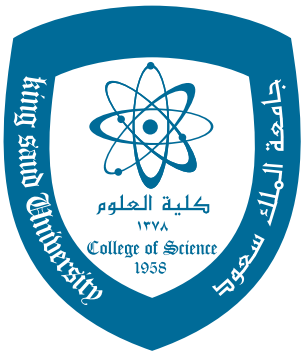


Kingdom of Saudi Arabia

Ministry of Higher Education

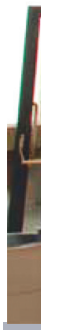
King Saud University

Department of Mathematics Handbook

College of Science

1431/1432 H

2010/2011 G

College of Science

Contents

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For more information about the Department and to look at the home pages of faculty members, please visit the Department website: http://math.ksu.edu.sa

About the Department

The Department of mathematics was established in 1378 H (1958 G). It is one of the earliest established departments and, at present, it is one of the largest departments in the University. Since its inception, the Department is continuously developing and serving the ever increasing number of students from different colleges of the University. The Department has two branches, one for the males in the main campus in Deriya, and the other is for the females in Malaz in the city center.

Currently, there are 74 faculty members comprising professors, associate professors and assistant professors specialized in various mathematical areas, namely; analysis, algebra, geometry, topology, numerical analysis, discrete mathematics and different areas of applied mathematics. In addition to faculty members, the Department has also 46 lecturers, investigators, teaching assistants and demonstrators.

Apart from teaching duties, the faculty members in the Department are actively involved in research in different areas of mathematics and their research papers are published in reputed international journals. Some of the faculty members are on the editorial boards of various journals and many of them are also reviewers of various journals of international repute. The Department is also planning to establish an Excellence Center in Applied Mathematics to promote high quality of research having practical applications and a B.Sc. Program in actuarial and financial mathematics.

The activity of the Department involves cooperation at the national and at the international levels. At the national level, cooperation with Hail University has started two years ago through an M.Sc. program, while at the international level the Department is:

- Arranging cooperation with the Department of Mathematics in the University of Calgary in Canada which has been recently selected as a benchmark department.
- Arranging cooperation with the University Parise-1 (Pantheon Sorbonne).

The Department awards B.Sc., M.Sc. and Ph.D. degrees in different areas of mathematics. By the end of the academic year 1428-1429 H (2007/2008 G), there were 271 students enrolled for the B.Sc. Degree, 40 for the M.Sc. and

18 for the Ph.D. Moreover, 69 students have graduated during that year, out of which 68 were conferred the B.Sc. Degree, and one a Ph.D. Degree.

In addition, the Department teaches mathematics courses required by other programs of the College of Science such as Statistics, Operation Research, Chemistry, Physics and Astronomy. It also caters for the needs of mathematics teaching of other colleges in the University such as Engineering, Computer science, Pharmacy and Agriculture. Furthermore the Department offers training services through the Community Service Center, and consultations to various sectors in the Kingdom in the field of mathematics and its applications.

Vision

Leading the way towards achieving outputs of high caliber in mathematics and its applications, and contributing to the enrichment of the Knowledge Society.

Mission

Offering excellent programs aimed at graduating students in the field of mathematics and its applications capable of meeting the development's needs of the Kingdom and its community, as well as enriching Knowledge through education, research, authoring original books, translating to Arabic well - reputed books, and optimal use of technology.

Objectives

- To produce qualified personnel capable of contributing to the extensive development witnessed by the various sectors in the Kingdom.
- To attract mathematically talented candidates for teaching and research positions, and to prepare them for faculty posts in the universities of the Kingdom.
- To provide the general education institutions with capable mathematics teachers.
- To provide service courses to the College programs and the programs of other scientific colleges.
- To enrich the Arabic Library with mathematics texts authored in, or translated to, Arabic.

- To encourage research programs and participation in specialized scientific conferences.
- To actively pursue the prospect of establishing a Center of Excellence in Applied Mathematics.
- To offer workshops and lectures, specialized and general, to the various sectors requiring mathematical training, and to provide consultations to research centers and other institutions.

Department Of Mathematics

Graduates' Job Opportunities

- High school teachers.
- Mathematicians in government ministries and institutions and private sectors that require mathematical skills such as: the Ministry of Finance, the Saudi Arabian Monetary Agency, the General Organization for Social Insurance, the Central Department of Statistics and Information, the Public Pension Agency, Banks, Research Centers, ARAMCO, SABIC, etc.
- Meritorious students pursue higher studies and ultimately join as faculty in colleges and universities in the Kingdom of Saudi Arabia.

Departmental Administration

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Main Scientific Awards

Several international and national awards have been obtained by some faculty members ; namely:

The Lester R. Ford award, Mathematical Association of America, 2006:

Dr. Ibtesam Bajunaid

Almarai award, organized by Almarai Company, 2008-2009:

Dr. Najla Al-Towaijiry

The “Award of Excellence in Teaching”, organized by the College of Science for the academic year 2008/2009:

Dr. Tahsin Ghazal and Dr. Fairouz Tchier.

The “Award of Excellence in Research”, organized by the College of Science for the academic year 2008/2009:

Dr. Eman Fahmy.

The Study System at the College of Science

Teaching at the College of Science is subject to the following scheme:

1. The school year consists mainly of two regular semesters and a summer semester, if available.
2. The stage of academic progress is indicated by the academic level since the number of levels to graduate is at least eight levels in conformity with the approved Study Plan.
3. The duration of the level is a full semester (not less than 15 weeks) and this period does not include the periods of registration and final exams.
4. The duration of the summer semester is not less than eight weeks where the teaching time allocated for each course is doubled.
5. A number of courses (subjects) are taught during each academic level according to the program of each specialty in the different departments.
6. Students have to study 136 class units (credit hours) to obtain a Bachelor’s Degree as follows:

   A. The student studies a number of 31 credit hours during the Preparatory Year (two semesters in one academic year).

B. The student studies 97 credit hours (optional + compulsory) in the Program of Specialization in the various College departments throughout the six semesters following the Preparatory Year (beginning with the third semester).

C. University Requirements: The student selects 8 credit hours of the requirements of the University out of 22 optional credit hours during the period of study at the College.

7 - The student chooses the specialty department before the end of the Preparatory Year based on the conditions set by each department.

1. The New Academic System (e-Register)

Registration is the cornerstone of the academic system, the center of the educational process, and the first step to start university life. The new Academic System (e-Register) offers new students the following opportunities:

1. To create an e-mail through the site of the Deanship of Electronic Transactions and Communications:
http://www.ksu.edu.sa/sites/KSUArabic/Deanships/Computer/Pages/

2. To have an access to the academic system by using the link: http://edugate.ksu.edu.sa; then, entering a user name and a password.

3. Online Registration (registration, adding, and dropping): a student can register, in person, from any location during the periods of registration and dropping plus an additional period specified in the academic calendar; thus, without having to visit the College or the Department, the student can perform the following:

A. Registration: Registration of courses and deciding the required number of credit hours.

B. Adding and dropping: The student may drop and add courses during the first week of teaching provided that the study load does

not go above , or lower than, the allowed course load.

4. To view the course schedule of the College and the available/closed groups.
5. To view the study schedule and print it.
6. To view the Academic Record and print a copy (an unofficial copy).
7. To view the results of the final exams as soon as they are put online.
8. To view the Study Plan, the courses passed by the student, and the ones remaining to be studied.
9. To know about the penalties imposed upon the student.
10. To view the financial rewards.
11. To make suggestions and submit complaints.
12. To write the academic performance evaluation of faculty members.
13. To exchange electronic messages and change the password.
    * In case of any problem while registering, please consult the College Registration Office (Room 1A7 - Building 4).

2. Rules and Mechanisms for Registration of Courses

• **The Course** is a module that meets the needs of the level specified in the approved Study Plan in each specialty (Program). The Course has a number, a code, a title, and a description depending on the different departments (see the Department's Manual Guide).

• **The Course** is divided into a set of theoretical lectures and practical lessons (study units) taught weekly during the academic level.

• **The Credit Hour** is a weekly theoretical lecture that is not less than fifty minutes, or a practical lesson which is not less than one hundred minutes.

• The registration of the courses for all students is done automatically through the website: http://edugate.ksu.edu.sa

• The academic levels vary in the number of the units of study, from 12 units to 20 units, for each level.

• The Courses are registered automatically at the beginning of the following semester for the student's convenience. Then, the student can modify the course schedule by adding or dropping.

• The following table shows the student's study load corresponding to the cumulative average:

GPA	2	2.5	3	3.5	4	4.5	5
Hours allowed for registration	14	15	16	17	18	19	20

• The Processes of dropping and adding are performed by the student electronically in the first week of the semester through accessing the gate of the academic system of the University Deanship of Admission and Registration (http://edugate.ksu.edu.sa).

• No student has the right to register a course without passing its pre-requisite course.

• Students, who pass all courses without failures, are registered in the courses of the level beginning gradually with the lower levels according to the study plans approved.

• Students, who fail in some courses, are registered in courses that ensure their minimum study load in each semester taking into account the following points:

- No conflict in the course study schedule.
- Satisfying the previous requirements of the course or courses to be registered.

Calculating the Average and Cumulative GPA:

The Average and cumulative GPA are calculated every semester for the student automatically by the system. To know how to calculate the averages, you should follow the following steps:

Calculating the Semester Average:

The GPA is calculated considering the following points:

1. Knowing the number of hours of the courses.
2. Knowing the mark obtained in each course.
3. Knowing the corresponding grade of each mark.
4. Knowing the value of each grade.
5. Knowing the points = number of hours of the course × value of the grade.
6. Determining the total points obtained in all courses of the semester.
7. Determining the total number of hours registered in the semester.
8. The average is calculated every semester according to the following formula:

GPA =	Total points (item 6) / Number of hours registered in the semester (item 7)

The following table shows the percentage of marks, grade and value obtained by the student in each course, which is used to calculate the points:

Mark	Grade	Letter of Grade	Value of Grade
From 95-100	Excellent +	A+	5.00
From 90 to less than 95	Excellent	A	4.75
From 85 to less than 90	Very Good+	B+	4.50
From 80 to less than 85	Very Good	B	4.00
From 75 to less than 80	Good +	C+	3.50
From 70 to less than 75	Good	C	3.00
From 65 to less than 70	Pass +	D+	2.5
From 60 to less than 65	Pass	D	2.00
Less than 60	Failure	E	1.00
Absence from lectures (25% or more)	Debarred	H	1.00

Calculating the Average Cumulative:

The GPA semester average is calculated as follows:

1) The grand total of points (for all semesters that have been studied).
2) The grand total of credit hours (for all semesters that have been studied).
3) The cumulative average is calculated according to the following formula:

GPA =	Grand total of points _____ Grand total of credit hours

Here is an example of how to calculate the grades above:

Calculating the grade of the first semester:

Course	Credit Hours	Mark	Grade	Grade Value	Points
Phys 101	4	67	D+	2.5	4 × 2.5 = 10
Chem101	4	73	C	3	4 × 3 = 12
Eng 121	3	77	C+	3.5	3 × 3.5 = 10.5
Arab 101	2	81	B	4	2 × 4 = 8
	13				40.5
GPA = Total points ÷ No. of hours registered in semester = 40.5 ÷ 13 = 3.12					

Calculating the grade of the second semester:

Course	Credit Hours	Mark	Grade	Grade Value	Points
Math 101	3	61	D	2	3 × 2 = 6
Stat 101	3	73	C	3	3 × 3 = 9
Computer Science 206	3	80	B	4	3 × 4 = 12
Arab 103	3	88	B+	4.5	3 × 4.5 = 13.5
Islam 101	2	92	A	4.75	2 × 4.75 = 9.5
Eng 122	3	97	A+	5	3 × 5 = 15
	17				65
GPA = Total points ÷ No. of hours registered in semester = 65 ÷ 17 = 3.82					

Calculating the average cumulative:

GPA = Total points ÷ Total hours of all semesters = 105.5 ÷ 30 = 3.52

Dropping and Adding of a Course:

• The process of dropping and adding is performed through portal (http://edugate.ksu.edu.sa) during the first week of the semester only; but the number of credit hours registered has to be at least 12 hours.
• The student may drop only one course due to an excuse acceptable to the Dean of the College. This procedure should occur at least five weeks before the final exams begin. The student has the right to apply for such a procedure at a maximum of four courses during the whole period of study at the College.

Attendance, postponing and dropping out of College:

• The student must be regular in attendance attending at least 75% of the lectures and the practical classes.
• If any student has a percentage of absence of 25% , or more, in any course, he is denied access to the final exam of this course and his result is F.
• A student may apply for postponement of the study before the beginning of the semester for an excuse accepted by the College Board. The postponement should not exceed two consecutive semesters or three intermittent semesters as a maximum limit while studying at the College.
• The University Council may, in case of necessity, exempt the applicant from the previous provision.
• If a student drops out of College for one semester without requesting the postponement of his registration, the University has the right to dismiss his registration. The University Council has the right to do this for a lesser period of time.
• The student is not considered as dropping out of College if he is a visiting student at another university.

Visiting Student:

The Visiting Student is a student who studies some courses at another university, or at a branch of the university to which he belongs without being transferred. The courses he studied are accredited according to the following regulations:

• The student has to have a transcript (including a grade point average) for, at least, two semesters at his college before he applies as a visiting student.

