prerequisite
			Lectures	Sec./Lab				
1	Analytical Mechanics	363MATH-3	3	-	3	156	5.57	362MATH -3
2	Complex Analysis	314MATH-3	3	-	3	156	5.57	313MATH-3
3	Linear Algebra	324MATH-3	3	-	3	156	5.57	313MATH-3
4	Real Analysis 1	315MATH-3	3	-	3	156	5.57	313MATH-3
5	Numerical Analysis 1	316MATH-3	3	-	3	156	5.57	212MATH -3
6	Differential Equations 2	332MATH-3	3	-	3	156	5.57	331MATH-3
	Total		18	-	18	780	27.85	

Seventh Level								
#	Course Name	Course Code	Contact Hours		Credit Hours	Workloads	ECTS	Prerequisite
			Lectures	Sec./Lab				
1	Topology	442MATH-3	3		3	156	5.57	315MATH-3
2	Discrete Mathematics	425MATH-3	3		3	156	5.57	313MATH-3
3	Partial Differential Equations	434MATH-3	3		3	156	5.57	332MATH-3
4	Applied Statistics	453STAT-3	2	2	3	159	5.68	251STAT-3
5	Real Analysis 2	417MATH-2	2		2	102	3.64	315MATH-3
6	Mathematical Methods	433MATH-3	3		3	156	5.57	212MATH -3
7	Graduation Project	480MATH-4	3	1	4	219	8	Complete more than 92 Credit Hours
	Total		19	3	21	948	34.03	

Eighth Level								
#	Course Name	Course Code	Contact Hours		Credit Hours	Workloads	ECTS	Prerequisite
			Lectures	Sec./Lab				
1	Differential Geometry	443MATH-3	3		3	156	5.57	331MATH-3
2	Mathematical Modeling	472MATH-3	3		3	156	5.57	332MATH-3
3	Functional Analysis	418MATH-2	2		2	102	3.64	417MATH-2
4	Operations Research	473MATH-3	3		3	156	5.57	324MATH-3
5	Fluid Mechanics	464MATH-3	3		3	141	5.04	434MATH-3
6	Numerical Analysis 2	419MATH-3	3		3	156	5.57	434MATH-3
	Total		17	-	17	711	25.39	

6.2 Courses Descriptions

Course Name	Course Code	Contact hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
General Mathematics	101MATH	3	-	3	1	1	-

Student's workload				
In-class activities	Contact Hours		Self-learning/study	Hours
Lectures	45		HW/Assignments	20
Laboratory			Study for exam	70
Exams and quizzes	5		Working for lab	
			Preparation for classes	24
Total	**50 ~42**		Total	**114**
Total Learning Hours = **156**			Equivalent **ECTS points** = Total LH/28 = **5.57**	

(1) Brief Course Description

General Mathematics course contents are the basic algebraic operations, equations, inequalities, functions, topics in analytical Geometry, system of equations, system of inequalities and matrices.

(2) Course Objectives

After finishing the course, the student is expected to be familiar with the following:

- Basic Algebraic Operations
- Equations and Inequalities
- Functions
- Topics in Analytical Geometry
- System of equations and Inequalities
- Matrices

(3) Course Contents

- Basic Algebraic Operations
- Equations and Inequalities
- Functions
- Topics in Analytical Geometry
- System of Equations and Inequalities
- Matrices

(4) Assessment Criteria

- First mid-term exam 20%
- Second mid-term exam 20%
- Quizzes and home work 10%
- Final Exam 50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignment to prepare scientific projects

(6) Text Book

- Precalculus, Custom Edition, Barnett, Ziegler and Byleen, complied by Samir H. Saker, McGraw Hill,(2009).

(7) Reference Books

-Algebra and Trigonometry, R. E. Larson, R. P. Hostetler, 6th Edition, Houghton Mifflin Company,(2004).
- College Algebra and Trigonometry, R. Aufmann, V. Barker and R. Nation, 4th Edition, Houghton Mifflin
Company,(2003).

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Calculus 1	**211MATH**	**3**	**-**	**3**	**2**	**3**	**101 Math**

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		HW/Assignments	14
Laboratory			Study for exam	49
Exams and quizzes	5		Working for lab	
			Preparation for classes	15
Total	**50 ~42**		Total	**78**
Total Learning Hours = **120**			Equivalent **ECTS points** = Total LH/28 = **4.29**	

(1) Brief Course Description

Calculus (1) is an important course in Mathematics, because it is the basis in studying other courses.

(2) Course Objectives

After finishing the course, the student is expected to be familiar with the followings:

- Importance of differentiation in Science, Engineering, Management and other fields.
- The basic rules of differentiation and their applications.
- Development of logical thinking and necessary skills to solve problems.

(3) Course Contents

- **The functions**: Definition, Types of functions, domain of the functions, graph of functions, composite functions, different properties of functions, inverse function.
- **Limits and Continuity**: limit by definition, theorems, limits and continuity of trigonometric functions.
- **Derivatives of Functions**: Techniques of differentiation, derivative rules, chain rule, implicit and parametric differentiation, higher order derivatives.
- **Applications of Differentiation:** The absolute, local maximum and minimum values of a function, Rolle's theorem, Mean Value theorem, critical points, increasing and decreasing functions, concavity and convexity, inflexion points, vertical and horizontal asymptotes and graph of curves.

(4) Assessment Criteria

- First mid-term exam 20%
- Second mid-term exam 20%
- Quizzes and home work 10%
- Final Exam 50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignment to prepare scientific projects

(6) Text Book

- Calculus, H. Anton, 8th Edition, John Wiley and Sons, (2005).

(7) Reference Books

- Calculus, J. Stewart, 5th Edition, Brooks/ Cle Publishing Company, (2003).
- Calculus, R. E. Larson, R. P. Hostetler and B. H. Edwards, 7th Edition, Houghton Mifflin Company, (2002).
- Calculus, G. B. Thomas, Early Transcendentals, 11th Edition, Addition-Wesley, New York (2006).
- Calculus, E. Swokowski, M. Olinic and D. Pence, 6th Edition, PWS Publishing Company, (1994).

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Calculus 2	212MATH	3	-	3	2	4	211 Math

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		HW/Assignments	22
Laboratory			Study for exam	62
Exams and quizzes	5		Working for lab	0
			Preparation for classes	30
Total	**50 ~42**		Total	**114**
Total Learning Hours = **156.**			Equivalent **ECTS points** = Total LH/28 = **5.57**	

(1) Brief Course Description

Calculus (2) is an important course in Mathematics, because it enable students to study other courses

(2) Course Objectives

After finishing the course, the student is expected to be familiar with the following:

- Importance of integration in Science, Engineering, Management and other fields.
- Integration methods and their applications, numerical series, geometric series.
- Logical thinking & necessary skills to solve problems.

(3) Course Contents

- **Indefinite Integration**: Definition and properties of indefinite integration, table of indefinite integral formulae, some theorems of integration.
- **Methods of Integration**: Integration by substitution, integration by parts, integration by partial fractions, integration by other methods.
- **Definite Integration**: Fundamental theorem of calculus, change of variables, properties of definite integral.
- **Application of Integration**: Area calculations, revolution of solids, arc length and surfaces of revolution.
- **Improper Integrals**: Types of improper integrals, examples and applications.

(4) Assessment Criteria

- First mid-term exam 20%
- Second mid-term exam 20%
- Quizzes and home work 10%
- Final Exam 50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work.
- Mini-model education.
- Assignment to prepare scientific projects.

(6) Text Book

- Calculus, H. Anton, 8th Edition, John Wiley and Sons, (2005).

(7) Reference Books

- Calculus, J. Stewart , 5th Edition, Brooks/ Cle Publishing Company, (2003).
- Calculus, R. E. Larson, R. P. Hostetler, and B. H. Edwards. 7th Edition, Houghton Mifflin Company, (2002).
- Calculus, G. B. Thomas, Early Transcendentals, 11th Edition, Addition-Wesley, New York (2006).
- Calculus, E. Swokowski, M. Olinic and D. Pence, 6th Edition, PWS Publishing Company (1994).

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Foundation of Mathematics	221MATH	3	-	3	2	3	-

Student's workload				
In-class activities	Contact Hours		Self-learning/study	Hours
Lectures	45		HW/Assignments	22
Laboratory	0		Study for exam	77
Exams and quizzes	5		Working for lab	0
			Preparation for classes	15
Total	**50 ~42**		Total	**114**
Total Learning Hours = **156**			Equivalent **ECTS points** = Total LH/28 = **5.57**	

(1) Brief Course Description

Foundation of Mathematics gives the opportunity for understanding the primary concepts in Mathematics (Mathematical logic, set theory, relations, applications; binary process and algebraic systems), which considered to be the basic for studying Mathematics.

(2) Course Objectives

After finishing the course, the student is expected to be familiar with the following:

- Basic concepts in Mathematics.
- Skills necessary to understand the logical and abstract Mathematics.
- Methods to understand hypotheses, theories and proofs.