• The student must obtain a prior approval from his college permitting him to study as a visiting student while specifying the courses that will be studied.

• The College has the right to require a specific grade to be achieved by the student to offset the course. The student should obtain an official letter from the Deanship of Admission and Registration directing him to study as a visiting student.

• The student has to join a college or a university officially recognized.

• The courses, under consideration by the student to be studied outside the University, must be equivalent in their description to the University courses, and their course units should be no less than the units of any of the courses contained in the graduation requirements.

• The maximum of the total units of study that can be calculated from outside the University is twenty percent (20%) of the total units required for graduation at King Saud University.

• The courses that are studied by the visiting student are not included in the cumulative average. These courses are recorded in his academic record.

• The student must provide the Deanship of Admission and Registration with the results he obtained during the first two weeks of study in the semester following the period of study as a visitor. If not reported within that period, the student is considered as dropping out of College during those semesters.

Dismissal from the University:

The student is dismissed from the University in the following cases:

• If he receives three consecutive warnings due to a cumulative average below a minimum of 2.

• The student may be given a fourth opportunity by the Council of the University based upon the recommendation of the College Council to raise his cumulative GPA by studying the available courses.

• The University Council may give the dismissed students, due to warnings, an opportunity that does not exceed two semesters as a maximum.

• If the student does not fulfill his graduation requirements at the College in a period of up to half of the period prescribed for graduation in addition to the duration of the Program.

• The student is given an exceptional opportunity by the University Council to meet the graduation requirements during a maximum period not exceeding twice the original term specified for graduation.

• The University Council may allow dismissed students, due to the exhaustion of failure times, to attend twice the duration of the Program. This extension should not exceed a maximum of two semesters.

Examinations and Grades:

• Based on a proposal from the Department Council, the College Council specifies a mark for the student's semester work, varying from 40% to 60% of the final grade of the course.

• The mark of the course's semester work is calculated by one of the following two methods:

- Oral, practical tests, research, or other forms of classroom activity, or

from all the above or some of them, in addition to at least one written exam.
- Two written exams at least.

• Based on the recommendation of the course teacher, it is permissible for the Council of the Department, that teaches the course, to allow the student to complete the requirements of any course in the following semester and to give the student a grade of I (incomplete) in his academic record. Only the grades achieved by the student are included in the GPA or cumulative after the completion of the requirements of that course.

• If one semester passes without changing the grade incomplete (I), the student is given an F which is calculated in the GPA and cumulative.

• The grades obtained by the student in each course are calculated according to the schedule mentioned above.

Restrictions of the Final Examinations:

• No student may be tested in more than two courses in one day.
• The student is not allowed to enter the final exam after half an hour of its beginning, and is not allowed to leave the exam room before half an hour after its beginning.

• Based on a recommendation from the relevant Department Council, the College Council specifies the duration of the final written exam to be within a period not less than one hour, and not more than three hours.

• Cheating in the exam, initiating it, or violating the instructions and rules of examination procedures are actions punishable in accordance with the Regulations of the Students' Discipline issued by the University Council.

• In cases of necessity, the College Council, in charge of teaching a course, has the right to approve re-marking of the answer sheets in a period of time not later than the beginning of the following semester in accordance with the following rules:

- A student may apply for re-marking the answer sheets of only one course per semester.

- The student, who wishes to re-mark his answer sheets, may apply for re-marking to the department, that teaches this course, not later than one month after taking the final exam.

- A student, who has already applied for re-marking and proved the invalidity of his application, should never apply for re-marking his answer sheets in any exam in the future.

Transferring:

1) Transferring from one college to another within the University:

• It is permissible, with the consent of the respective deans of the colleges, to transfer from one college to another in accordance with the conditions approved by the College Council to which the student wishes to transfer.

• The student's college academic record has to show all courses previously studied, including grades, semester and cumulative averages throughout the study at the college from which he is transferred.

2) Transferring from one major to another within the College:

• The student may, after the approval of the Dean, transfer to another specialty within the College according to the guidelines established by the College Council.

• The student's college academic record has to show all courses previously studied, including grades, semester and cumulative averages throughout the study at the college from which he is transferred.

Graduation:

The student graduates after completing successfully the graduation requirements in accordance with the study plan, provided that his cumulative average is no less than 2 (Pass) .

Educational Programs

The Department offers programs in Mathematics leading to: Bachelor's, Master's and Ph.D. degrees.

Bachelor of Science in Mathematics

The Department started this Program, first for male students in 1378 H (1958 G), and subsequently for female students in 1403 H (1982 G). This Program is being taught in Arabic and English languages. The Department is moving gradually towards teaching in English starting from the year 1429 – 1430 H . Currently, arrangements are being made to implement a B.Sc. Program in actuarial and financial mathematics for which approval has been obtained.

Program Mission

To provide basic Mathematical concepts and skills within a high caliber program that produces competitive graduates capable of meeting the educational and developmental needs and challenges of the Kingdom in all domains relevant to Mathematics and its applications.

Program Objectives:

(1) To provide the students with scientific qualifications required by various public and private sectors.

(2) To prepare the students for teaching posts in educational institutions.

(3) To prepare the students for graduate studies leading to Master's and Ph.D. degrees.

(4) To foster in the students rational thinking and to enhance their Information Technology skills in the domain of mathematics.

Admission Requirements

Students are admitted to this Program based on the following:

(a) Requirements for enrolment in the College of Science.
(b) Requirements set by the Department.

Degree Requirements

The student should complete successfully 136 credit hours in at least 8 semesters as mentioned in the Study Plan.

Study Plan

At the beginning of the academic year 1429-1430 H (2008-2009 G), the College of Science joined the Program of the Preparatory Year in the University. This required the development of the Program Study Plan to be compatible with the new arrangement. The updated plan has passed through the official stages and it has been approved by the academic authorities in the Department, the College and the University. This Study Plan has become applicable to the new students starting from the academic year 1430-1431H (2009-2010 G).

General Scheme of the Study Plan:

Requirement Type	Course Code and Title	Prerequisite	Corequisite	Credit Hours
Preparatory Year Requirements	ENG 140 : English Language (1) (E)			8
	ENG 150 : English Language (2) (E)			8
	MATH 140 : Introduction to Mathematics (E)			2(2+0+0)
	MATH 150 : Differential Calculus (E)	MATH 140		3(3+0+0)
	CT 140 : Computer Skills (E)			3
	CI 140 : Learning, Thinking and Research Skills			3
	ENT 101 : Entrepreneurship			1
	CHS 150 : Health and Fitness			1
	MC 140 : Communication Skills			2
Total credit hours of the Preparatory Year requirements				31
University Requirements		Students select any 8 credit hours from the courses of the Islamic Culture.		
Total credit hours required by the University				8

Requirement Type	Course Code and Title	Prerequisite	Corequisite	Credit Hours
Mathematics Courses Required by the Department	MATH 111 : Integral Calculus (E)	MATH 150		4(3+1+0)
	MATH 131 : Foundations of Mathematics	MATH 150		4(3+1+0)
	MATH 160 : Computational Mathematics (E)	CT 140& MATH 111		2(1+0+1)
	MATH 201 : Differential and Integral Calculus (E)	MATH 111		4(3+1+0)
	MATH 202 : Vector Calculus (E)		MATH 201	4(3+1+0)
	MATH 225 : Introduction to Differential Equations (E)	MATH 201		4(3+1+0)
	MATH 243 : Number Theory	MATH 131		4(3+1+0)
	MATH 246 : Linear Algebra	MATH 131		4(3+1+0)
	MATH 316 : Mathematical Methods (E)	MATH202 & MATH 225		4(3+1+0)
	MATH 343 : Group Theory	MATH243 & MATH 246		4(3+1+0)
	MATH 352 : Numerical Analysis (1)	MATH160 & MATH 246		4(3+1+0)
	MATH 373 : Introduction to Topology (E)	MATH 382		4(3+1+0)
	MATH 382 : Real Analysis (1) (E)	MATH 201		4(3+1+0)
	MATH 425 : Partial Differential Equations (E)	MATH 316		4(3+1+0)
	MATH 431 : Combinatorics and Graph Theory (1)	MATH 246		4(3+1+0)
	MATH 441 : Rings and Fields	MATH 343		4(3+1+0)
	MATH 473 : Introduction to Differential Geometry (E)	MATH202 & MATH 246		4(3+1+0)
	MATH 481 : Real Analysis (2) (E)	MATH 382		4(3+1+0)
	MATH 487 : Complex Analysis (E)	MATH 382		4(3+1+0)
	MATH 499 : Research Project	Completion of 100 credit hours		3(0+0+0+3)

Requirement Type	Course Code and Title	Prerequisite	Corequisite	Credit Hours
Total credit hours required by the Department of Mathematics				77
Requirement of the Department other than Mathematics courses	PHYS 101 : General Physics (1)			4
	STAT 100 : Introduction to Statistics	MATH 150		3
	STAT 105: Statistical Methods (E)	STAT 100		4
Total Credit hours required by the Department other than Mathematics courses				11

Requirement Type	Course Code and Title	Prerequisite	Corequisite	Credit Hours
Elective courses	Students select any 9 credit hours from the following list of courses :			
	MATH 379 : Foundations of Euclidean and Non-Euclidean Geometry	MATH202 & MATH 246		4(3+1+0)
	MATH391 : History of Mathematics	MATH243		2(2+0+0)
	MATH 426 : Modeling in Mathematical Biology (E)	MATH225& MATH160		3(3+0+0)
	MATH 433 : Combinatorics and Graph Theory (2)	MATH 431		4(3+1+0)
	MATH 436 : Mathematical Logic (E)	MATH 131		4(3+1+0)
	MATH 442 : Applications of Algebra	MATH 441		4(3+1+0)
	MATH 453 : Numerical Analysis 2() (E)	MATH 352		4(3+1+0)
	MATH 456 : Introduction to Mathematical Programming	MATH 246		3(2+1+0)
	MATH 466 : Dynamical Systems and Chaos (E)	MATH 316		4(3+1+0)
	MATH 482 : Multivariable Calculus (E)	MATH 246 & MATH 481		3(2+1+0)
	STAT 215 : Probability (1)	STAT 100 & MATH 111		4
	PHYS 102 : General Physics (2)			4
	ECON 101 : Principles of Microeconomics			3
	ECON 102 : Principles of Macroeconomics	ECON 101		3
	CSC 201: Computer Programming			4
	CSC 202: Computer Programming Using MATLAB	CSC 201		4
	MGT 101 : Principles of Management and Business			3
Total credit hours of the elective subjects				9
Total credit hours				136

The letter (E) which appears beside some courses means that these courses are being taught in English.

Semester-wise Study Plan

1st Semester				
Course Code	Course Title	Pre-requisite	Co-requisite	Credits
CI 140	Learning, Thinking and Research Skills			3
CHS150	Health and Fitness			1
ENG140	English Language (1) (E)			8
MATH140	Introduction to Mathematics (E)			2(2+0+0)
ENT 101	Entrepreneurship			1
Total Credit Hours				15

2nd Semester				
Course Code	Course Title	Pre-requisite	Co-requisite	Credits
CT 140	Computer Skills (E)			3
MC 140	Communication Skills			2
ENG150	English Language (2) (E)			8
MATH150	Differential Calculus (E)	MATH140		3(3+0+0)
Total Credit Hours				16

3rd Semester				
Course Code	Course Title	Pre-requisite	Co-requisite	Credits
PHYS 101	General Physics (1)			4
STAT 100	Introduction to Statistics	MATH150		3
MATH 111	Integral Calculus (E)	MATH150		4(3+1+0)
MATH 131	Foundations of Mathematics	MATH150		4(3+1+0)
	University Requirement			2
Total Credit Hours				17

4th Semester				
Course Code	Course Title	Pre-requisite	Co-requisite	Credits
STAT 105	Statistical Methods (E)			4
MATH 160	Computational Mathematics (E)	CT 140& MATH 111		2(1+0+1)
MATH 201	Differential and Integral Calculus (E)	MATH 111		4(3+1+0)
MATH 202	Vector Calculus (E)		MATH 201	4(3+1+0)
MATH 246	Linear Algebra	MATH 131		4(3+1+0)
Total Credit Hours				18

5th Semester				
Course Code	Course Title	Pre-requisite	Co-requisite	Credits
MATH 225	Introduction to Differential Equations (E)	MATH 201		4(3+1+0)
MATH 243	Number Theory	MATH 131		4(3+1+0)
MATH 352	Numerical Analysis (1)	MATH160 & MATH 246		4(3+1+0)

MATH 382	Real Analysis (1) (E)	MATH 201		4(3+1+0)
	University Requirement			2
Total Credit Hours				18

6th Semester				
Course Code	Course Title	Pre-requisite	Co-requisite	Credits
MATH 316	Mathematical Methods (E)	MATH 202 & MATH 225		4(3+1+0)
MATH 343	Group Theory	MATH243& MATH 246		4(3+1+0)
MATH 373	Introduction to Topology (E)	MATH 382		4(3+1+0)
	University Requirement			2
	Elective Course			3
Total Credit Hours				17

7th Semester				
Course Code	Course Title	Pre-requisite	Co-requisite	Credits
MATH 425	Partial Differential Equations (E)	MATH 316		4(3+1+0)
MATH 431	Combinatorics and Graph Theory (1)	MATH 246		4(3+1+0)
MATH 441	Rings and Fields	MATH 343		4(3+1+0)
MATH 481	Real Analysis (2) (E)	MATH 382		4(3+1+0)
	Elective Course			3
Total Credit Hours				19

8th Semester				
Course Code	Course Title	Pre-requisite	Co-requisite	Credits
MATH 473	Introduction to Differential Geometry (E)	MATH 202 & MATH 246		4(3+1+0)
MATH 487	Complex Analysis (E)	MATH 382		4(3+1+0)
MATH 499	Research Project	Completion of 100 credit hours		3(0+0+0+3)
	University Requirement			2
	Elective Course			3
Total Credit Hours				16

Elective Courses

Course Code	Course Title	Pre-requisite	Credits
MATH 379	Foundations of Euclidean and Non-Euclidean Geometry	MATH 202 & MATH 246	4(3+1+0)
MATH391	History of Mathematics	MATH243	2(2+0+0)
MATH 426	Modeling in Mathematical Biology (E)	MATH 225 & MATH 160	3(3+0+0)
MATH 433	Combinatorics and Graph Theory (2)	MATH 431	4(3+1+0)
MATH 436	Mathematical Logic (E)	MATH 131	4(3+1+0)
MATH 442	Applications of Algebra	MATH 441	4(3+1+0)
MATH 453	Numerical Analysis (2) (E)	MATH 352	4(3+1+0)
MATH 456	Introduction to Mathematical Programming	MATH 246	3(2+1+0)
MATH 466	Dynamical Systems and Chaos (E)	MATH 316	4(3+1+0)
MATH 482	Multivariable Calculus (E)	MATH 246 & MATH 481	3(2+1+0)
STAT 215	Probability (1)	STAT 100 & MATH 111	4

Course Code	Course Title	Pre-requisite	Credits
PHYS 102	General Physics (2)		4
ECON 101	Principles of Microeconomics		3
ECON 102	Principles of Macroeconomics	ECON 101	3
CSC 201	Computer Programming		4
CSC 202	Computer Programming Using MATLAB	CSC 201	3
MGT 101	Principles of Management and Business		3

Equivalency between Courses due to updating the Study Plan

- Courses with same code, title and number of credit hours are automatically deemed equivalent.
- Courses with same title and number of credit hours but with different codes are handled according to the following table :

Courses after updating the Study Plan			Courses before updating the Study Plan		
Course Code	Course Title	Credit Hours	Course Code	Course Title	Credit Hours
MATH 225	Introduction to Differential Equations	4	MATH 224	Introduction to Ordinary Differential Equations	4
MATH 246	Linear Algebra	4	MATH 242	Linear Algebra (1)	4
MATH 352	Numerical Analysis(1)	4	MATH 253	Numerical Analysis	4
MATH 382	Real Analysis (1)	4	MATH 282	Real Analysis (1)	4
MATH 425	Partial Differential Equations	4	MATH 423	Introduction to Partial Differential Equations	4
MATH 441	Rings and Fields	4	MATH 344	Rings and Fields	4
MATH 473	Introduction to Differential Geometry	4	MATH 374	Introduction to Differential Geometry	4
MATH 481	Real Analysis (2)	4	MATH 384	Real Analysis (2)	4
MATH 487	Complex Analysis	4	MATH 385	Complex Analysis (1)	4
MATH 431	Combinatorics and Graph Theory (1)	4	MATH 434	Introduction to Graphs and Combinatorics	4

- All other courses are handled on a case by case basis.

Course Contents

MATH 140 : Introduction to Mathematics (E) 2 (2+0+0) credit hours

Linear equations and applications, linear inequalities, absolute value in equations and inequalities, complex numbers, quadratic equations and applications, functions , odd and even functions, operations on functions, inverse functions, exponential and logarithmic functions, trigonometric functions, conic sections, systems of equations and inequalities, matrices, matrix operations.

MATH 150 : Differential Calculus (E) 3 (3+0+0) credit hours

The concept of limit, computation of limits, continuity and its consequences, limits involving infinity, formal definition of limit, the concept of derivative, computation of derivatives (power rule, higher order derivatives, acceleration), the product and quotient rules, the chain rule, derivatives of exponential and logarithmic functions, implicit differentiation and inverse trigonometric functions, the mean value theorem, indeterminate forms and L'Hopital's rule, maximum and minimum values, increasing and decreasing functions, concavity and the second derivative test, optimization, related rates.
Prerequisite : MATH 140

MATH 111 : Integral Calculus (E) 4 (3+1+0) credit hours

Definition of Definite Integral and its Properties, The Anti-derivative, Indefinite Integral and the Fundamental Theorem of Calculus. Change of Variables, Integrals of natural and general exponential functions, Integrals of natural and general Logarithmic functions, Derivatives and Integrals of Hyperbolic and Inverse-Hyperbolic functions, Techniques of Integration: by parts, Trigonometric substitutions, Completing the square, Integrals of rational functions, Miscellaneous Substitutions, Indeterminate forms, Improper Integrals, Applications of Integration: Area, Solids of Revolutions, Arc length and Surface of Revolution, Linear Motion, Work, Momentum and Center of Mass, Numerical Integration, Polar coordinates, relation between polar and Cartesian coordinates, Graphs of polar curves, Area in Polar coordinates, Parametric Equations.
Prerequisite : MATH 150

MATH 131: Foundations of Mathematics 4 (3+1+0) credit hours

Introduction to logic, methods of proof, mathematical induction. Sets, operations, on sets, cartesian product, binary relation, partition of a set, equivalence relation, equivalence classes, mappings, equivalence of sets, finite sets, countable sets, cardinal numbers, Binary operations, morphisms, Definition and examples of groups, definition and examples of rings and fields.
Prerequisite : MATH 150

MATH 160 : Computational Mathematics (E) 2 (1+1+0) credit hours

Introduction to Mathematics software : Mathematica and MatLab, Calculus by Mathematica, Linear Algebra by MatLab, Applications : Modeling , Simulation and Visualization, Internet research, Writing Mathematical reports and projects with Scientific Work Place.
Prerequisite : CT 140 and MATH111

MATH 201 : Differential and Integral Calculus (E) 4 (3+1+0) credit hours

Cartesian, cylindrical and spherical coordinate systems, Functions of two and three variables, limits and continuity, partial derivatives, the chain rule, extrema of functions of two variables, Lagrange multipliers, Double integrals, moments and center of mass, double integrals in polar coordinates, triple integrals, application of triple integrals, triple integrals in cylindrical and spherical coordinates, surface area, Sequences, infinite series, convergence tests, representation of functions by power series, Taylor and Maclaurin series, the binomial series.
Prerequisite : MATH 111

MATH 202 : Vector Calculus (E) 4 (3+1+0) credit hours

Vectors in two and three dimensions, scalar and vector products, equations of lines and planes in 3-dimensional space, Surfaces of revolution and their equations in cylindrical and spherical coordinates, Vector valued functions of a real variable, curves in space, curvature, Rates of change in tangent and normal directions, directional derivatives, Gradient of a function, equations of normal and tangent space to a surface at a point, Vector fields, divergence, curl of a vector, line and surface integrals. Green's theorem, Gauss' divergence theorem, Stockes' theorem.
Corequisite : MATH 201

MATH 225 : Introduction to Differential Equations (E)4 (3+1+0) credit hours

Classification of Differential equations and their origins, Methods of solution of first order differential equations, orthogonal trajectories, Linear equations with constant coefficients and variable coefficients, Linear system of equations, power series solutions of linear differential equation of the second order with polynomial coefficients, Laplace transform and the convolution, Fourier>s series.
Prerequisite : MATH 201

MATH 243 : Number Theory 4 (3+1+0) credit hours

First and second principles of Mathematical Induction, Well-ordering principle. Divisibility, Euclidean Algorithm, Prime numbers and their properties, Linear Diophantine equations, Congruences and their properties, linear Congruences, The Chinese remainder theorem, Fermat's little theorem, Euler's theorem, Wilson's theorem, Arithmetic functions, Pythagorean triples, Some cases of Fermat's last theorem.
Prerequisite : MATH 131

MATH 246: Linear Algebra 4 (3+1+0) credit hours

Matrices and their operations, types of matrices, Elementary transformations, Determinants, elementary properties, Inverse of a matrix, Vector spaces, linear independence, finite dimensional spaces, linear subspaces, Inner product spaces, Linear transformation, kernel and image of a linear transformation, Eigen values and eigen vectors of a matrix and of a linear operator.
Prerequisite : MATH 131

MATH 316 : Mathematical Methods (E) 4 (3+1+0) credit hours

Inner product space, sequences of functions and their modes of convergence, Strum-Liouville problem (ordinary and singular), self-adjoint differential operator, Fourier series, convergence in L^2, pointwise convergence, Orthogonal polynomials (Legendre, Hermite, Laguerre) and their properties, expansions of functions, Bessel functions, properties, orthogonality , Fourier transform, Fourier integral, applications.
Prerequisite : MATH 202 and MATH 225

MATH 343 : Group Theory 4 (3+1+0) credit hours

Definitions and examples, subgroups, Lagrange's theorem, normal subgroups, Factor groups, homomorphisms, isomorphism theorems, automorphisms, Cayley's theorem and its generalization. Simple groups, permutation groups, Class equation. Group action on a set, p-groups, Cauchy's theorem, Sylow theorems, External and internal direct products of groups, Burnside's theorem. Dihedral groups, Quaternions, Groups of automorphisms of cyclic groups.
Prerequisite: MATH 246 and MATH 243

MATH 352 : Numerical Analysis (1) 4 (3+1+0) credit hours

Numerical methods for nonlinear equations, Error and convergence, analysis, Direct & iterative methods for linear systems, Error analysis & iterative methods convergence, Interpolation & approximation Error analysis, Numerical differentiation & numerical integration & their error analysis .

Prerequisite: MATH 160 and MATH 246

MATH 373 : Introduction to Topology (E) 4 (3+1+0) credit hours

Topological spaces, examples, closure of a set, derived set, subspace topology, Bases, finite product topology, subbases, Metric spaces, examples, metrizability, $\mathbf{R}^n$ as a metrizable space, Continuous functions, characterization of continuous functions on topological and metric spaces, homeomorphisms, examples, topological property,Compact spaces, compactness in $\mathbf{R}^n$ limit point and sequentially compact spaces.
Prerequisite: MATH 382

MATH 379 : Foundations of Euclidean and Non-Euclidean Geometry 4 (3+1+0) credit hours

Axiomatic methods and Axiomatic systems, Euclidean geometry: Euclid's postulates, Transformations in E^2 and E^3; translations, rotations, reflections, dialations and isometrics, The parallel postulates and non-Euclidean geometry, the hyperbolic plane, Affine geometry: Linear and affine transformations, isometrics, Finite affine planes, A brief introduction to projective geometry.
Prerequisite : MATH 202 and MATH 246

MATH 382 : Real Analysis I (E) 4 (3+1+0) credit hours

Basic properties of the field of real numbers, completeness axiom, countable sets, Sequences and their convergence, monotone sequence, Bolzano-Weierstrass theorem, Cauchy criterion, Basic topological properties of the real numbers, Limit of a function, continuous functions and properties of continuity, uniform continuity, compact sets, The derivative of a function, mean value theorem, LHospital rule, Taylor theorem.
Prerequisite: MATH 201

MATH 391 : History of mathematics (A &E) 2 (2+0+0) credit hours

Mathematics in Babylonia and Egypt, The Greek mathematics, History of mathematics in India and China, Mathematics in the Islamic age, Development of mathematics in Europe from the seventeenth century up to now.
Prerequisite: MATH 243

MATH 425 : Partial Differential Equations (E) 4 (3+1+0) credit hours

Classification and formation of PDE, First order equation, solution of the quasil-linear equation by Lagrange Method, Cauchy problem, Second order linear equation, classification, solution factorization of operator and by separation of variables, Cauchy problem, Laplace's equation, harmonic functions; Dirichlet,

Neumann, and Mixed conditions; examples in Cartesian, polar, cylindrical, and spherical coordinates, Wave equation in one and two dimensions, solution by Fourier series , Heat equation in bounded and unbounded one-dimensional domain, solution by Fourier series and transform.
Prerequisite: MATH 316

MATH 426 : Modeling in Mathematical Biology (E) 3 (3+0+0) credit hours

Introduction to compartments models: What is a Model, What is the goal of a Model, Examples: Foxe and Rabbits model, Brief introduction to Glucose Insulin model; Phase-Plane Analysis: Linear System, Population dynamics: Verhulst Model, A Predator-Prey Model, reaction kinetic; A basic epidemic model (SIR); Nonlinear Systems and Linearization, Qualitative Analysis of the General Population Interaction Model, Qualitative Analysis of the Epidemic Model, The Spruce Budworm Model, SI Model with treatment and Hopf Bifurcation, A cell population model, Parameter estimation, Project.
Prerequisite: MATH 160, MATH 225

MATH 431 : Combinatorics and Graph Theory (1) 4 (3+1+0) credit hours

Basic counting principles, The inclusion-exclusion principle, The pigeonhole principle, Ordinary generating functions, Exponential generating functions, Homogeneous recurrence relations, Non-homogeneous recurrence relations, Basic concepts in graph theory, Eulerian graphs, Hamiltonian graphs, Trees, Planar graphs, Coloring, Chromatic polynomials.
Prerequisite: MATH 246

MATH 433 : Combinatorics and Graph Theory (2) 4 (3+1+0) credit hours

Partitions of sets. Stirling numbers. Partitions of integers. Ferrers diagrams. Euler's identity. Ordered sets. Dilworth's theorem. Linear extensions. Combinatorial designs. Block designs. Latin squares. Connectivity of graphs. Blocks. Edge connectivity. Matching. Hall's theorem. Directed graphs. Tournaments. Networks. Connectivity and networks.
Prerequisite: MATH 431

MATH 436 : Mathematical Logic (E) 4 (3+1+0) credit hours

Propositional calculus. The deduction theorem for propositional calculus. Completeness and consistency of propositional calculus. Predicate calculus. First-order theorems. Consistency of first-order predicate calculus. Completeness theorem for predicate logic.
Prerequisite: MATH 131

MATH 441 : Rings and Fields 4 (3+1+0) credit hours

Rings, group of units and groups of automorphisms of a ring. Ideals and factor rings Principal ring. Prime and maximal ideals. Field of quotients of integral domain. Characteristic of a ring. Direct sum of rings. Modules. Euclidean rings. Ring of polynomials. Roots of polynomials over a field. Field extensions. Finite and simple extensions of fields. Algebraic closure of a field. Splitting fields. Finite fields.