(3) Course Contents

- **Mathematical Logic:** Statements, open statements, truth values, simple and compound statements, negation, logical connectives and their T-F values, implications, logical equivalence, tautologies, methods of giving proofs.
- **Sets**: Representation of sets, subsets, power set, partitions of set, algebraic operations on sets and their properties.
- **Relations:** Cartesian product of sets and properties, binary relations and properties, domain, Range and inverse of a set, partially and totally ordered relations, equivalence relations, equivalence classes, partitions and equivalence relations on a set, congruent of modulo n.
- **Mappings:** Definition of mapping and its properties, types of mapping, composition of mappings
- **Binary operations on Set:** Definition, examples and properties of binary operations, semi-group, monoid.

(4) Assessment Criteria

- First mid-term exam 20%
- Second mid-term exam 20%
- Quizzes and home work 10%
- Final Exam 50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions.
- Home work.
- Mini-model education.
- Assignment to prepare scientific projects. ·

(6) Text Book

- Foundations of Discrete Mathematics, P. Fletcher, H. Hoyle and C. W. Batfy, PWS-Cant Pub. Co, (1991).

(7) Reference Books

- Introduction to Abstract Algebra, W. K. Nicholson, PWS-Kent publishing Co Boston, 1993.
- Discrete Mathematics and Applications, K. H. Rosen, McGraw-Hill, 5th Edition (2004).
- Elements of Logic and Moderen Algebra, M. V. shat and M.L. Bhave, Published by S.Chand and Company Ltd. H. O. Ram Nagar, New Delhi, (1986).

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Abstract Algebra (1)	**222MATH**	**3**	**-**	**3**	**2**	**4**	**221 MATH**

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		HW/Assignments	24
Laboratory			Study for exam	60
Exams and quizzes	5		Working for lab	
			Preparation for classes	30
Total	**50 ~42**		Total	**114**
Total Learning Hours **= 156.**			Equivalent **ECTS points** = Total LH/28 = **5.57**	

(1) Brief Course Description

The student will learn some algebraic systems such as semi group and group and study various examples of them.

(2) Course Objectives

After finishing the course, the student is expected to be familiar with the following:

- Basic concepts in abstract algebra.
- Logical and abstract thinking of the course.
- Abstract proof of the theorems in the course.
- Exercises and applications.

(3) Course Contents

- **Group:** Definition of group, abelian group, various examples, general properties of a group, cyclic group, subgroups (theories and examples)
- **Permutations:** Symmetric group of order n for any natural number n (i.e., S_n, o), cyclic permutation of length n.
- **Transpositions:** Even and odd permutations, alternatimg group, subgroup of even permutations of (S_n, o).
- **Normal Subgroups:** Cosets, factor group G / N for any $N \lhd G$
- **Homomorphism of Groups:** Symmetry, basic homomorphism theorems, isomorphism.

(4) Assessment Criteria

- First mid-term exam 20%
- Second mid-term exam 20%
- Quizzes and home work 10%
- Final Exam 50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

- A First Course in Abstract Algebra, J. B. Fraleigh, 6th Ed. Addison-Wesley Publishing Co. London, 1998.

(7) Reference Books

- Introduction to Abstract Algebra, W. K. Nicholson, PWS-Kent Publishing Co Boston, 1993.
- Topics in Algebra, I. N. Herstein, John Wiley and Sons, 1975.
- Elements of logic and Modern Algebra, M. V. Bhat and M. L. Bhave, Published by S. Chand and Company Ltd, New Delhi - 110055 (1986).

Course name	Course code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit hours			
Analytic Geometry	241MATH	3	-	3	2	3	-

Student's workload				
In-class activities	Contact Hours		Self-learning/study	Hours
Lectures	45		HW/Assignments	22
Laboratory			Study for exam	77
Exams and quizzes	5		Working for lab	
			Preparation for classes	15
Total	**50 ~42**		Total	**114**
Total Learning Hours = **156**			Equivalent **ECTS points** = Total LH/28 = **5.57**	

(1) Brief Course Description

Analytic Geometry is one of the most important course in Mathematics. Through the algebraic equation of the second degree in two or three variables, we plot the geometric shapes which represents the equation through which we study the properties of this geometric shape.

(2) Course Objectives

After finishing the course, the student is expected to be familiar with the following:

- Identification of conic section through its equation.
- Conversion of the general equation of conic section to the standard formula.
- Classification of the general equation of second degree in two and three variables.
- Identification of the linear surfaces.
- Identification of the different coordinate systems
- The geometric methods to convert from one coordinate system to another.
-

(3) Course Contents

- **Plane**: Cartesian, orthogonal and polar coordinate system and relations of the conversion from one to other, conic section represented by the general equation of second degree in two variables (a pair of straight line, circle, a parabola, ellipse and hyperbola), conic section in polar coordinates
- **Space**: Coordinate systems and relations of the conversion from one to the other, different type equations of the straight line and plane, regular surfaces, quadratic surfaces (for example a ball).

(4) Assessment Criteria

- First mid-term exam 20%
- Second mid-term exam. 20%
- Quizzes and homework 10%
- Final Exam. 50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions.
- Home work.
- Mini-model education.
- Assignments to prepare scientific projects. ·

(6) Text Book

- Analytic Geometry, 6th Edition, Brooks Douglas R. Riddle, / Cole Publ. Co., (1995).

(7) Reference Books

- Calculus with analytic geometry, C.H. Edwards and D.E. Penney, 6th Edition, Prentice Hall, (2002).
- Geometric Analysis planar and spatial. A. D. Abd-Alshafi Obada. Dr. Hassan Mustafa Alawade. Dar AlfekerAlarabe 1425.

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Mathematical Statistics	**251 STAT**	**3**	**-**	**3**	**2**	**4**	**-**

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		HW/Assignments	24
Laboratory			Study for exam	60
Exams and quizzes	5		Working for lab	
			Preparation for classes	30
Total	**50 ~42**		Total	**114**
Total Learning Hours **= 156**			Equivalent **ECTS points** = Total LH/28 = **5.57**	

(1) Brief Course Description

Mathematical Statistics is an important course in Mathematics, this course enables the student to organize, describe and represent data graphically and establish the relationship between statistics and different fields such as industry, economy, agricultures and etc.

(2) Course Objectives

After finishing the course, the student is expected to be familiar with the following:

- Application of statistics in different type problems.
- Application of statistical methods to describe and analyze the data.
- Identification of the methods for data collection, organization and analysis.
- Software in Mathematical Statistics. (SSPS, MATLAB – Excel)

(3) Course Contents

- **Introduction to Statistics**: Definition of statistical science and its applications, types of data , methods and data collection techniques.
- **Methods of Representing Data**: Represention of descriptive and quantitative data in frequency table and graphically, frequency distributions, graphical representation of the frequency tables
- **Measure of Central Tendency**: Arithmetic mean and its properties, median, mode, geometric and harmonic mean.
- **Measure of Dispersion**: Range, quartiles, quartile deviation, deciles, percentile, mean deviation, variance, standard deviation, standard error, coefficient of variation, moments, measure of skewness, measure of kurtosis.
- **Correlation and Regression**: Definition of correlation, relationship through scatter plots, properties of correlation coefficient, Spearman's correlation coefficient, Karl-Pearson's

correlation coefficient, definition of regression, simple linear regression model, estimation of simple linear regression coefficients using least square method

(4) Assessment Criteria

- First mid-tern exam 20%
- Secondmid-term exam 20%
- Quizzes and home work 10%
- Final Exam 50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

- Elementary Statistics: Picturing the World, Larson, R. C.& Farber, E. 3rd Edition, Prentice Hall. (2006).

(7) Reference Books

- Introduction to the Statistics. Mood, A. M. & et. Al. 3rd Edition, McGraw-Hill, (1974).
- Principles of Statistics and Probability, Dr. Adnan Albarre, & others, Alnasher & SAlmatabe, 3rd Edition, 1997.

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Statics	261MATH	3	-	3	2	3	-

Student's workload				
In-class activities	Contact Hours		Self-learning/study	Hours
Lectures	45		HW/Assignments	22
Laboratory			Study for exam	77
Exams and quizzes	5		Working for lab	
			Preparation for classes	15
Total	**50 ~42**		Total	**114**
Total Learning Hours **= 156**			Equivalent **ECTS points** = Total LH/28 = **5.57**	

(1) Brief Course Description

The course gives an idea about types of vector product (scalar and cross product), force analysis in two and three dimensions, information about moments, friction laws and the virtual work.

(2) Course Objectives

After finishing the course, the student is expected to be familiar with the following:

- Importance of statics in branches of science and engineering.
- Statics rules and its application in various branches of science and life.
- Application of statics in solving problems.