Prerequisite: MATH 343

MATH 442 : Applications of Algebra 4 (3+1+0) credit hours

Classical cipher systems, Steam ciphers, Introduction to cryptanalysis, Exponential ciphers and public keys, Introduction to codes, Linear codes, Perfect codes, Cyclic codes.

Prerequisite: MATH 441

MATH 453 : Numerical Analysis (2) (E) 4 (3+1+0) credit hours

Numerical methods for solving nonlinear systems: fixed point iteration, Newton and quasi Newton methods, Numerical methods for solving initial value problems in ODE: finite difference, multistep and predictor corrector methods; derivation of some methods, error analysis, stability and convergence, Rung-Kutta methods, Numerical methods for solving boundary value problems in ODE: finite difference methods for linear and nonlinear problems, error analysis and convergence, Collocation method, Applications (applicable problems solved by the computer).

Prerequisite: MATH 352

MATH 456 : Introduction to Mathematical Programming 3 (2+1+0) credit hours

Modeling of real life optimization problems, Convex sets & polyhedra approach and geometrical approach, Exchange method & the structure of matrices, Simplex method & variants (2 phase; revised, degeneracy Blands rule etc), Duality theory and application, Transportation Problem, Networks & Flow problems.

Prerequisite: MATH 246

MATH 466 : Dynamical Systems and Chaos (E) 4 (3+1+0) credit hours

Dynamical systems, regular and irregular behavior of nonlinear dynamical systems, existence and uniqueness theorems; linear ODEs with constant and periodic coefficients, Floquet theory; linearization and stability analysis, Nonlinear oscillations and the method of averaging; perturbation methods; bifurcation theory and normal forms; phase plane analysis for autonomous

systems, Hamiltonian dynamics, chaotic systems, Chaotic motion, Lyapunov exponents functions, Poincare maps, including horseshoe maps and the Melnikov method.
Prerequisite: MATH 316

MATH 473 : Introduction to Differential Geometry (E) 4 (3+1+0) credit hours

Theory of curves in space, Regular curves, Arc Length and reparametrization, natural parametrization, Serret-Fernet apparatus, existence and uniqueness theorem for space curves, Bertrand curves, Involutes and evolutes, Local theory of surfaces: Simple surfaces, coordinate transformations, tangent vectors and tangent spaces, First and second fundamental forms, Normal and geodesic curvatures, Weingarten map, principal, Gaussian and mean curvatures, Geodesics, equations of Gauss and Codazzi-Mainardi.
Prerequisite : MATH 202 and MATH 246

MATH 481 : Real Analysis II (E) 4 (3+1+0) credit hours

Riemann Integrations: the definition, Darboux theorem, Riemann sums, the fundamental theorem. Sequences and series of functions: uniform convergence for the sequences and series of functions, power series. Lebesgue measure: Borel σ-algebra, outer measure, Lebesgue measurable sets, Properties of Lebesgue measure. Lebesgue integral: simple functions, measurable functions, definition of Lebesgue integral, Monotone convergence theorem, bounded convergence theorem, the relation between Lebesgue and Riemann integrals.
Prerequisite : MATH 382

MATH 482 : Multivariable Calculus (E) 4 (3+1+0) credit hours

Define norms, inner product on general vector spaces, linear transformations and their properties, basic concepts of topology in the Euclidian space, Continuous functions on the Euclidian space and their properties, differentiability in $\mathbf{R}^n$ and its properties, chain rule and other rules, higher order derivatives and Taylor's, Theorem, maxima and minima, quadratic forms, Lagrange multiplier method, Inverse and implicit function theorems in higher dimension, Integration of function of n variables, Fubini Theorem and change of variable formula.
Prerequisite: MATH 246 and MATH 481

MATH 487 : Complex Analysis (E) 4 (3+1+0) credit hours

Complex numbers, Cartesian and polar representation of complex numbers, powers and roots of complex numbers, Limits and continuity of a complex fun, Analytic functions, Cauchy-Riemann equations, harmonic functions. Exponential, trigonometric, hyperbolic functions and logarithmic functions, Complex integration, contour integrals, Cauchy's theorem, Cauchy's formula,

Bounds on analytic functions, Series representation of analytic functions, Taylor and Laurent series, power series, Zeros and singularities, Residue theory, Applications to real and improper integrals.
Prerequisite: MATH 382

MATH 499 : Research Project 3 (0+0+0+3) credit hours

The student should prepare a research project under the supervision of a faculty member. This procedure involves three main steps:

- Choosing the subject matter of the project.
- Locating relevant references and studying them.
- Writing up the research project and presenting it.

Prerequisite: Completion of 100 credit hours

Master's Programs

Master of Science in Mathematics (thesis and courses option)

Since 1980 the Mathematics Department has offered a Master of Science Degree which requires, both, course study and a Thesis work. The aim of this Program is to provide the students with a strong mathematical background, and at the same time to enable them to specialize in one of their chosen areas of interest in Mathematics. Many students had graduated from the Department through this option. Currently the Department is planning the introduction of a Master's Program by courses only. This aims at providing the student with a broad background of a number of courses which makes it possible for him to work in more than one field, in addition to the possibility of continuing his postgraduate study for a Ph.D. degree.

Program Objectives

- Broadening the general mathematical skill of the students while offering them opportunity to gain in depth knowledge in a chosen branch.
- Preparing the students to study independently and acquainting themselves with scientific research processes.
- Raising the abilities of capable students to the standard required for commencing a Ph.D. program, and dealing with the frontiers of current mathematical research.
- Contributing to meet the requirements of the Kingdom for specialists in Mathematics in the fields of Education, Industry and Planning.

Admission Requirements

Beside the admission criteria stipulated in the Unified Graduate Studies Statutes for Saudi universities, the applicant must satisfy the following requirements:

1) The applicant must hold a B.Sc. degree (Science or Education) in Mathematics with a GPA of at least 3.75 out of 5.

2) The applicant must score at least 70% marks in the aptitude test for graduates organized by the National Center for Assessment in Higher Education.

3) The applicant must pass the written admission test arranged by the Department.

Degree Requirements

1) The student must successfully complete (24) credit hours of the courses.

2) The student must present a satisfactory research thesis in his chosen area of specialization.

Study Plan

1. The Plan comprises 5 Tracks:
   - Track A: Algebra.
   - Track B: Geometry and Topology.
   - Track C: Analysis.
   - Track D: Computational and Discrete Mathematics.
   - Track E: Applied Mathematics.

2) The student must successfully complete 24 credit hours of courses according to the following scheme:

1st Semester: All students must pass the following common courses:

MATH540	Theory of Modules
MATH570	Topology and Calculus in R^n
MATH580	Measure Theory I

2nd Semester: 3 courses selected from the Track list. (9 credit hours)

3rd Semester: 2 courses selected from the Track list. (6 credit hours)

List of Courses

Track A: Algebra

Code	Name	Credit hours
MATH541	Group Theory (I)	3
MATH 542	Linear Algebra	3
MATH 543	Galois Theory	3
MATH 544	Ring Theory (I)	3
MATH 545	Representation Theory of Finite Groups	3
MATH 546	Homological Algebra	3
MATH 547	Commutative Algebra	3
MATH 548	Fuzzy Algebraic Systems	3
MATH 549	Finite Fields	3
MATH 590	Selected Topics in Algebra	3
MATH 530	Introduction to Discrete Structures	3
MATH 531	Graph Theory	3
MATH 532	Ordered Sets	3
MATH 551	Numerical Linear Algebra	3
MATH 555	Mathematical Programming	3
MATH 571	Singular Homology and Cohomology Theory	3
MATH 573	Differentiable Manifolds	3
MATH 581	Functional Analysis (I)	3

Track B: Geometry and Topology

Code	Name	Credit hours
MATH 571	Singular Homology and Cohomology Theory	3
MATH 572	Vector Bundles and K Theory	3
MATH 573	Differentiable Manifolds	3
MATH 574	Geometry of Manifolds	3
MATH 575	Geometry of Submanifolds	3
MATH 576	Selected Topics in Geometry and Topology	3
MATH 522	Partial Differential Equations (I)	3
MATH 546	Homological Algebra	3
MATH 547	Commutative Algebra	3
MATH 581	Functional Analysis (I)	3
MATH 585	Complex Analysis	3

Track C: Analysis

Code	Name	Credit hours
MATH 581	Functional Analysis (I)	3
MATH 582	Functional Analysis (II)	3
MATH 583	Topological Vector Spaces	3
MATH 584	Measure Theory (II)	3
MATH 585	Complex Analysis	3
MATH 586	Potential Theory	3
MATH 587	Summability Theory	3
MATH 588	Holomorphy and Calculus in Normed Spaces	3

MATH 589	Selected Topics in Analysis	3
MATH 520	Ordinary Differential Equations	3
MATH 522	Partial Differential Equations (I)	3
MATH 523	Partial Differential Equations (II)	3
MATH 542	Linear Algebra	3
MATH 547	Commutative Algebra	3
MATH 554	Approximation Theory	3
MATH 573	Differentiable Manifolds	3

Track D: Computational and Discrete Mathematics

Code	Name	Credit hours
MATH 530	Introduction to Discrete Structures	3
MATH 531	Graph Theory	3
MATH 532	Ordered Sets	3
MATH 533	Mathematical Logic	3
MATH 534	Formal Languages and Complexity	3
MATH 535	Combinatorial Design	3
MATH 536	Coding Theory	3
MATH 537	Cryptography	3
MATH 538	Selected Topics in Discrete Mathematics	3
MATH 550	Numerical Analysis	3
MATH 551	Numerical Linear Algebra	3
MATH 552	Numerical Solutions Of Ordinary Differential Equations	3

Code	Name	Credit hours
MATH 553	Numerical Solution of Integral Equations	3
MATH 554	Approximation Theory	3
MATH 555	Mathematical Programming	3
MATH 556	Non-linear Optimization Techniques	3
MATH 557	Selected Topics in Numerical Analysis	3
MATH 541	Group Theory (I)	3
MATH 542	Linear Algebra	3
MATH 549	Finite Fields	3
MATH 581	Functional Analysis (I)	3

Track E: Applied Mathematics

Code	Name	Credit hours
MATH 511	Quantum Mechanics I	3
MATH 512	Fluid Dynamics	3
MATH 513	Perturbation Theory	3
MATH 514	Calculus of Variations	3
MATH 515	Selected Topics in Mathematical Modeling	3
MATH 516	Selected Topics in Applied Mathematics	3
MATH 520	Ordinary Differential Equations	3
MATH 521	Applied Partial Differential Equations	3
MATH 522	Partial Differential Equations (I)	3
MATH 523	Partial Differential Equations (II)	3

Code	Name	Credit hours
MATH 530	Introduction to Discrete Structures	3
MATH 531	Graph Theory	3
MATH 541	Group Theory (I)	3
MATH 542	Linear Algebra	3
MATH 550	Numerical Analysis	3
MATH 555	Mathematical Programming	3
MATH 573	Differentiable Manifolds	3
MATH 581	Functional Analysis (I)	3
MATH 582	Functional Analysis (II)	3
MATH 586	Potential Theory	3

Course Contents

MATH511 Quantum Mechanics (I) 3 credit hours

Foundations of Quantum Mechanics and its mathematical tools. Energy Spectra for some molecules. Wave Mechanics and Schrödinger equation. Scattering Theory.

MATH 512 Fluid Dynamics 3 credit hours

Fundamental concepts. Basic equation for incompressible flow. Navier-Stokes equations. Boundary Layer. Flow about an immersed body.

MATH 513 Perturbation Theory 3 credit hours

Asymptotic expansions, Regular perturbation problems, Methods used include matched asymptotic expansions, Lighthill's Strained coordinate technique and the method of multiple scale, Applications to problems in fluid Mechanics, Magnetohydrodynamics and Quantum Mechanics.

MATH 514 Calculus of Variations 3 credit hours

General variations of a functional constrained extrema. Euler equations. Hamilton-Jacobi equation and related topics. The second variation and sufficient conditions for an extremum.

MATH 520 Ordinary Differential Equations 3 credit hours

Existence and uniqueness of solutions of linear systems. Stability theory. Poincare's theory for two dimensional systems. Sturm-Liouville boundary problems.

MATH 521 Applied Differential Equations 3 credit hours

Partial Differential Equations as mathematical models of physical problems. Linear second order equations and their classification (Laplace's equation, wave equation, heat- equation). Methods of solution Green's function. Special analysis of elliptic differential operators in a Hilbert space.

MATH 522 Partial Differential Equations (I) 3 credit hours

The space of test functions $C_0^\infty(\Omega)$. The space of distributions and its topology. The convolution product of two distributions. Existence theorem for linear equations with constant coefficients. The space of tempered distributions and Fourier transforms. Sobolev spaces.

MATH 523 Partial Differential Equations (II) 3 credit hours

Treatment of the Theory of partial differential equations with emphasis on the fundamental features of elliptic equations. Existence and uniqueness of solutions for various types of boundary conditions. Discussion of representative examples of elliptic, parabolic and hyperbolic equations.

MATH 530 Introduction to Discrete Structures 3 credit hours

Graphs, Subgraphs, Trees, Connectivity, Euler Tours and Hamiltonian Cycles, Ordered Sets, Comparability and Covering Graphs, Dilworth Theorem, Block designs, Latin Squares, finite Geometries, Tournaments, Codes.

MATH 531 Graph Theory 3 credit hours

Colouring, Planar Graphs, Directed Graphs, Shortest Path Problem, Matching and b-matching, algorithms for Eulerian and Hamiltonian Walks, Independent Sets and Cliques, Graph Factorizations, Graph labellings.

MATH 532 Ordered Sets 3 credit hours

Fundamental theorems, algorithmic aspects of chains decompositions, cutsets, fibers, algorithmic and structural aspects of linear extensions, fixed points, the diagram, the dimension, the jump number, sorting, linear extensions and probability, many machine scheduling, order preserving maps, structure and classification.

MATH 533 Mathematical Logic 3 credit hours

The nature of mathematical logic (Axiom systems, Formal systems, Syntactical variables); First-Order theories (Functions and predicates, Truth functions, First Order languages, Structures, Logical axioms and rules); Theorems in First-Order Theories (the Tautology theorem, the Deduction theorem, the Equivalence and Equality theorems, Prenex form, Godel's Completeness theorem, Löwenheim-Skolem theorem).

MATH 534 Formal Languages and Complexity 3 credit hours

Deterministic automata; regular languages, context-free, Turing machines, Halting problem, The classes and NP, Cook's theorem (The NP-completeness of the satisfiability problem) , examples of NP-complete problems, complexity hierarchies.

MATH 535 Combinatorial Design 3 credit hours

Pairwise Orthogonal Latin Squares (POLS), Transversal Designs (TDs), Group Divisible Designs (GDDs), Pairwise Balanced Designs (PBDs), Room Squares, Balanced Incomplete Block Designs (BIBDs) , Finite Planes and Finite Geometries, Symmetric BIBDs,Methods of Direct and Recursive Constructions of Steiner Triple Systems (STSs) , Designs and Codes, Covering and Packing Designs.

MATH 536 Coding Theory 3 credit hours

Irreducible Polynomials on finite fields, algorithms of Berlekamp, single double-error correcting codes, cyclic codes, the group of a code and quadratic residue of a code.

MATH 537 Cryptography 3 credit hours

Introduction to cipher systems, Finite State Machines, Introduction to computational complexity, stream Ciphers, Cipher systems based on number theory.

MATH 540 Theory of Modules 3 credit hours

Modules and submodules, Isomorphism Theorems of Modules, Direct sum of modules, Projective modules, Injective modules, Exact sequences, Trosion modules, Free modules, Direct Decomposition of finitely generated modules over P.I.D. Application to group theory.

MATH 541 Group Theory I 3 credit hours

Structure of finitely generated abelian groups, Semi-direct product of groups, chain conditions, Free groups and presentation of groups.

MATH 542 Linear Algebra 3 credit hours

Linear functional and dual spaces, Canonical form of linear transformations, Jordan and rational forms, Multilinear forms, Hermitian, unitary and normal transformations, Tensor product of vector spaces.

MATH 543 Galois Theory 3 credit hours

Historical background. Separability and simple extensions. Galois extensions. Cyclotomic fields. Solvable and radical extension. Solvability of equations of degree less than five. Transcendental basis.

MATH 544 Ring Theory I 3 credit hours

Hom and duality, Tensor product of modules, primitive rings, the Jacobson radical, prime radical, completely reducible rings, semisimple rings and certain relevant theorems, Artinian and Noetherian rings. On lifting idempotents, local and semi- perfect rings, The Brauer group.

MATH 545 Representation Theory of finite groups 3 credit hours

Semi-simple modules, semi-simple rings, group Algebra representation, character, induced character, generalized character, Representation direct product, Representation of abelian groups, Clifford's theorem, applications.

MATH 546 Homological Algebra 3 credit hours

Review of Modules (Tensor product of modules, the Horn functions, Free modules, projective and injective modules). Introduction to categories and functors, The homology and cohomology functors, cohomology of groups and its relation to extension problem.

MATH 547 Commutative Algebra 3 credit hours

Ideals and their radicals, Modules, Noetherian and Artinian rings, Primary

decompositions, localization, Principal ideal theorem, Cohen-Macaulay rings, Hilbert rings.

MATH 548 Fuzzy Algebraic Systems 3 credit hours

Fuzzy sets, Fuzzy relations, Fuzzy subgroups, Fuzzy normal subgroups, Fuzzy congruences, Fuzzy ideals, Fuzzy prime and maximal ideals, Other Fuzzy substructures of algebraic systems.

MATH 549 Finite Fields 3 credit hours

Minimal polynomials, Irreducible polynomials, automorphism groups of GF(P^m), Primitive elements, Application of finite fields in designs of codes and aspects of cryptography like discrete logarithms and the use of elliptic curves.

MATH 550 Numerical Analysis 3 credit hours

Norms, Arithmetic, and well-posed computations (Norms of vectors and matrices, Floating-point arithmetic and rounding errors, Well-posed computations); Iterative solution of non- linear equations (Functional iterations for a single equation: error propagation, second and higher order iteration methods. Some explicit iteration procedures: The Chord method, Newton method, method of false position and Aitkin's delta square method, Special methods for polynomials: evaluation of polynomials and their derivatives, sturm sequence, Bernoulli's method, Bairsou's method); Solution of Systems of Nonlinear equations: Substitution, Secant and Newton Raphson method, Continuation methods.

MATH 551 Numerical Linear Algebra 3 credit hours

Direct solution of linear equations: Elimination and Factorization method, Ill-conditioning, Iterative refinement, Orthogonal Factorizations: (Jacobi, Gauss-Seidel, SOR, Conjugate Gradients, Pre-conditioning, Chebyshev semi-iteration methods). Matrix Eigenvalue Problems: Power method and inverse iteration, Jacobi, Givens and Householder methods, Sturm Sequence and QR method, Singular value decomposition.

MATH 552 Numerical Solution of Ordinary Differential Equation 3 credit hours

Introduction: Taylor, Euler, and modified Euler methods. Linear Multistep Methods: Order, consistency, zero-stability, convergence, Bounds for local and global truncation error, Absolute and relative stability, Skob predictor-corrector methods, Milne's error estimate. Range-Kulta Methods: Derivation of classical RK methods of 2nd order, stability of RK methods. Boundary value problems: Finite difference methods, shooting methods, collocation method and variational methods.

MATH 553 Numerical Solution of Integral Equations 3 credit hours

Review of basic theory of integral equations. Fredholm integral equations: Nystrom's method, product integration methods, projection methods, Eigenvalue problems, First Kind equation and regularization. Volterra Integral Equations: Quadrature, Spline methods and collocation. Integral equations of mathematical physics. Boundary Integral Equations.

MATH 554 Approximation Theory 3 credit hours

Polynomial Interpolation: Lagrange interpolation formula, error in polynomial interpolation, Newton's interpolation method, Hermite interpolation. The approximation problem, existence of best approximation and uniqueness: approximation in a metric space, approximation in normed space, conditions for uniqueness of the best approximation, the uniform convergence of polynomial approximations, Least Squares approximation, Chebyshev approximation, Spline approximation.

MATH 555 Mathematical Programming 3 credit hours

Simplex Method with its variant forms, Duality theory for linear programming, Sensitivity Analysis, Parametric programming, Integer programming, Goal programming, Applications in various fields.

MATH 556 Nonlinear Optimization Techniques 3 credit hours

Search Methods for one variable, convex functional and their differentiability. Constrained problems: Jacobian method and Lagrangian technique, Kuhn-Tuker conditions. Unconstrained problems: Gradient method, quadratic programming, separable programming, Geometric programming, linear combination method, convex programming, Penalty methods and binar method.

MATH 570 Topology and Calculus in R^n 3 credit hours

Connected spaces, path connected spaces, components, locally connected spaces, Quotient spaces, separation axioms (Hausdorff, normal etc). Limits, continuity and differentiability of functions of several variables, Mean value theorem, Taylor's Theorem, Inverse and Implicit function theorems. Smooth manifolds, Tangent spaces, smooth functions on manifolds, Inverse and Implicit function theorems on manifolds.

MATH 571 Singular Homology and Cohomolyg Theories 3 credit hours

Singular Homology groups, Mayer-Vetories sequence, applications, attaching spaces with maps, CW-complexes, Cellular homology, Cohomology groups, Cup and Cap products, Duality on manifolds.

MATH 572 Vector Bundles and K-Theory 3 credit hours

General theory of Vector Bundles and K-Theory.

MATH 573 Differentiable Manifolds 3 credit hours

Definition and examples of manifolds, Submanifolds, tangent and cotangent bundles, Vector fields, Differential forms, Tensors, Integration on manifolds.

MATH 574 Geometry of Manifolds 3 credit hours

Differentiable manifolds. Tensor fields and operations. Differential forms and de Rham's Theorem. Principal fiber bundles, holonomy groups. Curvature form and structural equations. Bianchi's identity. Covariant differentiation. Geodesics. normal coordinates. Riemannian connection. Spaces of constant curvature. Schurs Theorem.

MATH 575 Geometry of Submanifolds 3 credit hours

Immersions, submanifolds of a Riemannian manifold, Gauss and Wenigarten formulae, Structure equations, Hypersurfaces in Euclidean space, Type number and rigidity, Minimal submanifolds with constant mean curvature, Total absolute curvature, tight immersions.

MATH 580 Measure Theory I 3 credit hours

Rings, Algebras, σ-algebras, Monotone classes, Measure: elementary properties, outer measure, extension, completion and approximation theorems, Lebesgue's measure, Lebesgue-Stielje's measure, Measurable functions, Integration with respect to a measure, the main theorems, the convergence of measurable functions, L^p spaces.

MATH 581 Functional Analysis I 3 credit hours

Normed spaces, Banach spaces, continuous linear operators, Hahn-Banach theorem, Duality, the open mapping theorem, The closed graph theorem, the uniform boundedness theorem, Hilbert spaces, Adjoint operators, unitary and normal operators, projections, spectral theory in finite dimensional spaces, spectral properties of bounded linear operators.

MATH 582 Functional Analysis II 3 credit hours

Compact linear operators and their spectral properties. Spectral properties of bounded, self-adjoint operators. spectral family of a bounded self-adjoint operator. Spectral representation of bounded self-adjoint operators. Banach Algebras. Spectral theory in Banach algebra. Commutative Banach Algebras. Gelfand Mapping. Spectral theorem for normal operators.

MATH 583 Topological Vector Spaces 3 credit hours

Filters, locally convex spaces. Linear maps. Quotient spaces, Normality, Metrizability, convergence of filters. Completeness. Locally compact spaces, finite dimensional spaces. Hahn-Banach-Dieudonne theorem. Grothendieke's completeness theorem.

MATH 584 Measure Theory (II) 3 credit hours

The product of two measure spaces. Fubini's theorem. Infinite product of probability spaces. Kolmogorov's consistency theorem. The Radon-Nikodym theorem. Conditional probability, conditional expectation. The Daniel's integral. Riesz- Representation Theorem. Haar measure on a compact group.

MATH 585 Complex Analysis 3 credit hours

Harmonic function, the general form of Cauchy's Theorem, Normal families, Conformal mapping. Analytic continuation, univalent function theory.

MATH 586 Potential Theory 3 credit hours

Harmonic and subharmonic functions in IR^n. Poisson integral. Classical Dirichlet problem. Different sets of axioms defining harmonic functions on a locally compact space. Superharmonic functions and potentials. Reisz-decomposition theorem for positive superharmonic functions. Balayage. Exceptional sets (e.g. polar sets, sets of capacity Zero), a convergence theorem for decreasing filtered superharmonic functions. Generalized Dirichlet problem in a harmonic space. Flux and its use in some superharmonic extension theorems in a harmonic space without positive potentials.

MATH 587 Summability Theory 3 credit hours

Some modes of convergence, general summability methods, some well known summability methods, Tauberian summability theorem.

MATH 588 Holomorphy and Calculus in Normed Spaces 3 credit hours

Multilinear Maps. Polynomials. Differential maps. Mean value theorem. Higher differentials. Finite expansion and Taylor's formula. Holomorphic functions. The strong Maximum Modulus theorem. Power series. Analytic mappings. Gateaux holomorphy. Radius of boundedness.