(3) Course Contents

- **Introduction in Vector algebra:** Graphical and algebraic introduction, types of vector product (scalar product, cross product).
- **Analysis of Structures to Centroids and Centers.**
- **Force and Moment Vectors**: Moments of inertia for area, equivalent systems of forces, trilateral and conditions of equilibrium of rigid bodies.
- **Centers of Gravity of Objects of Simple and Complex shapes**
- **Laws of Friction**, Coefficient of friction between the body and Plane, study of coup and sliding friction and stability of equilibrium.
- **Virtual work**

(4) Assessment Criteria

- First mid-term exam 20%
- Second mid-term exam 20%
- Quizzes and home work 10%
- Final exam 50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

- Vector Mechanics for Engineers :Statics, Beer and Johnston, 8th ed., McGraw-Hill, 2007

(7) Reference Books

-Statics, A. Ramsay, London, 1972.
- A Text Book on Statics, M. Ray, New Delhi (India), 1984.
- Fundamental of Statics, Adel Younis, Alrashed Library, Riyadh, 2005.

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Calculus (3)	313MATH	3	-	3	3	5	212 MATH

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		HW/Assignments	22
Laboratory	0		Study for exam	62
Exams and quizzes	5		Working for lab	0
			Preparation for classes	30
Total	**50 ~42.**		Total	**114**
Total Learning Hours = **156.**			Equivalent **ECTS points** = Total LH/28 = **5.57**	

(1) Brief Course Description

Calculus (3) is an important course in mathematics, it enables the student to study other courses.

(2) Course Objectives

After finishing the course, the student is expected to be familiar with the following:

- Importance of differentiation and integration in branches of science and geometry and the relationship establishment between them.
- Basis of differentiation and integration of functions with several variables and their applications and vector calculation.
- Necessary skills to solve problems.

(3) Course Contents

- **Multivariate Functions**: Definition of the function of several variables, limit function of several variables, continuous function of several variables, partial differentiation, exact differentiation, upper and lower limits, directional derivatives, tangent planes.
- **Multiple Integral**: Double integral, geometric meaning of double integral, properties of double integral, evaluation of double integral, evaluation of area and volume using double integrals, double integral in polar coordinates, triple integrals, triple integrals in the cylindrical and spherical coordinates, volumes using triple integrals.
- **Linear integral**: definition, theorems

(4) Assessment Criteria

- First mid-term exam 20%
- Second mid-term exam 20%
- Quizzes and home work 10%
- Final exam 50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Homework
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

- Calculus, H. Anton, 8th Edition, John Wiley and Sons, (2005).

(7) Reference Books

- Calculus, J. Stewart, 5th Edition, Brooks/ Cle Publishing Company, (2003).
- Calculus, R. E. Larson, R. P. Hostetler and B. H. Edwards. 7th Edition, Houghton Mifflin Company, (2002).
- Calculus, G. B. Thomas, Early Transcendentals, 11th Edition, Addition-Wesley, New York (2006).
- Calculus, E. Swokowski, M. Olinic and D. Pence, 6th Edition, PWS Publishing Company (1994).

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Complex Analysis	**314MATH**	**3**	**-**	**3**	**3**	**6**	**313MATH**

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		HW/Assignments	22
Laboratory			Study for exam	65
Exams and quizzes	5		Working for lab	
			Preparation for classes	27
Total	**50 ~42**		Total	**114**
Total Learning Hours **= 156**			Equivalent **ECTS points** = Total LH/28 = **5.57**	

(1) Brief Course Description

Complex Analysis is an important course in Mathematics, this course enables the student to understand the concept of real and complex numbers and solution of some issues that do not have solution in the field of real numbers and will also be able to apply rules of the field of real numbers on the field of complex numbers.

(2) Course Objectives

After finishing the course, the student is expected to be familiar with the following:

- Definition of complex numbers and operations on them
- Applications of the rules of real numbers field on field of complex numbers.
- The differences between the real and complex numbers.
- To distinguish between analytical characteristics and function differentiability.
- Transformation of simple regions
- Applications of residue theory in the calculation of complex integrals.

(3) Course Contents

- **System of Complex Numbers**: Structure of complex numbers, algebraic properties, polar and exponential formula, powers and roots, De Moivre's theorem, geometrical representation.
- **Functions of Complex Variable**: Curves and regions in the complex plane, single-valued and Multi-valued functions, limits and continuity.
- **Derivation**: Derivation conditions, Cauchy-Riemann equations, analytic function, harmonic function, simple functions (exponential, logarithmic, trigonometric and Hyperbolic functions), derivation rules with applications.
- **Simple Transformations**: Translation, rotation, restricted dimension transformation, linear transformation, inverse transformation.
- **Integration of Function of Complex Variable**: Liner integration of complex functions, orbit, simple and multiple connected regions, Cauchy- Goursat theorem, Cauchy integral formula and its applications.

- **Series**: Series and sequences, convergence, Taylor's series, Laurent series, power series, zeros and singular points.
- **Residue Theory**: Residue theory, residue theorem, integration of trigonometric functions, improper integrals.

(4) Assessment Criteria

- First mid-term exam 20%
- Secondmid-term exam 20%
- Quizzes and home work 10%
- Final exam 50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

- Complex Variables and Applications, J.W. Brown and R.V. Churchill, 7th Edition McGraw-Hill Company, New York,2000.

(7) Reference Books

-Basic Complex Analysis, J. E. Marsden and M. J. Hoffman, 2nd Edition, W.H. Freeman and Company, New york, 1987.
- Invitation to Complex Analysis, R .P. Boas.Dar Random, New York, 1987.
- Complex Analysis, Dr. Ramadan Sabra. Dar Almanahej, 2007.
- Principles of Complex Analysis. D. Mahmoud Kutkut, Dar Alshorooq 1990.

Course name	Course code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit hours			
Real Analysis(1)	315MATH	3	-	3	3	6	313 MATH

Student's workload				
In-class activities	Contact Hours		Self-learning/study	Hours
Lectures	45		HW/Assignments	22
Laboratory			Study for exam	62
Exams and quizzes	5		Working for lab	
			Preparation for classes	30
Total	**50 ~42**		Total	**114**
Total Learning Hours = **156**			Equivalent **ECTS points** = Total LH/28 = **5.57**	

(1) Brief Course Description

Real analysis is an important course in Mathematics, studying this course enables the student to solve mathematical problems and applications by using logical methods and mathematical theorems.

(2) Course Objectives

After finishing the course, the student is expected to be familiar with the following:

- Algebraic and non-algebraic properties of *R*.
- Variuos mathematical proof methods to prove some basic theorems in analysis.
- Evaluation of limits of sequences and functions by using theorems.
- To distinguish different types of continuity of functions.
- Derivative of some functions using theorems.
- Geometric meaning of important mathematical concepts; limit, continuity and derivative.

(3) Course Contents

- **Real Numbers:** Algebraic properties, Bernoulli's inequality, Cauchy's inequality, triangle inequality, topology of real numbers.
- **Sequences**:: Convergence, algebraic operations, theorems, subsequences, Bolzano-Weierstrass theorem, Cauchy criterion, Cauchy sequences.
- **Limits**: Precise definition, convergence criterion, divergence criteria, theorems, infinite limits, limits at infinity.
- **Continuity**: The precise definition of continuity, discontinuity criterion, continuity on intervals, combination of continuous functions, composition of continuous functions, Bolzano's theorem (Intermediate Value theorem), uniform continuity, relation between continuity and uniform continuity, uniform continuity criteria, Lipschitz functions.

- **Differentiation**: Differentiation theorem, differentiation rules, chain rule, derivative of inverse function, Fermat's theorem, Rolle's theorem, Mean Value theorem with its applications, Darboux's theorem, L'Hopital's rule, Taylor's theorem.

(4) Assessment Criteria

- First mid-term exam 20%
- Second mid-term exam 20%
- Quizzes and home work 10%
- Final Exam 50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignsment to prepare scientific projects

(6) Text Book

- Introduction to Real Analysis, R.G. Bartle and D.G. Sherbert, 3rd Edition, John Wiley and Sons, New York, 2000.

(7) Reference Books

- Introduction to Real Analysis, M. Stoll, 2nd Edition, Addison-Wesley Longman, Boston, 2001.
- Elementary Analysis: Theory of Calculus K. A. Ross, Springer-Verlag New York, 1980
- Principles of Real Analysis, D. Mahmoud Kutkut, Dar Almarekh, 1990.

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Numerical Analysis 1	316MATH	3	-	3	3	6	212MATH

Student's workload				
In-class activities	Contact Hours		Self-learning/study	Hours
Lectures	45		HW/Assignments	22
Laboratory			Study for exam	62
Exams and quizzes	5		Working for lab	
			Preparation for classes	30
Total	**50 ~42**		Total	**114**
Total Learning Hours = **156**			Equivalent **ECTS points** = Total LH/28 = **5.57**	

(1) Brief Course Description

Numerical analysis is an important course in Mathematics, studying this course enables the student to solve the problems by using numerical methods with the help of computer or software.

(2) Course Objectives

After finishing the course, the student is expected to be familiar with the following:

- Numerical methods to solve algebraic equations
- Various numerical methods to solve system of linear equations
- Interpolation methods in the approximation of functions
- Numerical methods to find numerical differentiation and integration of functions
- Numerical methods in solving ordinary differential equations of first order
- Some Software (Matlab - Mathematical) in numerical solutions.