Master of Science in Mathematics (Courses Option)

This Program is not for a new degree but a stream designed to renew the standard and course contents while reducing the role of the thesis work in the current Program. Therefore, the general aims of the previous program are retained. Moreover, this Program is expected to achieve the following added benefits:

- Provision of a broad spectrum of mathematical knowledge suitable for students whose graduate study ends with an M. sc. Degree. In particular for those candidates who are suppose to work in the field of education.
- In the presence of a successful Ph.D. program, the depth of mathematical knowledge furnished by the new program should provide students with the required background for successfully meeting the demands of the Ph.D. Program (such as the comprehensive examination).
- Enrolment of a bigger number of applicants without significantly increasing the Department's load of supervision commitments.
- The new program offers some recent specialties (such as discrete mathematics and computational mathematics) which bestow on the graduates a professional aura that should prove useful for employment in some applied fields like computer systems and digital communication.

Admission Requirements

Beside the admission criteria stipulated in the unified graduate studies regulations for Saudi universities, the applicant must satisfy the following requirements:

1) The applicant must hold a B.Sc. degree (Science or Education) in Mathematics with a GPA of at least 3.75 out of 5.
2) The applicant must score at least 70% in the aptitude test for graduates organized by the National Center for Assessment in Higher Education.
3) The applicant must pass the written admission test arranged by the Department.

Degree Requirements

The student must successfully complete 42 credit hours of M.Sc. courses in four semesters as follows:

- 35 hours of compulsory courses.
- 4 hours from optional courses.
- 3 hours for a research project.

Program Structure

42 Credit hours including a research project of three credit hours:

Number and Code of the course	Number & Type of Courses	Credit Hours
--	9 Core Courses	35
--	1 Elective Course	4
MATH 5991	Research Project	3
Total		42

Study Plan:

1. Core Courses:

Course Code	Course title
MATH5101	Ordinary Differential Equations
MATH5301	Introduction to Discrete Structures
MATH5391	Selected Topics in Mathematics
MATH5401	Group Theory and Modules
MATH5411	Introduction to Rings and Modules
MATH5501	Numerical Analysis

MATH5701	Geometry and Topology
MATH5801	Measure Theory
MATH5811	Functional Analysis

2. Elective Courses:

Course Code	Course title
MATH5121	Partial Differential Equations
MATH5141	Quantum Mechanics
MATH5311	Combinatorics
MATH5321	Ordered Sets
MATH5421	Algebra Rings and Modules
MATH5431	Algebraic Number Theory
MATH5511	Numerical Linear Algebra
MATH5521	Numerical Solutions of Ordinary Differential Equations
MATH5711	Algebraic Topology
MATH5721	Differential Geometry
MATH5821	Complex Analysis
MATH5831	Advanced Functional Analysis

Program Schedule:

First Semester

Course Code	Course title	Credit hours
MATH5401	Group Theory and Modules	4
MATH5701	Geometry and Topology	4
MATH5801	Measure Theory	4
Total		12

Second Semester

Course Code	Course title	Credit hours
MATH5411	Introduction to Rings and Modules	4
MATH5501	Numerical Analysis	4
MATH5811	Functional Analysis	4
Total		12

Third Semester

Course Code	Course title	Credit hours
MATH5101	Ordinary Differential Equations	4
MATH5301	Introduction to Discrete Structures	4
	Elective course*	4
Total		12

Fourth Semester

Course Code	Course title	Credit hours
MATH5391	Selected Topics in Mathematics	3
MATH5991	Research Project	3
Total		6

* The student selects one 4 unit course from a list of 4 optional courses offered by the Department subject to its capabilities.

Course Contents

MATH5101 Ordinary Differential Equations 4(3+1)

Existence and uniqueness of solutions of linear systems. Stability Theory, Liapunov method. Two-dimensional autonomous systems, Poincare-Bendixson Theory. Second order linear differential equations: properties and zeros of the solutions. Sturm-Liouville theory: Linear differential operators in L^2 space, eigen functions and eigen values of self-adjoint linear operators, orthogonal polynomials and eigen function expansions.

MATH5121 Partial Differential Equations 4(3+1)

Elementary theory of distributions. Types of linear partial differential equations. Fundamental solutions of some linear differential operators such as the Laplacian, the heat, and the wave operators. Applications to solving non-homogeneous problems. Green's function and its application to boundary-value problems. Elliptic equations: Boundary-value problems for the Laplacian operators in n-dimensions, harmonic functions, the Dirichlet problem, existence and uniqueness of solutions. Generalizations and applications. Solutions of parabolic and hyperbolic equations in Sobolev spaces. Generalized mixed problems.

MATH5141 Quantum Mechanics 4(3+1)

Foundation of quantum mechanics and its mathematical tools. Energy spectra for some molecules. Dirac formulation of quantum Mechanics (fundamental concepts), elementary quantum systems (application of wave mechanics and uncertainty principle). Symmetries in quantum mechanics (groups matrix and its generators), operator algebra. Quantum theory of radiation. Quantum theory of damping (Langevin approach).

MATH5301 Introduction to Discrete Structures 4(3+1)

Graphs, Directed graphs, Basic definitions, Isomorphism of graphs, Subgraphs, Paths and cycles, Matrix representation of graphs, Connectedness, Bridges, Cut-vertices. Trees, Spanning trees, Weighted graphs and minimum spanning trees, Shortest paths, Eulerian circuits, Hamiltonian cycles, Tournaments, Applications. Planar graphs, Euler's Formula, Kuratowski's theorem. Graph

coloring, Vertex coloring, Edge coloring, Map coloring, Chromatic polynomials. Ordered sets, Comparability and covering graphs, Dilworth theorem, Block designs, Latin squares, Orthogonal Latin squares, Finite geometries, Basic definitions and properties.

MATH5311Combinatorics 4(3+1)

General counting methods, The inclusion-exclusion principle, Ordinary generating functions, Exponential generating functions, Recurrence relations, Linear recurrence relations, Homogeneous recurrence relations, Nonhomogeneous recurrence relations, Polya counting theory, Equivalence relations, Permutation groups, Burnside's Lemma, Inequivalent colorings, Cycle index, Polya's enumeration formula. Mobius inversion formula, Techniques of computing Mobius functions, Mobius functions for special lattices. The Pigeon-hole principle and its generalizations, Ramsey numbers, Ramsey theorem .
Prerequisite (MATH 5301)

MATH5321 Ordered Sets 4(3+1)

Basic definitions, Fundamental theorems, Chain decomposition, Linear extensions, Fixed points, Algorithmic aspects of chain decomposition, Cutsets, Fibers, Cutset and fiber decomposition, Drawing, The diagram, Algorithmic and structural aspects of linear extensions, Dimension, Jump number, Sorting, Linear extensions and probability, Single machine scheduling, Many machine scheduling, Order preserving maps, Structure and classification, Lattices, Free Lattices, Distributive Lattices, Planar Lattices.
Prerequisite (Mat 5301)

MATH5391 Selected Topics in Mathematics 3(3+0)

The course covers selected topics in mathematics suggested by the student's supervisor.

MATH5401 Group Theory and Modules 4(3+1)

Group action on a set, Series of groups, Solvable groups, Supersolvable groups, Polycyclic groups and nilpotent groups, Semi-direct product and group extensions, Free groups, group presentations, Finite and algebraic field extensions, Normal and separable extensions, Galois extensions, Galois group and Artin's Theorm.

MATH5411 Introduction to Rings and Modules 4(3+1)

Modules, Module homomorphisms, Exact sequences, External direct product, Internal direct product, Complete direct sum, direct sum, Free modules, Projective

and injective modules, Modules over principal ideal domain, Algebras, Tensor products, Localization, Primary decomposition, Integrally closed domains, Chain conditions, Noetherian and Artinian rings.
Prerequisite (MATH5401)

MATH5421 Rings and Modules 4(3+1)

Ring Extensions, Dedekind domains, Hilbert and Nullstellensatz Theorem. Simple and primitive rings, The Jacobson radical of a ring, Semi-simple rings, Wedderburn-Artin theorem for semi-simple Artinian rings, Essential and small submodules, Singular submodules, Radical of a module, Primitive rings and density theorem, prime ideals and lower nilradical.
Prerequisite (MATH5401) and (MATH5411)

MATH 5431 Algebraic Number Theory 4(3+1)

Number fields, Solvable and radical extensions, Abel's theorem, Kummer theorem, The ring of algebraic integers, Trace and norm, Discriminant and integral basis, Prime factorization of ideals, Norm of ideals, Quadratic and cyclotomic fields, Transcendence Bases, Linear Disjointness and Separability.
Prerequisite (MATH5401) and (MATH5411)

MATH5501 Numerical Analysis 4(3+1)

Floating point arithmetic and rounding errors, well-posed computation and convergence. Numerical methods for solving nonlinear equations with one variable: bisection, regula-falsi, functional iterative, Newton, secant and Aitken Δ. Error and convergence analysis for these methods, Special numerical methods for solving polynomials: evaluation of polynomials and their derivatives, Matrix and vector norms, convergence of vectors, Method for solvingsystem of nonlinear equations: Fixed point, Newton, finite difference Newton, quasi-Newton, steepest descent, Error and convergence analysis for these methods

MATH5511 Numerical Linear Algebra 4(3+1)

Eigenvalues and eigenvectors. Special matrices. Direct methods for solving system of linear equations. Analyzing the errors involved using these methods. Iterative refinement method. Iterative methods for solving system of linear equations: Jacobi, Gauss-Seidel and SOR. Error and convergence analysis for these methods. Various methods for solving least square problems along with analytical and computational discussion. Numerical methods for the matrix eigenvalue problems: power and inverse power iteration, Jacobi, Givens, Householder, LR and QR. Singular value decomposition. Applications.

MATH5521 Numerical Solutions of Ordinary Differential Equations 4(3+1)

Multi-step methods for solving initial value problems in ODE: Euler, midpoint, trapezoidal, Simpson, Adam-Multon and other. Derivation these methods using Taylor expansion, integration and interpolation techniques. Error and convergence analysis for these methods: local and global errors, consistency and stability. Predictor corrector methods, error (Milne's device) and stability. Various Runge-Kutta methods: derivation of some of these methods. Error and stability of Runge-Kutta methods. Numerical solutions for solving system of first order ODE. Finite difference and shooting methods for solving linear and nonlinear boundary value problems in ODE. Error and convergence analysis for these methods. Applications.

MATH5701 Geometry and Topology 4(3+1)

Connected spaces, Path connected spaces, Connected components, Locally connected spaces, Quotient spaces, The separation axioms (Hausdorff, Regular, Normal). Differentiable manifolds, Submanifolds of IR^n and Classical Lie groups, Tangent spaces, Differentiable mappings between manifolds, Inverse and Implicit function theorems on manifolds.

MATH5711 Algebraic Topology 4(3+1)

Homotopy of paths, the fundamental group, The fundamental group of the circle, the punctured plane, S^n and surfaces, Covering spaces, lifting properties, The classification of covering spaces, universal cover and deck transformations, Chain complexes, simplicial homology, Homotopy invariance, Excision, Mayer-Vietoris sequence, Cellular homology.

MATH5721 Differential Geometry 4(3+1)

Definition and examples of manifolds, submanifolds, Immersions and submersions, Lie groups, Equivalence classes of curves and derivations, Tangent vectors, The tangent bundle of a manifold, Vector fields and flows, Lie derivatives and bracket, Differential forms, Integration on manifolds.

MATH5801 Measure Theory 4(3+1)

Rings, Algebra, σ-algebra, Monotone classes, Measure, elementary properties, outer measure, extension, completion and approximation theorems, Lebesgue's measure, Lebesgue-Stieltje's measure, measurable functions, integration with respect to a measure, the main theorems, the convergence of measurable functions, Radon-Nikodym theorem (absolutely continuous functions), Fubini-Tonelli theorem,L^p spaces: Holder and Minkowski inequalities, completeness of L^p spaces, L^p space as a Banach space, the dual of L^p space.

MATH5811 Functional Analysis 4(3+1)

Banach spaces: Basic properties and examples, convex sets, subspaces and quotient spaces, linear functional and the dual spaces, Hahn-Banach theorem, the uniform boundedness principle, the open mapping theorem and closed graph theorem, Hilbert spaces: the Riesz representation theorem, orthonormal bases, isomorphic Hilbert spaces, Operators on Hilbert spaces: Basic properties and examples, adjoints, projection, invariant and reducing subspaces, positive operators and the polar decomposition, self-adjoint operators, normal operators, isometric and unitary operators, the spectrum and the numerical range of an operator.

MATH5821 Complex Analysis 4(3+1)

Holomorphic functions, Cauchy-Riemann equations, power series, logarithmic function, Cauchy integral formula (general form), Analytic functions, zeros of holomorphic functions. Maximum principle, Liouville's theorem, fundamental theorem of algebra, open mapping theorem, Schwarz lemma, Mobius transformations, Rouche's theorem, Conformal mappings and Riemann's theorem, Topology on the space of holomorphic functions. Montel's theorem, Harmonic and subharmonic functions, Weirstrass's theorem, Mittag Leffler theorem, Introduction to several complex variables.