(3) Course Contents

- **Errors:** Classification of errors, approximation of numbers, theorems on errors.
- **Methods of Solving Algrbraic and Transcendental Equations :** Bisection method, secant method, Newton-Raphson method, method of convergence approximation and error calculation in each method.
- **Numerical Solution of Systems of Linear Algebraic Equations :** Gauss method, Gauss-Jordan method, LU-factorization method, Gauss-Jacobi method, Gauss-Seidel method, Method of eigenvalues.
- **Numerical Solution of Systems of Nonlinear Algebraic Equations :** Newton's method, method of convergence approximations.

- **Interpolation (Function Approximation):** Lagrange's and Newton's divided difference method, forward-difference and backward-difference interpolation formulae, inverse interpolation.
- **Numerical Differentiation and Integration:** Numerical derivatives, trapezoidal rule, Simpson's method, Gauss-quadrature method.
- **Numerical Solution of Differential Equations of First Order:** Euler's method, Euler's improved method, Runge-Kutta method.

(4) Assessment Criteria

- First mid-term exam 20%
- Second mid-term exam 20%
- Quizzes and home work 10%
- Final Exam 50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assign ments to prepare scientific projects

(6) Text Book

- Numerical Methods with Applications by Autar Kaw and Egwu Eric Kalu, Publisher, Lulu.com 2008.

(7) Reference Books

- Numerical Analysis, V. A. Patel, Harcourt Brace, College Publishers, (1994).
- Numerical Mathematics and Computing, W. Cheney and D. Kincaid, Brooks / Cole Publishing Company, (2003).

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Abstract Algebra (2)	323MATH	3	-	3	3	5	222 MATH

Student's workload				
In-class activities	Contact Hours		Self-learning/study	Hours
Lectures	45		HW/Assignments	22
Laboratory			Study for exam	62
Exams and quizzes	5		Working for lab	
			Preparation for classes	30
Total	**50 ~42.**		Total	**114**
Total Learning Hours **= 156.**			Equivalent **ECTS points** = Total LH/28 = **5.57**	

(1) Brief Course Description

Abstract Algebra (2)is an extension of abstract algebra(1), which requires the concept and understanding of group theory while abstract algebra(2) requires the concept and understanding of ring theory(extension of group theory), fields and their extensions, this course focus on some types of rings and knowledge of isomorphism of ring.

(2) Course Objectives

After finishing the course, the student is expected to be familiar with the following:

- Concept of ring which is an extension of the group
- Concept of subring which is an extension of the subgroup, ideal which is an extension of the normal subgroup and factor ring which is an extension of the factor group.
- Concept of homomorphism of rings as an extension of homomorphism of groups
- Types of rings, fields and their extensions

(3) Course Contents

- **Ring:** Definition and theorems, commutative ring, zero divisors, ring and its group of unit, integral domain, field
- **Subrings and Ideals:** Subrings, ideals and relationship between them, factor ring.
- **Homomorphism and Isomorphism of Ring**: Definition, theorem and examples, kernel and image of homomorphism, first, second and third isomorphism theorems and its applications.
- **Euclidean Rings and Ring of Polynomials**: Euclidean rings, unique factorization theorem, construction of ring polynomials, roots of ring of polynomials over a field, polynomial ring on the field of rational numbers.

- **Field Extension**: Simple algebraic extension and simple transcendental extension, finite extension, algebraic closure, splitting fields, finite field.

(4) Assessment Criteria

- First mid-term exam 20%
- Second mid-term exam 20%
- Quizzes and home work 10%
- Final exam 50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

- Topics in Algebra, I.N. Herstein, New York, John Wiley and Sons, 1977.
- A First course in Abstract Algebra, J. B. Fraleigh, 7th Edition, Addison-Wesley Publishing Co. London, 2003

(7) Reference Books

- A Survey of Modern Algebra, S. Maclane and G. Birkhoff, New York: Macmillan, 1977.
-Algebra, S. Lang, 3rdEdition, Addison-Wesley, 1993.
- Basic Algebra, M. Cohn Paul, Springer-Verlag New York 2002.

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Linear Algebra	324MATH	3	-	3	3	6	323MATH

Student's workload				
In-class activities	Contact Hours		Self-learning/study	Hours
Lectures	45		HW/Assignments	22
Laboratory			Study for exam	62
Exams and quizzes	5		Working for lab	
			Preparation for classes	30
Total	**50 ~42**		Total	**114**
Total Learning Hours = **156**			Equivalent **ECTS points** = Total LH/28 = **5.57**	

(1) Brief Course Description

Linear Algebra is an important course in field of algebra and has wide applications not only in Mathematics but also in other branches. The course requires the knowledge of vector space, subspace, basis, dimensions and linear transformations.

(2) Course Objectives

After finishing the course, the student is expected to be familiar with the following:

- Basic topics of linear algebra such as matrices and vectors
- Spaces, linear transformations, basis and dimension
- Methods for solving linear equations in *n* variables
- Methods of solving systems of linear equations and algebraic properties of matrices and determinants
- Methods to find eigenvalues and Eigen vectors
-

(3) Course Contents

- **Vector Spaces over a Field**: Definition, theorem and examples of vector space.
- **Linear Combination of Vectors and Spanning Set**.
- **Sub-Spaces**: Definition and theorem, examples of sub-space, subset generated by vector space, sub-space generated by subset from vector space, sum and direct sum of two subspaces, intersection of two subspaces.
- **Linear Independence and Correlation**: Definition and examples, basis and dimension of vector space, linear dependence.
- **Coordinate Matrices and Change of Basis.**
- **Inner Product Space**: Definition and examples, orthogonality, angle and distance between two vectors in inner product space.

- **Linear Transformations**: definition, examples and theorems on liner transformation, kernel and range of linear transformations, matrices of general linear transformations.
- **Eigen values**, Eigen vectors and diagonalization.

(4) Assessment Criteria

- First mid-term exam 20%
- Second mid-term exam 20%
- Quizzes and home work 10%
- Final exam 50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

-Elementary Linear Algebra, H. Anton, John Wiley (2001).
- Elementary Linear Algebra, R. E. Larson and B. E. Edwards, Edition Heath 5th ed., D.H. and Company, (2004).

(7) Reference Books

- Theory and Problems of Linear Algebra, S. Lipschutz, Schaum's Outline Series (2000).
- Linear Algebra and its Applications, David C. Lay, Addisson Wesley (2003).

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Differential Equations 1	331MATH	3	-	3	3	5	212MATH

Student's workload				
In-class activities	Contact Hours		Self-learning/study	Hours
Lectures	45		HW/Assignments	22
Laboratory			Study for exam	57
Exams and quizzes	5		Working for lab	
			Preparation for classes	35
Total	**50 ~42**		Total	**114**
Total Learning Hours = **156**			Equivalent **ECTS points** = Total LH/28 = **5.57**	

(1) Brief Course Description

Differential Equations is an important course in Mathematics, studying this course enables the student to solve differential equations then use them in some applications by using different methods.

(2) Course Objectives

After finishing the course, the student is expected to be familiar with the following:

- Concepts and understanding of topics of the course
- Use of proper mathematical notation
- Use of deductive methods and critical thinking to solve problems

(3) Course Contents

- Some basic definitions.
- First-order differential equations and their applications.
- Higher-order differential equations with constant coefficients and their applications
- Laplace transformations and their applications.

(4) Assessment Criteria

- First mid-term exam 20%
- Second mid-term exam 20%
- Quizzes and home work 10%
- Final exam 50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

- A First Course in Differential Equations, 8th edition, Dennis G. Zill. Copyright 2005

(7) Reference Books

- Differential Equations, 3rd ed., P. Blanchard, R. Devaney and G. Hall, Thomson Brooks / Cole, Boston University, 2006.
- Ordinary Differential Equations, D. K. Arrowsmith, C. M. Place, Chapman & Hall. (1982).

Course name	Course code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit hours			
Differential Equations 2	332MATH	3	-	3	3	6	331MATH

Student's workload				
In-class activities	Contact Hours		Self-learning/study	Hours
Lectures	45		HW/Assignments	22
Laboratory			Study for exam	47
Exams and quizzes	5		Working for lab	
			Preparation for classes	45
Total	**50 ~42**		Total	**114**
Total Learning Hours = **156**			Equivalent **ECTS points** = Total LH/28 = **5.57**	

(1) Brief Course Description

Differential Equations is an important course in applied mathematics, studying this course enables the student to solve differential equations with variable coefficients and solve some boundary value problems by using different methods.

(2) Course Objectives

After finishing the course, the student is expected to be familiar with the following:

- Concepts and understanding in the topics of the course .
- Use of proper mathematical notation
- Use of deductive methods and critical thinking to solve problems

(3) Course Contents

- Higher order differential equations with variables coefficients
- System of differential equations
- Method of variation of parameters to solve differential equations
- Method of undetermined coefficients to solve differential equations
- Power series solution of differential equations
- Boundary value problems
- Stability of solution.

(4) Assessment Criteria

- First mid-term exam 20%
- Second mid-term exam 20%
- Quizzes and home work 10%
- Final exam 50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini model education
- Assignments to prepare scientific projects

(6) Text Book

- A First Course in Differential Equations, 8th edition, Dennis G. Zill. Copy right 2005.

(7) Reference Books

- Differential Equations, 3rd ed., P. Blanchard, R. Devaney and G. Hall, Thomson Brooks / Cole, Boston University, 2006.
- Ordinary Differential Equations,
- D. K. Arrowsmith, C. M. Place, Chapman & Hall. (1982).

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Probability Theory	**352 STAT**	**3**	**-**	**3**	**3**	**5**	**251 STAT**

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		HW/Assignments	22
Laboratory			Study for exam	65
Exams and quizzes	5		Working for lab	
			Preparation for classes	27
Total	**50 ~42**		Total	**114**
Total Learning Hours = **156**			Equivalent **ECTS points** = Total LH/28 = **5.57**	

(1) Brief Course Description

Probability Theory is an important course in Mathematics, studying this course enables the student to solve random problems by using probability principles and apply it in different fields (statistical applications, industry, economy).

(2) Course Objectives

After finishing the course, the student is expected to be familiar with the following:

- Application of probability in random experiment
- Application of probability distributions in problems with an outcome that can't be predicted
- Application of the course in random operations in the future
- Some software (MATLAB - FORTRAN - Java) in probabilities

(3) Course Contents

- **Introduction to Sets**: Subset, union, intersection, differences, classes of sets, permutation and combinations.
- **Principles of Probability**: Random experiment, sample space, events, probability calcutation methods, definition and axioms of probability, conditional probability, independent events, dependent events, methods of counting, overall probability theory, conditional probability, Baye's theorem (simply with replacement and without replacement).
- **Random Variable**: Definition of random variable, types of random variables, probability density function, probability mass function, cumulative distribution function, relation between distribution function and density function, probability distribution function for two variables and its properties, conditional probability functions, independent variables, mathematical expectation, variance, standard deviation,
- **Probability Distributions**: Discrete probability distributions and its properties, binomial distribution, Poisson distribution, continuous probability distributions and properties, normal distribution, standard normal distribution.

- **Sampling Distribution**: Sampling distribution of means and its properties, central limit theorem, sampling distribution of sample variance and proportion, probability distribution based on different means of samples, probability distribution of sample variance, probability distribution of ratios in sample, sampling distribution of samples selected together, Tchebytchev theorem.

(4) Assessment Criteria

- First mid-term exam 20%
- Second mid-term exam 20%
- Quizzes and home work 10%
- Final exam 50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

-First Course in Probability: Sheldon Ross.

(7) Reference Books

- Probability, Random Variables and Stochastic Processes A. Papoulis & S.U. Pillai. 4th Edition, Tata McGraw-Hill. (2005).
- Principles of Statistics and Probability, Dr. Adnan al-Barre, & Others, Alnasher & Almatabea, 3rd Edition, 1997
- Introduction to Statistics and Probability by Dr. Fair Valleys and Others, Alrashed Library, 2nd edition, 2005

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Dynamics	362MATH	3	-	3	3	5	212 MATH

Student's workload				
In-class activities	Contact Hours		Self-learning/study	Hours
Lectures	45		HW/Assignments	22
Laboratory			Study for exam	62
Exams and quizzes	5		Working for lab	
			Preparation for classes	30
Total	**50 ~42.**		Total	**114**
Total Learning Hours **= 156.**			Equivalent **ECTS points** = Total LH/28 = **5.57**	

(1) Brief Course Description

Dynamics enables the student to describe phenomena and try to model them into mathematical expression identical to mathematical, physical and geometric rules.

(2) Course Objectives

- To describe and model the movement of particle in a straight line and plane, to study the causes of motion and study equations of motion
- To study moments of inertia of some forms and the motion of elastomeric particle in a plane
- Importance of dynamics in branches of science and engineering.
- To accustome the student to think logically and gain necessary proper skills to resolve issues.
-

(3) Course Contents

- **Dynamics**: Basic principles of the motion, motion in a straight line, speed and acceleration, motion of variable mass particle in a straight line, some applications.
- **Laws of Motion**: Newton's laws of motion, law of payment, work, energy, principle of the conversation of momentum and energy, collision particles.
- **The Motion of Particle in the Plane**: Cartesian and polar coordinates to describe motion of the particle, circular motion, the central pathways, space formation using three cartesian and cylindrical coordinates
- **Motion of Projectiles**: Non-resistant, the path of the projectile.
- **Moments of Inertia of Some Simple Objects.**
- **Rigid Body Motion in Plane**: transitional motion and rotational motion.

(4) Assessment Criteria

- First mid-term exam 20%
- Second mid-term exam 20%
- Quizzes and home work 10%
- Final exam 50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

- Vector Mechanics for Engineers: Dynamics, Beer & Johnston, 8th edition, McGraw-Hill, 2007

(7) Reference Books

- Classical Mechanics, Chow, John Wiley, 1995
- "Dynamics of Particle and Coherent body, "Abu al-Nur Abdullah, Ismail Hassanein, Alrashed Library, Riyadh, Saudi Arabia, 2006.
- "General Mechanics (2) Dynamics,"Fouad Zein Arab, Dar Alrateb Aljameaea, Lebanon.

Course name	Course code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Analytical Mechanics	363MATH	3	-	3	3	6	362 MATH

Student's workload				
In-class activities	Contact Hours		Self-learning/study	Hours
Lectures	45		HW/Assignments	22
Laboratory			Study for exam	62
Exams and quizzes	5		Working for lab	
			Preparation for classes	30
Total	**50 ~42**		Total	**114**
Total Learning Hours = **156**			Equivalent **ECTS points** = Total LH/28 = **5.57**	

(1) Brief Course Description

Analytical Mechanics is an important course in Mathematics, studying this course enables the student to study motion of particles and rigid bodies, chosen coordinates, cyclic coordinates, canonical transformations and study applications depending on Hamilton's principle.

(2) Course Objectives

- Importance of analytical mechanics in branches of science and engineering
- To describe & study motion of particles and rigid bodies in chosen coordinates and cyclic coordinates, canonical transformations and study applications depending on Hamilton's principle
- To accustome the student to think logically and to gain necessary proper skills to resolve issues

(3) Course Contents

- **Generalized Coordinates**: Conservative and non-conservative groups, constraints of power, employment and the amount of motion in generalized coordinates - the principle of Drop (the amount of linear motion, angular momentum, total energy).
- **Lagrange's Method and Applications**.
- **Hamilton's Method :** Hamilton's principle, principle equation, Jacobi equation and their use in solving the harmonic oscillator, variability of the principles and the principle of minimum action.
- **Canonical Transformations Generating Functions**: Poisson brackets and using moments in relationships.

(4) Assessment Criteria

- First mid-term exam 20%
- Second mid-term exam 20%
- Quizzes and home work 10%
- Final exam 50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

- Lecture Notes on Analytical Mechanics, P. Lidstrom, Div. of Mechanics. Lund University, 2007.

(7) Reference Books

-Goldstein, Poole & Safko: Classical Mechanics. 3rd ed. Addison Wesley, 2002.
- "Analytical Dynamics" Haim Baruh, Pub. McGraw Hill 1998.
- "Analytical Mechanics" Grant R. Fowles, Pub. Brace Publisher Harcount, 1995.
- “Analytical Mechanics” Ismail Hassanein, Abu al-Nur Abdullah, Alrashed Library, 2005.

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Real Analysis 2	417MATH	2	-	2	4	7	315 MATH

Student's workload				
In-class activities	Contact Hours		Self-learning/study	Hours
Lectures	30		HW/Assignments	16
Laboratory			Study for exam	42
Exams and quizzes	5		Working for lab	
			Preparation for classes	15
Total	**35 ~29.**		Total	**73**
Total Learning Hours **= 102.**			Equivalent **ECTS points** = Total LH/28 = **3.64**	

(1) Brief Course Description

Real analysis is an important course in Mathematics, the student will be able to solve mathematical problems and applications by using logical methods and mathematical theorems and will be expert in using mathematical methods of proving.

(2) Course Objectives

After finishing the course, the student is expected to be familiar with the following:

- Evaluation of the area using Riemann sums.
- Various mathematical proof methods to prove some fundamental theorems in analysis
- Fundamental theorems to evaluate Riemann integrals
- Distinction between the uniform and pointwise convergence of sequence of functions
- Convergent tests of numerical series and series of functions

(3) Course Contents

- **Riemann Integral**: Definition of Riemann integral, Riemann criterion for integrability, the integrability of monotone and continuous functions, properties of Riemann integral, First & Second fundamental theorem, integration by parts, first & second substitution theorems, Mean Value Theorem, Taylor's theorem, improper integrals, liner integrals.
- **Infinite Series**: Convergence of infinite series, tests for convergence, Cauchy criterion for series, absolute convergence, rearrangement of series, tests for absolute convergence, alternating series, Abel's test, Dirichlet's test.
- **Sequences and Series of Functions**: Pointwise and uniform convergences, Cauchy criterion, Weierstrass theorem, series of functions, differentiation and integration of series of functions, Uniqueness theorem, Taylor's series, Fourier series.