MATH5831 Advanced Functional Analysis 4(3+1)

Spectrum of an operator, compact linear operators and their spectral properties, spectral properties of bounded self-adjoint operators, positive operators, product of positive operators, square root of positive operator, projection operators: Theorem (positivity, norm), Theorem (partial order), Theorem (product of projections), Theorem (sum of projections), Theorem (difference of projections), Spectral family of a bounded self-adjoint operator, Banach algebras, Gelfand' mapping, spectral theorem for normal operators.

MATH5991 Research Project 3(3+0)

The student undertakes a supervised independent study and review of current research papers in an active branch of Mathematics .

Doctorate Program

This Program has been implemented by the Department since the first semester of the year 1414 H.

Program Objectives

- Providing the student with a broad knowledge of mathematics particularly the in - depth knowledge of the chosen branch.
- Equipping the student with the ability to pursue independent research in an active area of mathematics.
- Meeting the requirements of higher educational institutions and research centers for highly qualified mathematicians.
- Satisfying the aspirations of a growing number of M.Sc. degree holders in mathematics to obtain a higher qualification locally.
- Promoting the quality of the Department's performance and fostering its research activities.

Admission Requirements

In addition to the admission criteria stipulated in the Unified Graduate Studies Regulations for Saudi universities, the applicant must satisfy the following requirements:

1) The applicant must hold an M.Sc. degree (Science or Education) in Mathematics with a GPA of at least 3.75 out of 5.

2) The applicant must score at least 83% in the Standardized Test of English Proficiency (STEP) or at least 500 in TOEFL.

3) The applicant must score at least 75% in the aptitude test for graduates organized by the National Center for Assessment in Higher Education.

4) The applicant must pass the personal interview.

Degree Requirements

1. The Study for the degree is by thesis and courses.

2. The student must successfully complete a minimum of 18 credit hours of which a maximum of six can be selected from the M.Sc. course content lists which he/she has not previously studied.

3. The student must pass a comprehensive examination to be held

accordance with the regulations and guidelines of the Graduate College. The examination must include Analysis, the specialization branch and a supporting branch. These branches are to be chosen with the consent of the Department Council.

4. The student must present a research thesis showing creativity and originality.

Study Plan

1. The Plan comprises 5 Tracks, namely;

- Track A: Algebra.
- Track B: Geometry and Topology.
- Track C: Analysis.
- Track D: Computational and Discrete Mathematics.
- Track E: Applied Mathematics.

2. The student must pass the common course MATH 690 (Advanced Topics in Mathematics).

3. Students at the same level in the same Track must study the same courses. These courses are assigned by the Department.

4. The Courses are taught in two semesters as follows:

First Semester

Three courses to be selected from the Track list and the M.Sc. lists (subject to stipulation 2 of the degree requirements).

Second Semester

Two courses from the Track list and MATH690 (Advanced Topics in Mathematics).

List of Courses

Track A: Algebra

MATH 641	Group Theory (II)	(3 hours)
MATH 642	Ring Theory (II)	(3 hours)
MATH 643	Algebraic Geometry	(3 hours)
MATH 644	Algebraic Number Theory	(3 hours)
MATH 645	Universal Algebra	(3 hours)

Track B: Geometry and Topology

MATH 671	Analysis on Complex Manifolds	(3 hours)
MATH 672	Variational Theory and Minimal Submanifolds	(3 hours)
MATH 673	Lie Groups and Symmetric Spaces	(3 hours)
MATH 674	Geometric Topology	(3 hours)
MATH675	Algebraic Topology	(3 hours)
MATH 676	Homotopy Theory	(3 hours)
MATH 677	Topology of CW-Complexes	(3 hours)

Track C: Analysis

MATH 681	Stochastic Differential Equations	(3 hours)
MATH 682	Ergodic Theory	(3 hours)
MATH 683	Complex Analysis (II)	(3 hours)
MATH 684	The Theory of Distributions	(3 hours)
MATH685	Harmonic Analysis	(3 hours)
MATH686	Function Algebras	(3 hours)
MATH 687	Geometric Function Theory	(3 hours)

Track D: Computational and Discrete Mathematics

MATH 631	Lattice Theory	(3 hours)
MATH 632	Coding Theory	(3 hours)
MATH 633	Enumerative Combinatorics	(3 hours)
MATH 634	Model Theory	(3 hours)
MATH 651	Numerical Analysis (II)	(3 hours)
MATH 652	Numerical Solutions of Partial Differential Equations	(3 hours)
MATH 653	M Theory of Integer Programming	(3 hours)
MATH 654	Dynamic Programming	(3 hours)
MATH 655	Variational Inequalities	(3 hours)

Track E: Applied Mathematics

MATH 611	Quantum Mechanics (II)	(3 hours)
MATH 612	Methods in Fluid Dynamics	(3 hours)
MATH 613	Topics in Deterministic and Non-deterministic Modeling	(3 hours)
MATH 652	Numerical Solutions of Partial Differential Equations	(3 hours)
MATH 684	The Theory of Distributions	(3 hours)

Course Contents

MATH 611 Quantum Mechanics (II)

Angular momentum, fundamental properties of Lie groups, the isospin groups, Quarks and SU3, Representations of the permutation group, Mathematical Excursion, field quantization, Quantum theory of relaxation, Quantum theory of scattering, the one center point interaction in three dimensions.

MATH 612 Methods in Fluid Dynamics

Basic equations of Compressible flow, Analytical and Computational methods of solving Navier-Stoke's equation, Boundary layer theory, Finite element methods for inviscid and viscous compressible flows.

MATH 613 Topics in Deterministic and Non-deterministic Modeling

Topics of interest in Mathematical Modeling.

MATH 631 Lattice Theory

Lattice Theory: Two Definitions of Lattices, Some algebraic concepts, Polynomials, Identities, and Inequalities, Free Lattices, Special elements, Distributive lattices: Characterization theorems, Congruence Relations, Boolean algebras, Topological Representation, Distributive lattices with pseudocomplementation, Modular and Semi-modular lattices: Modular lattices, semimodular lattices, partition lattices, complemented modular lattices, Equational classes of lattices.

MATH 632 Designs and Codes

Covering and Packing Designs and Codes, Skolem sequences and applications in Designs and Codes, Methods of finding Designs and Codes.

MATH 633 Enumerative Combinatorics

General counting methods, generating functions, recurrence relations, inclusion-exclusion principle, Polaya's enumeration formula, ordered sets, Mobius inversion formula, techniques for computing Mobius functions, Mobius functions for special lattices.

MATH 634 Model Theory

What is Model Theory?, Model Theory for sentential logic languages, models and satisfaction, theories and examples of theories, Elimination of quantifiers, Completeness and Compactness, Countable models of complete theories, Elementary extensions and elementary chains, Skolem functions and indiscernibles, Examples.

MATH 641 Group Theory (II)

Study of finite groups and infinite groups and their structures.

MATH 642 Ring Theory (II)

Study of some aspects of commutative and non-commutative rings.

MATH 643 Algebraic Geometry

Affine and projective varieties, Morphism, Rational maps, non-singular curves, Introduction to projective space, Riemann Roch's Theorem, Hurwicz's Theorem, embedding in projective space, Elliptic curves, classification of curves.

MATH 644 Algebraic Number Theory

Review of congruences and Chinese remainder theorem, Quadratic reciprocity, Dedekind domains, Integral ideals, Ideal class group, Norm and traces, Basis and discriminant computations, the arithmetic of number fields.

MATH 645 Universal Algebra

Concept of Lattices , Complete lattices, Equivalence relations and algebraic lattices, Closure Operators, Universal Algebras, Examples, Isomorphism algebras, Sub-algebras, Theorem of Birkhoff, congruences and Quotient Isomorphism Theorems, Direct products, Subdirect products, Varieties, Free algebras, Malcev conditions, Boolean algebras, Boolean rings, Ideals and Filters, Stone Duality.

MATH 651 Numerical Analysis (II)

Floating-point arithmetic and rounding errors: direct and iteration methods of solving systems of linear equations, Error estimates and convergence criteria. Iterative methods for the nonlinear operator equations: Fixed-point principle, Newton's Method, Kantorovich Method, Quasi-Newton's Method, Quasi-Newton's Method with error terms and estimates.

MATH 652 Numerical Solution of Partial Differential Equations

Finite Difference Methods: Elliptic, parabolic and hyperbolic equations, Accuracy, Consistency, Stability, Energy methods for stability, Hyperbolic systems,

Boundary Conditions, Dissipation, Dispersion, Finite Element Methods: Elliptic equations, Ritz method, Galerkin method, Construction of basis function, Interelement continuity and patch test, Semi-discrete Galerkin methods for time dependent problems, Solution of systems of ordinary differential equations.

MATH 653 Theory of Integer Programming

Problems, algorithms and complexity, introduction to integer linear programming, Estimates in integer linear programming, the complexity of integer linear programming, totally unimodular matrices, recognizing total unimodularity, integral polyhedral and total dual integrality, Cutting planes, Further methods in integer linear programming.

MATH 654 Dynamic Programming

Basic theory relating to the functional equations of dynamic programming. Analytic and computational methods for one-dimensional and multi-dimensional problems, Lagrange multipliers and reduction of state dimensionality, Applications of dynamic programming in various fields.

MATH 655 Variational Inequalities

Basic Concepts. Formulation of the variational inequalities. Existence and Uniqueness results. Fixed point approach. Penalty method. Lagrange Multiplier Method. Error estimate for the finite element approximation. Applications. Linear Complementarity problems and its generalization. Equivalence among variational inequality problems. Unilateral problem and complementarity problem and their significance.

MATH 671 Analysis on Complex Manifolds

Vector Bundles, Almost Complex Manifolds, the Canonical Connection and Curvature of a Hermitian Holomorphic Vector Bundle, Sobolev Spaces, Differential Operators, Kaehler Manifold, Differential Operators on a Kaehler Manifold, The Hodge decomposition Theorem on compact Kaehler manifolds, Kodaira's vanishing theorem, Hodge manifolds.

MATH 672 Variational Theory and Minimal Submanifolds

The first and second variation of arc length, Jacobi fields conjugate points, comparison theorems of Morse and Rauch, Myer's theorem on compactness of Riemannian Manifolds, Variation of immersion, Normal variation, first and second variation of the area function, Minimal submanifolds, stability of minimal submanifolds, Index of minimal submanifolds, minimal submanifolds in spheres, complex submanifolds of a complex projective space.

MATH 673 Lie Groups and Symmetric Spaces

Lie Groups and their Lie-algebras, action of Lie groups on a smooth manifold, homogeneous spaces, Riemannian homogeneous spaces, the cannonical connection and Jacobi equations, two-point homogeneous spaces, Riemannian symmetric space, structure of orthogonal involutive Lie algebras, symmetric spaces and orthogonal involutive Lie algebras, curvature of symmetric spaces, Riemannian symmetric spaces of rank one.

MATH 674 Geometric Topology

Cohomology and duality theorems, deRahm's theorems, cup products and transversality theory of submanifolds.

MATH 675 Algebraic Topology

Extraordinary cohomology theories, K-Theory, fixed point theory.

MATH 676 Homotopy Theory

The fundamental problems: extension, homotopy, and classification, maps of the n-sphere into itself, filtered spaces, fibrations, homotopy and the fundamental group, spaces with base points, groups of homotopy classes, H-spaces, H's spaces, exact sequences of mapping functions; relative homotopy groups, the homotopy sequence, the operations of the fundamental group on the homotopy sequence, the Hurewicz map, the homotopy addition theorem, the Hurewicz theorems, homotopy relations in fiber spaces, fibrations in which the base or fiber is a sphere, elementary homotopy theory of Lie groups and their coset groups.

MATH 677 Topology of CW-Complexes

Cell-complexes, CW-complexes, homotopy properties of CW-complexes, cellular homology and cohomology.

MATH 681 Stochastic Differential Equations

Measure-theoretic background, Ito's integral, McShane's Integral, Ito's formula. Stochastic Differential Equations, existence and uniqueness of solutions, dependence on initial distributions, properties of solutions, solutions as Markov and diffusion processes, Generalization to Hilbert valued processes.

MATH 682 Erdogic Theory

Measure-preserving transformations. Recurrence. Ergodicity. The Ergodic Theorem. Mixing. Isomorphism and spectral invariants. Entropy. Bernoulli transformations. Topological Entropy.

MATH 683 Complex Analysis (II)

Mittag-Leffler Theorem. Weierstrass Theorem. Subharmonic functions. The domain of Holomorphy. Pseudoconvexity and plurisubharmonicity. Runge domain. The partial differentiation problem.

MATH 684 The Theory of Distributions

Test functions, semi-norms(locally convex spaces), the inductive limit topology of C_0^∞ (Ω), the topology on D' (Ω), the dual of C_0^∞ (Ω), the topology E'(Ω), the space of s(IR^n, Tempered distributions, The Fourier transformation in s(R^n), the Paly-Wienner-Schwartz theorem, The Sobolev spaces H^p (R^n), some applications in partial differential equations.

MATH 685 Harmonic Analysis

Elements of the theory of topological groups, Integration on locally compact spaces, Invariant functional, Convolutions and group representation, Characters and duality of locally compact groups.

MATH 686 Function Algebras

Algebras of functions, the Silov boundary, Representations of the carrier space, Homomorphisms of certain function algebras into a Banach algebra, Direct sum decompositions and related results, completely regular commutative Banach algebras, the algebra C(Ω) for certain special Ω . The l_p -algebras, functions with absolutely convergent Fourier series, functions of class C(n), Continuous functions of bounded variation, holomorphic functions of one variable, algebra of power series.