(4) Assessment Criteria

- First mid-term exam 20%
- Second mid-term exam 20%
- Quizzes and home work 10%
- Final exam 50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

- Introduction to Real Analysis, R.G. Bartle and D.G. Sherbert, 3rd Edition. John Wiley and Sons, New York, (2000).

(7) Reference Books

- Introduction to Real Analysis, M. Stoll 2nd Edition, Addison–Wesley Longman, Boston, (2001).
- Elementary Analysis: Theory of Calculus, K.A. Ross Springer-Verlag NewYork, (1980).
- Principles of Complex Analysis, D. Mahmoud Kutkut, House Sunrise 1990.

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Functional Analysis	**418MATH**	**2**	**-**	**2**	**4**	**8**	**317 MATH**

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	30		HW/Assignments	18
Laboratory	0		Study for exam	40
Exams and quizzes	5		Working for lab	0
			Preparation for classes	15
Total	**35 ~29**		Total	**73**
Total Learning Hours **= 102**			Equivalent **ECTS points** = Total LH/28 = **3.64**	

(1) Brief Course Description

Functional Analysis is an important course in Mathematics, studying this course enables the student to generalize mathematical concepts and theorems in more generalized spaces.

(2) Course Objectives

After finishing the course, the student is expected to be familiar with the following:

- Generalization of mathematical concepts in more general spaces
- Concepts of metric spaces and normed spaces to study convergence and divergence of sequences
- Linear operators and functions in different spaces
- Definition of Hilbert spaces

(3) Course Contents

- **Metric Space**: Metric space, examples, continuous functions and convergence in metric space, complete metric space, topology generated by metric
- **Normed Space**: Linear space, linear subspace, normed spaces, relationship between metric and normed spaces, banach space, continuity and convergence in normed spaces, topology generated by normed.
- **Operators**: Linear operators, continuous linear operators, linear operators in normed spaces.
- **Functionals**: Linear functionals, continuous linear functionals, dual space, generalized functions.

(4) Assessment Criteria

- First mid-term exam 20%
- Second mid-term exam 20%
- Quizzes and home work 10%
- Final exam 50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

- Introductory Functional Analysis with Applications, E. Kreyszig, John Wiley and Sons, New York (1978).

(7) Reference Books

- A Course in Functional Analysis, J.B. Conway, 2nd ed., Springer, Berlin, (1990).
- A First Course in Functional Analysis, C. Goffman and G. Pedrick. Prentice-Hall (1974).
- Functional Analysis, B. V. Limaye, 2nd ed., New Age International, New Delhi (1996).
- Introduction to Functional Analysis, A. Taylor and Delay, Wiley, New York, (1980).
- Principles & the Theory of Functions and Mathematical Analysis Dali, translated by Dr. Ibrahem Mahmoud Shousha, Dar Al-Mir, 1989.

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Numerical Analysis 2	**419MATH**	**3**	**-**	**3**	**3**	**8**	**434 MATH**

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		HW/Assignments	22
Laboratory			Study for exam	60
Exams and quizzes	5		Working for lab	
			Preparation for classes	32
Total	**50 ~42**		Total	**114**
Total Learning Hours = **156**			Equivalent **ECTS points** = Total LH/28 = **5.57**	

(1) Brief Course Description

Numerical analysis is an important course in Mathematics, studying this course enables the student to solve mathematical problems and different applications by using numerical methods and some computer software to solve numerical problems.

(2) Course Objectives

After finishing the course, the student is expected to be familiar with the following:

- Numerical methods to solve ordinary differential equations
- Numerical methods in solving ordinary differential equations of higher order
- Numerical methods in solving partial differential equations
- Introduction of the differential equations and its numerical solutions
- Some software (Matlab – Mathematica and others) in solving ordinary and partial differential equations

(3) Course Contents

- **Numerical Solution of Systems of Differential Equations:** Numerical solution of system of differential equations of first order and higher-order, Reduction in rank translate to equations of first order, application of software in numerical solutions of differential equations.
- **Numerical Solution of Partial Differential Equations**: Fourier method to separate variables, D'Alembert method to change variables, open manner, Crank-Nicholson method, numerical solution of partial differential equations (elliptic, hyperbolic and parabolic), methods of solving of partial differential equations of first and second order, the general solution (Fourier method and , D'Alembert method & use the software to find the solution).
- **Systems of Partial Differential equations.**

- **Difference Equations.**

(4) Assessment Criteria

- First mid-term exam 20%
- Second mid-term exam 20%
- Quizzes and home work 10%
- Final exam 50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

- Numerical Methods with Applications by Autar Kaw and Egwu Eric Kalu, Publisher: Lulu.com 2008.

(7) Reference Books

- Numerical Analysis, Harcourt Brace, V. A. Patel College Publishers, (1994).
- Numerical Methods for Ordinary Differential Equations, John Denholm Lambert, John Wiley & Sons, Chichester, (1991).

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Discrete Mathematics	425MATH	3	-	3	4	7	221 MATH

Student's workload				
In-class activities	Contact Hours		Self-learning/study	Hours
Lectures	45		HW/Assignments	22
Laboratory			Study for exam	60
Exams and quizzes	5		Working for lab	
			Preparation for classes	32
Total	**50 ~42**		Total	**114**
Total Learning Hours = **156**			Equivalent **ECTS points** = Total LH/28 = **5.57**	

(1) Brief Course Description

Discrete Mathematics is one of the most important branch in mathematics that contains different problems of discrete variables not continuous variables such as algebraic set, combination theory, logic algebra, boolean algebra and forms theorem. Discrete mathematics has different applications in information theory, computer science and artificial intelligence.

(2) Course Objectives

After finishing the course, the student is expected to be familiar with the following:

- Basics of discrete mathematics
- Concepts of the combination theorem and its applications.
- Concepts of the boolean algebra and its application in designing the logic circuits.
- Concepts and applications of graph theory.

(3) Course Contents

- **Counting:** Basics of counting, permutations, combinations and the binomial theorem.
- **Boolean Algebra:** Definition, properties, Boolean functions, logic gates, logic circuits
- **Graphs:** Graphs and graph models, graph terminology and special types of graphs, connectivity, paths, cycles, Hamiltonian graphs, Hamiltonian paths, Hamiltonian cycles, Euler graphs, Euler paths, shortest- path problems, planar graphs, graph coloring.
- **Trees:** Definitions, properties, spanning trees, minimum spanning trees, binary search trees, trees applications, Huffman coding, different algorithms

(4) Assessment Criteria

- First mid-term exam 20%
- Second mid-term exam 20%
- Quizzes and home work 10%
- Final exam 50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

- Discrete Mathematics and its Applications, K.H. Rosen, McGraw-Hill,(2000).

(7) Reference Books

- Discrete and Combinatorial Mathematics: An Applied Introduction, R.P. Grimaldi, Addison-Wesley, (1998).

- Principles of Discrete Mathematics, D. Marof Abed Al Rahman Samhan, D. Ahmed Humaid Charar. Dar Khuraiji to Alnasher & Altaozea, Riyadh 1426.

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Mathematical Methods	433MATH	3	-	3	4	7	313 MATH

Student's workload				
In-class activities	Contact Hours		Self-learning/study	Hours
Lectures	45		HW/Assignments	22
Laboratory			Study for exam	62
Exams and quizzes	5		Working for lab	
			Preparation for classes	30
Total	**50 ~42**		Total	**114**
Total Learning Hours = **156**			Equivalent **ECTS points** = Total LH/28 = **5.57**	

(1) Brief Course Description

Mathematical Methods is an important course in Mathematics, studying this course enables the student to use Fourier series in physics and also to derive function for its differential equations.

(2) Course Objectives

After finishing the course, the student is expected to be familiar with the following:

- Importance of mathematical methods in different branches of science, and engineering
- To study Fourier series and integral transforms (Fourier and Laplace).
- Importance of mathematical methods in basic physical applications
- Derivation of special functions (Gamma, Beta, Bessel, Legendre, Laguerre and Hermite) from different physical equations
- Necessary skills to solve problems

(3) Course Contents

- **Fourier Series and Fourier Integration.**
- **Laplace Transformation and its Applications.**
- **Special Functions** (Gamma, Beta, Bessel, Legendre, Laguerre and Hermite functions).
-

(4) Assessment Criteria

- First mid-term exam 20%
- Second mid-term exam 20%

- Quizzes and home work 10%
- Final exam 50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

- Special Functions for Scientists and Engineers, W. Bell, D. Van Nostrand Company, London.

(7) Reference Books

- Advanced Mathematics for Engineers and Scientists. Murray R. Spiegel, McGraw Hill Book Company.

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Partial Differential Equations	**434MATH**	**3**	**-**	**3**	**4**	**7**	**331 MATH**

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		HW/Assignments	22
Laboratory			Study for exam	60
Exams and quizzes	5		Working for lab	
			Preparation for classes	32
Total	**50 ~42**		Total	**114**
Total Learning Hours = **156**			Equivalent **ECTS points** = Total LH/28 = **5.57**	

(1) Brief Course Description

Partial differential equations is an important course as a mathematical applications to various scientific fields, the course enables the student to solve partial differential equations of first and second order and solve Boundary -value problems.

(2) Course Objectives

After finishing the course, the student is expected to be familiar with the following:

- Methods for solving partial differential equations
- Fundamental concepts in partial differential equations theory
- Applications of partial differential equations

(3) Course Contents

- Solution of first order linear partial differential equations.
- Solution of second order linear partial differential equations..
- Boundary-value problems for linear second order partial differential equations.of hyperbolic type (wave equation), parabolic type (heat equation) and elliptic type (Laplace equation).
-

(4) Assessment Criteria

- First mid-term exam 20%
- Second mid-term exam 20%
- Quizzes and home work 10%
- Final exam 50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

- A First Course in Differential Equations, 8th edition, Dennis G. Zill, Copyright 2005,

(7) Reference Books

- Partial Differential Equations, 4th ed., Fritz John, Springer,1991.
- Partial Differential Equations, Evans, L.C. AMS, 1991.
- Partial Differential Equations, Methods and Applications. Mcowen, R. Prentice-Hall, 1996.

Course name	Course code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit hours			
Topology	**442MATH**	**3**	**-**	**3**	**3**	**7**	**315 MATH**

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		HW/Assignments	22
Laboratory	0		Study for exam	60
Exams and quizzes	5		Working for lab	0
			Preparation for classes	32
Total	**50 ~42**		Total	**114**
Total Learning Hours = **156**			Equivalent **ECTS points** = Total LH/28 = **5.57**	

(1) Brief Course Description

Basic concept of topological space, subspace topology and relative topology, homeomorphism, topological properties, connected and compact space.

(2) Course Objectives

After finishing the course, the student is expected to be familiar with the following:

- Generalized concepts of Euclidean and metric spaces
- Deep concept of continuity
- Topological properties using the concept of equivalence topology
- Relationship between metric spaces and topological spaces
- Concepts of compactness and connectedness needed for the study of algebraic topology

(3) Course Contents

- Topological space: Definition and examples-Usual topology on the real line.
- Accumulation points (limit points) and the derived set.
- Closed sets and closure of set.
- Interior, exterior and boundary set.
- Neighborhood and Neighborhood system.
- Subspace topology and relative topology.
- Bases and sub bases.
- Continuity and topological equivalence.
- Open and closed functions.
- Homeomorphism and topological properties.
- Connected and compact space

(4) Assessment Criteria

- First mid-term exam 20%
- Second mid-term exam 20%
- Quizzes and home work 10%
- Final exam 50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

- An Introduction to General Topology, Paul E. Long, Charles E Merril Publishing Company, (1971).

(7) Reference Books

- A Introduction to Topology, B. Mendelson, Dover Publications, Inc., New York, (1990).
- General Topology, S. Lipschutz Schaum's Outline Series, (1965).
- Topology: A first Course, J. R. Munkres, Prentice-Hall, (1977).
- Foundation of Topology , C. W. Patt y, PWS-Kent Publishing Co. Boston, (1993).
- Introduction to General Topology, D. Ahmed Mohammed Zhran, Library AlkhbetaAlthqafeea, Bisha, 1420 H.
- Foundations of General Topology, A.D.Ahmed Abdel Monsef Allam, Library Dar Alzaman for Publication and Distribution, Medina ,1426 H.
- General Topology, A. D. Ahmed Abdel-Kader Ramadan, Dr.Taha Merse Aladoe, Alrashed Library, 2nd edition 1426H/ 2005.

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Differential Geometry	443MATH	3	-	3	4	8	331 MATH

Student's workload				
In-class activities	Contact Hours		Self-learning/study	Hours
Lectures	45		HW/Assignments	22
Laboratory			Study for exam	62
Exams and quizzes	5		Working for lab	
			Preparation for classes	30
Total	**50 ~42**		Total	**114**
Total Learning Hours = **156**			Equivalent **ECTS points** = Total LH/28 = **5.57**	

(1) Brief Course Description

Differential Geometry is an important course in Mathematics, which enables the student to understand concept of curvature and torsion curve, normal torsion of surface and Gaussian torsion of curves, evaluation of the area of surface and classification of its points.

(2) Course Objectives

After finishing the course, the student is expected to be familiar with the following:

- Curvature and the torsion of curves
- Demonstration of the surface area using the coefficients of the 1st fundamental form.
- Classification of the points of surfaces using the coefficients of the 2nd fundamental form
- Normal and Gaussian torsion of curves
- Asymptotic lines and main lines of surface
- Mean torsion of surface

(3) Course Contents

- **Curves Theory**: Basic definitions, curvature and torsion of regular curves, Frenet-Serret apparatus, Frenet-Serret theorem, the fundamental theorem of curves.
- **Surfaces Theory**: Basic definitions, 1st fundamental form and 2nd fundamental form, normal curvature, Geodesic curvature, Gaussian and mean curvatures, asymptotic lines and lines of curvature.

(4) Assessment Criteria

- First mid-term exam 20%
- Second mid-term exam 20%
- Quizzes and home work 10%
- Final exam 50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

- A First Course in Differential Geometry, Chuan-Chih Hsiung, International Press, (1997)

(7) Reference Books

- Differentiable Curves and Surfaces, M. Do Carmo, Prentice Hall, New Jersey, (1976).
- Modern Differential Geometry of Curves and Surface with Mathematica, A. Gray, 2nd Edition, CRC Press, (1997).
- Elements of Differential Geometry, Richard S. Millman, George D. Parker, Prentice Hall (1977).

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Applied Statistics	453 STAT	2	2	3	4	7	251 STAT

Student's workload				
In-class activities	Contact Hours		Self-learning/study	Hours
Lectures	30		HW/Assignments	16
Laboratory	30		Study for exam	43
Exams and quizzes	5		Working for lab	19
			Preparation for classes	27
Total	**65 ~54.**		Total	**105**
Total Learning Hours = **159.**			Equivalent **ECTS points** = Total LH/28 = **5.67**	

(1) Brief Course Description

Applied Statistics is an important course in Mathematics, enables the student to use statistics in solving statistical problems such as industry, economy, agriculture, planning and others.

(2) Course Objectives

After finishing the course, the student is expected to be familiar with the following:

- Application of statistics for solving different problems
- Statistical methods for data analysis
- Deep knowledge of statistics
- Some softwares (MATLAB, FORTRAN, Java) in Applied statistics

(3) Course Contents

- **Parametric Estimation**: Point estimation, intervals estimation, maximum value of error in estimation, sample size estimation, confidence intervals estimation for population mean in large samples size (small sample size), confidence interval estimation for proportion of population, confidence intervals estimation for variance and standard deviation, confidence interval estimation for difference of two populations means in large samples size (small sample size), confidence intervals estimation for difference between two mean in dependent populations, confidence intervals estimation for difference of two proportions, confidence intervals estimation for ratios of two normal populations variances.

- **Hypotheses Testing**: Testing the population mean (large and small sample), testing the population proportion, testing the population variance or standard deviation, testing the difference between two means (large and small sample), testing the difference between two proportions, testing the ratio of two variances, testing the pair samples.
- **Chi-Square Tests**: Chi-square test of goodness-of-fit, Chi-square tests of independence and homogeneity.
- **Analysis of Variances**: One-way analysis of variances for fixed variables, complete random design analysis, two-way analysis of variances for fixed variables, complete randomize block design, two-way analysis of variance, the model of the impact of two factors and several levels and interaction between them.
- **Regression and Correlation**: Statistical inference about regression factors, coefficient of association and coefficient of contingency, coefficient of determination, multiple linear regression, multiple and partial correlation, transformations in linear regression.
- **Non-parametric Statistics**: Sign test, Wilcoxon signed rank test, Mann- Whiteny test, Kruskal-Wallis test, Run test.

(4) Assessment Criteria

- First mid-term exam 20%
- Second mid-term exam 20%
- Quizzes and home work 10%
- Final exam 50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

- Elementary Statistics a Step by Step Approach , A. Bluman, 6th Edition, McGraw-Hill. (2006).

(7) Reference Books

- Principles of Statistics and Probability, Dr. Adnan Berry & Others, 3rd edition 1997.
- Concepts & Methods of Statistical Analysis, Mahmoud Hnde and Khalaf Salman, Alrashed Library, 3rd edition, 2007.
- Contribution in Applied Statistics, Dr. Nader Shaban Alsawah, University House –Alexandria.

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit hours			
Fluid Mechanics	**464MATH**	**3**	**-**	**3**	**4**	**8**	**434MATH**

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Lectures	45		HW/Assignments	22
Laboratory	0		Study for exam	60
Exams and quizzes	5		Working for lab	0
			Preparation for classes	17
Total	**50 ~42**		Total	**99**
Total Learning Hours = **141**			Equivalent **ECTS points** = Total LH/28 = **5.04**	

(1) Brief Course Description

Fluid Mechanics is an important course in Mathematics which shows the importance of fluids in practical life, derive mathematical expressions that controls motion of fluid (liquid-gas), apply information studied in complex variable course on complex potential function (upstream, downstream, bisexual, vortex motion in two dimensions, applications) and use mathematical methods, ordinary and partial differential equations in solving fluid mechanics problems.

(2) Course Objectives

After finishing the course, the student is expected to be familiar with the following:

- Importance of fluids in practical life and derivation of mathematical formulas that govern the movement of fluid (liquid-gas)
- Accustome the student to think logically and gain proper necessary skills to solve problems

(3) Course Contents

- **Definitions**: Method of fluids motion (Euler, Lagrange), continuity equation, Euler equations for the motion of the ideal non-negotiable compressing fluid, examples of integration of Euler equations.
- Complex potential function (upstream, downstream, bisexual, vortex motion in two dimensions, applications).
- **Fluid motion equations of viscous non-negotiable compressing** (Navier-Stokes equations)
- **Exact solutions to Navier-Stokes Equations** (Couette flow, Poisseville flow)
- **Time-Dependent Motion**
- **Fundamentals of Fluid Dynamics Experiment:** (Dimensional analysis, Baye's theorem, applications)

- **Forced Motion** (equations of forced motion, coefficient of forced viscosity, Brandel formula)

(4) Assessment Criteria

- First mid-term exam 20%
- Second mid-term exam 20%
- Quizzes and home work 10%
- Final exam 50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

- A Brief Introduction to Fluid Mechanics,Young, Munson and Okiishi, 3rd Edition, Wiley, 2007.

(7) Reference Books

-Fundamental Mechanics of Fluids, I.G. Currie, 3rd Edition (Kindle Edition), 2007.
-An Introduction to Fluid Dynamics, G.K. Batchelor, Oxford University Press, 2006.
- Continuum Mechanics, Ismail Hassanein and Others, Alrashed Library in Riyadh, 2008

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Mathematical Modeling	472MATH	3	-	3	4	8	332 MATH

Student's workload				
In-class activities	Contact Hours		Self-learning/study	Hours
Lectures	45		HW/Assignments	22
Laboratory	0		Study for exam	60
Exams and quizzes	5		Working for lab	0
			Preparation for classes	32
Total	**50 ~42**		Total	**114**
Total Learning Hours = **156**			Equivalent **ECTS points** = Total LH/28 = **5.57**	

(1) Brief Course Description

Mathematical Modeling is an important course in Mathematics, which enables the student to learn necessary skills to transform problems to mathematical models, to know the best control systems and to use software in modeling

(2) Course Objectives

After finishing the course, the student is expected to be familiar with the following:

- Basis of mathematical modeling
- Transformation of problems to mathematical models
- Mathematical programs (MATLAB) in modeling and simulation
- Optimal control systems

(3) Course Contents

- **The Areas of Mathematical Modeling:** Mathematical models and others models, mathematical model building steps.
- **Data Relationship Models** : Sources of error, control data, evaluation of mathematical models.
- **Principles of Mathematical Modeling-Linear and Non linear :** continuous and discontinuous.
- **Simulation and Analytical Solution.**

- **Systems Modeling**: Dynamical programming, application of software in modeling and simulation, general applications in different areas, linear statistical models, models designing.

(4) Assessment Criteria

- First mid-term exam 20%
- Second mid-term exam 20%
- Quizzes and home work 10%
- Final exam 50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

- A Course in Mathematical Modeling, Douglas Mooney and Randall Swift , Reviewed by Jan E. Holly, 1999.

(7) Reference Books

- Discrete Event System Simulation, Jerry Banks, John S. Carson and B. Nelson, Prenice – Hall Inc., 2000.
- Linear Models, D. Anies Ismail Kengo, D. Abdullah Abdul Karim Sheikh, Adaret Alnasher Alalme & Altawzeea 2005.

Course Name	Course Code	Contact Hours			Year	Level	Prerequisite
		Lectures	Sec/Lab	Credit Hours			
Operations research	473MATH	3	-	3	4	8	324MATH

Student's workload				
In-class activities	Contact Hours		Self-learning/study	Hours
Lectures	45		HW/Assignments	22
Laboratory			Study for exam	60
Exams and quizzes	5		Working for lab	
			Preparation for classes	32
Total	**50 ~42**		Total	**114**
Total Learning Hours = **156**			Equivalent **ECTS points** = Total LH/28 = **5.57**	

(1) Brief Course Description

Operation research is an important course in mathematics which enables the student to use operations research in decision making and finding the best solution in different fields such as industry, economy, agriculture and others.

(2) Course Objectives

After finishing the course, the student is expected to be familiar with the following:

- Operations research model developing
- Algorithms application such as simplex method to solve problems of operations research
- Application of operations research in solving different types of problems such as issues of transport and customization
- Some softwares (MATLAB - Fortran) in operations research

(3) Course Contents

- **Introduction to Operations Research.**
- **Methods of Decision-Making**: Circles theorem, pert method and application.
- **Graphical Method:** Solution of linear programming problems and associated problems by graphical method, solution of associated problems or binary associated problems by graphical method.
- **Solution of Linear Programming by Simplex Method**: Basics of simplex method, tabular simplex method, analysis of post-optimal solution, some problems based on linear programming and methods to overcome them, solution of associated problems.
- **Transportation and Assignment Problems**: Transportation problems, allocation or selection problems.

- **Integer Numerical Programming**: Approximation method to solve integer programming problems, additional conditions to solve integer programming problems, integer programming models of integer method, Branch and Bounded method.
- **Linear Programming and Statistics**: Random programming, application of linear programming in statistics.
- **Non-Linear Programming** (Objective): Convergent sequences of non-linear functions, Kohn– Tucker conditions and Lagrange multipliers, quadratic programming, means of reducing production time, forecasting.

(4) Assessment Criteria

- First mid-term exam 20%
- Second mid-term exam 20%
- Quizzes and home work 10%
- Final exam 50%

(5) Course Teaching Strategies

- Academic lectures
- Scientific discussions
- Home work
- Mini-model education
- Assignments to prepare scientific projects

(6) Text Book

-Nonlinear Programming, D. P. Bertsekas, Athena Scientific Belmont, Ma, ISBN:1886529000 (1999).

(7) Reference Books

- Operations Research, P. K. Gupta & D. S. Hira, S. Chand (2008).
- Operations Research and Statistics, D. Ali Mahmoud Ajour, Dar Alfeqar Aljamaee, 2007.

Course Title	Course Code	Number of Study Hours				Year	Level	Pre-requisites
		Theo.	Tut.	Lab.	Credit			
Graduation Project	**480MATH**	**3**	**0**	**2**	**4**	**4th**	**7th**	**92 Hours**

Student's workload				
In-class activities	**Contact Hours**		**Self-learning/study**	**Hours**
Orientation and discussion	30		Preparation for project work	40
Lab or theoretical work	30		Working on data and analysis or theoretical work	50
Presentation	15		Tasks accomplishments and report writing	40
Assignments	7		Preparation for presentation	20
Total	**82~69**		Total	**150**
Total Learning Hours = **219**			Equivalent **ECTS points** = Total LH/28 = **8**	

(1) Brief Course Description

In this course, students are able to carry out an interest-based research project. It provides the opportunity for students to work independently and according to their own study plans and thought processes on a mathematical subject while being supervised by a department professor. A research report that presents the project's outcomes and summarizes its findings is included, that expands the project's scope and scientific requirements. This course improves students' abilities to write academically and conduct scientific research.

(2) Course Objectives

This course is designed to provide students with the following concepts:

- Enables students to carry out a sustained, guided, independent study of a topic in mathematics.
- Training students through research in a current field of mathematics and problem-solving skills, literature searching, and presentation skills.
- Develop an appropriate level of mathematical literacy as well as competency in documentation, analyses, and presentation of results.
- Conduct independent research
- Ability to discuss and present research.

(3) Course Contents

- Literature review
- Analysis and discussion of the problem
- New approaches to the problem
- Application of the approaches
- Results analysis and discussion

- Writing the dissertation
- Preparation of the defending presentation

(4) Assessment Criteria

Supervisor: 50%

Referees: 50%

(5) Course Teaching Strategies

- Lectures, Reports and Essay Assignments, Homework, and Web-based Assignments.

(6) Text Book as per the research topic

Appendices

Appendix	
Math2.2	Mathematics Department Manual
Math2.6	Annual Program Report
Math4.7	Computer Lab and Classroom Committee Report, 2019-2020.
Math4.8	College of Science Library Rules.
Math4.9	List of Available Books on Mathematics, College of Science.
Math4.10	List of Available Books on Mathematics, Central Library.
Math4.11	Central Library Handbook.
JU2.3	The Student Guide