MATH 687 Geometric Function Theory

Zeros of analytic functions, Rouches theorem, The open mapping theorem, The maximum principle, Schwarz's Lemma, Caratheodory's inequality concerning the real part of an analytic function, Conformal mappings, Reflexion Principles, Mobius transformations (a detailed study), Schwarz-Christoffel transformation, Riemann mapping theorem (without proof), Univalent functions, Koee's constant, a general discussion on Bieberbach's conjecture and the integral representation of univalent functions in a disc (without proof), Some special classes of functions: star-like, convex, typically real.

MATH 690 Advanced Topics in Mathematics

The course covers recent research topics in Mathematics.

Facilities and Equipments

The Department has the following infrastructures to facilitate teaching and research activities:

Males' Branch in Deriya:

- Three computer laboratoriess containing 70 PCs: AA118 B4, AA119 B4 and 1B47 B4.
- A self-learning room 2B68 B4.
- Three video conference rooms:1A95 B4, 2A137 B4 and 1B21 B4.
- A library for faculty members 2A142 B4.

Females' Branch in Malaz:

- A computer laboratory containing 50 PCs: 2/A, B21
- Two video conference rooms: 2/1036 B15, 1/45 B21

Video Conference Room

Faculty Members, Assistants and Staff

Faculty Members (Males):

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1.	Dr. Abdellatif H. Laradji alaradji@ksu.edu.sa http://faculty.ksu.edu.sa/67272 2B66 B4	Algebra Representation of Finite Groups	Algerian	Ph.D. 1993	Illinois USA	Professor
2.	Dr. Akhlaq A. Siddiqui asiddiqui@ksu.edu.sa 2A149 B4	Functional Analysis & Algebraic Topology	Pakistani	Ph.D.1996	Edinburgh UK	Professor
3.	Dr. Eisa A. Al-Said eisasaid@ksu.edu.sa http://faculty.ksu.edu.sa/e-alsaid 2A129 B4	Numerical Analysis	Saudi	Ph.D.1990	Dundee UK	Professor
4.	Dr. Mongi Ahmed Blel mblel@ksu.edu.sa 2A148 B4	Complex Analysis and Special functions	Tunisian	Ph.D. 1980	Paris 6 France	Professor
5.	Dr. Messaoud A. Bounkhel bounkhel@ksu.edu.sa http://faculty.ksu.edu.sa/Dr.Messaoud_Bounkhel 2A184 B4	Optimization Mathematics and Control Theory	Algerian	Ph.D. 1999	Montpellier France	Professor
6.	Dr. Mohammed A. Al-Gwaiz malgwaiz@ksu.edu.sa http://faculty.ksu.edu.sa/MAlgwaiz 2A155 B4	Applied Mathematics and Differential Equations	Saudi	Ph.D. 1972	Wisconsin USA	Professor

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7.	Dr. Mohammed A. Guediri mguediri@ksu.edu.sa http://faculty.ksu.edu.sa/mohguediri 2A124 B4	Differential Geometry	Algerian	Ph.D. 1995	Montpellier France	Professor
8.	Dr. Mohammed S. Mahmoud sabdalla@ksu.edu.sa http://faculty.ksu.edu.sa/sebaweh 2A140 B4	Applied Mathematics	Egyptian	Ph.D. 1982	London UK	Professor
9.	Dr. Mourad Ben Slimane mbenslimane@ksu.edu.sa 1A83 B4	Analysis	Tunisian	Ph.D.1996	Ecole National Paris France	Professor
10.	Dr. Moustafa K. Damlakhi damlakhi@ksu.edu.sa http://faculty.ksu.edu.sa/57647 2A146 B4	Analysis (Partial Differential Equations)	Syrian	Doctorat d'etat,1982	Paris 11 France	Professor
11.	Dr. Nejmeddine Chorfi nchorfi@ksu.edu.sa 1B33 B4	Analysis	Tunisian	Ph.D.1998	Paris France	Professor
12.	Dr. Sami A. Baracket sbaraket@ksu.edu.sa 2A160 B4	Partial Differential Equations, Nonlinear Analysis	Tunisian	Ph.D.1994	Paris France	Professor
13.	Dr. Said Mesloub mesloub@ksu.edu.sa http://faculty.ksu.edu.sa/mesloub 2B78 B4	Partial Differential Equations	Algerian	Ph.D. 1999	Constantine Algeria	Professor

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14.	Dr. Sharief Deshmukh shariefd@ksu.edu.sa http://faculty.ksu.edu.sa/63187 2A122 B4	Differential Geometry	Indian	Ph.D. 1980	Aligarh India	Professor
15.	Dr. T. M. G. Ahsanullah tmgal@ksu.edu.sa http://faculty.ksu.edu.sa/ahsanullah 2B80 B4	Fuzzy and Algebraic Topology	Bangladishi	Ph.D. 1984	Brussels Belgium	Professor
16.	Dr. Yousef A. Alkhamees ykhamees@ksu.edu.sa http://faculty.ksu.edu.sa/1500 2A182 B4	Algebra (Ring Theory)	Saudi	Ph.D. 1977	Reading UK	Professor
17.	Dr. Ahmad H. Sharary ashararyl@ksu.edu.sa http://faculty.ksu.edu.sa/57119 2A177 B4	Algebra (Group Theory)	Palestinian	Ph.D. 1982	Middle East Technical University Turkey	Associate Prof.
18.	Dr. Ahmed A. M. Kamal akamal@ksu.edu.sa http://faculty.ksu.edu.sa/73646 2B59 B4	Algebra	Egyptian	Ph.D. 1991	Cairo Egypt	Associate Prof.
19.	Dr. Ahmed K. Khalifa khalifa@ksu.edu.sa http://faculty.ksu.edu.sa/70851 2A163 B4	Numerical Analysis	Egyptian	Ph.D. 1979	UK	Associate Prof.
20.	Dr. Ali A. Al-Sohebani aasuhaibani@gmail.com http://faculty.ksu.edu.sa/19193 2A154 B4	Algebra (Theory of Group Rings)	Saudi	Ph.D.1977	UK	Associate Prof.

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21.	Dr. Fawzi Ahmed Al-Thukair thukair@ksu.edu.sa http://faculty.ksu.edu.sa/Al-Thukair 2A174B4	Algebra (Number Theory)	Saudi	Ph.D. 1981	California USA	Associate Prof.
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23.	Dr. Imed Toumi Bachar abachar@ ksu.edu.sa 2A176 B4	Potential Theory and Nonlinear Analysis	Tunisian	Ph.D. 2006	Tunis Tunis	Associate Prof.
24.	Dr. Mahfooz Alam mahfuzam@ksu.edu.sa http://faculty.ksu.edu.sa/67548 2A158 B4	Complex Analysis	Indian	Ph.D. 1978	Aligarh India	Associate Prof.
25.	Dr. Malik Talbi mtalbi@ksu.edu.sa 1A84 B4	Non commutative geometry	French	Ph.D. 2001	Lyon 1 France	Associate Prof.
26.	Dr. Mansour A. Alyazidi yazidi@ksu.edu.sa http://faculty.ksu.edu.sa/Alyazidi 2A153 B4	Approximation Theory	Saudi	Ph.D. 1989	Oregon USA	Associate Prof.
27.	Dr. Marouf A. Samhan marsamhan@yahoo.com http://faculty.ksu.edu.sa/61489 2A126 B4	Algebra (Universal Algebra)	Jordanian	Ph.D. 1985	Illinois USA	Associate Prof.

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28.	Dr. Mohamed Jleli jleli@ksu.edu.sa http://faculty.ksu.edu.sa/74324 2A159 B4	Differential Geometry	Tunisian	Ph.D. 2004	Paris France	Associate Prof.
29.	Dr. Muhammad Asif Qureshi mohdasif@ksu.edu.sa http://faculty.ksu.edu.sa/61289 2B65 B4	Algebra (Commutative algebra)	Pakistani	Ph.D. 1981	Edinburgh UK	Associate Prof.
30.	Dr. Mosaad A. Alabdullatif mosaadal@ksu.edu.sa http://faculty.ksu.edu.sa/Abdullatif 2B58 B4	Discrete Mathematics (Graph Theory)	Saudi	Ph.D. 1997	Keele UK	Associate Prof.
31.	Dr. Nabil Ourimi ourimi@ksu.edu.sa http://faculty.ksu.edu.sa/73047 2A150 B4	Complex Analysis	Tunisian	Ph.D. 1997	Marcela France	Associate Prof.
32.	Dr. Mohamed adblewahed madblewahed@ksu.edu.sa 2A185	Numerical analysis	Tunisian	Ph.D.2002	Pau university France	Assistant Prof.
33.	Dr. Rizwan A. Butt rizwanbu@ksu.edu.sa http://faculty.ksu.edu.sa/67980 2A125 B4	Numerical analysis (Functional Analysis)	Pakistani	Ph.D. 1988	Leeds UK	Associte Prof.
34.	Dr. Salih A. Elsanousi elsanosi@ksu.edu.sa http://faculty.ksu.edu.sa/58902 2A145 B4	Analysis	Sudanese	Ph.D. 1975	Warwick UK	Associate Prof.

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35.	Dr. Salman A. Alsalman alsalman@ksu.edu.sa http://faculty.ksu.edu.sa/Dr.Al-Salman 2A173 B4	Algebra (Group Theory)	Saudi	Ph.D. 1973	Birmingham UK	Associate Prof.
36.	Dr. Souhail Chebbi schebbi@ksu.edu.sa http://faculty.ksu.edu.sa/72359 2B64 B4	Functional Analysis	Tunisian	Ph.D. 1998	Sorbonne France	Associate Prof.
37.	Dr. Tahsin M. Ghazal tmghazal@ksu.edu.sa http://faculty.ksu.edu.sa/tmghazal 2A183 B4	Topology (Algebraic Topology)	Jordanian	Ph.D. 1979	London UK	Associate Prof.
38.	Dr. Yousef S. Al-Shanaifi shanaifi@ksu.edu.sa http://faculty.ksu.edu.sa/1292 2A128 B4	Algebra (Commutative Rings Theory)	Saudi	Ph.D. 1990	Southampton UK	Associate Prof.
39.	Dr. Zafar Elahi F. Khawaja kzelahi@ksu.edu.sa http://faculty.ksu.edu.sa/khawaja 2A138 B4	Applied Mathematics (Fluid Dynamics)	Pakistani	Dr.Ing. 1977	Hanover Germany	Associate Prof.
40.	Dr. Bashir Ali dali bdali@ksu.edu.sa 2B 60 B54	Differential Geometry &Lie Groups	Tunisian	Ph.D.2001	Safaqis Tunis	Assistant Prof.
41.	Dr. Moncef Bouaziz mbouaziz@ksu.edu.sa 3/129 AA	Combinatorics	Tunisian	Ph.D.	Tunis-Elmanar University	Assistant Prof.

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42.	Dr. Borhen Halouani halouani@ksu.edu.sa http://faculty.ksu.edu.sa/Halouani.Borhen 2A157 B4	Complex Analysis	Tunisian	Ph.D. 2006	France	Assistant Prof.
43.	Dr. Fahad M. Alshammari fmobarak@ksu.edu.sa http://faculty.ksu.edu.sa/al-shammari 2A179 B4	Algebraic Geometry	Saudi	Ph.D. 2002	Arizona USA	Assistant Prof.
44.	Dr. Hocine A. Guediri hguediri@ksu.edu.sa http://faculty.ksu.edu.sa/Hocine-Guediri 2A175 B4	Functional and Complex Analysis	Algerian	Ph.D. 2001	Provance France	Assistant Prof.
45.	Dr. Houcine Sadraoui sadrawi@ksu.edu.sa http://faculty.ksu.edu.sa/72481 2B62 B4	Functional Analysis	Tunisian	Ph.D. 1992	Bordo USA	Assistant Prof.
46.	Dr. Jamal Khalifa Benameur jbenameur@ksu.edu.sa 2A152 B4	Partial Differential Equations	Tunisian	Ph.D.2004	Tunis	Assistant Prof.
47.	Dr. Mohammad A. Alzohairi zohairi@ksu.edu.sa http://faculty.ksu.edu.sa/zohairi 2A127 B4	Discrete Mathematics (Combanatorics Theory)	Saudi	Ph.D. 1997	Ottawa Canada	Assistant Prof.
48.	Dr. Mostafa Bashar mbachar@ksu.edu.sa 2A180 B4	Applied mathematics: Biomathematics	Austrian	Ph.D. 1999	France	Assistant Prof.

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49.	Dr. Omar Hamed omshamed@ksu.edu.sa http://faculty.ksu.edu.sa/OmarHamed 2A178 B4	Numerical Analysis (Integral Equations)	Jordanian	Ph.D. 1983	Salford UK	Assistant Prof.
50.	Dr. Youssef Boudabbous youssefboudabbous@yahoo.fr 2/ 129 AA	Combinatorics	Tunisian	University Habilitatun	University Of Sfax	Prof.
51.	Dr. Saleem A. Obaidat saleem@ksu.edu.sa http://faculty.ksu.edu.sa/73672 2A123 B4	Computational mathematics	Jordanian	Ph.D.2005	Institute of Mathematics and Informatics Bulgaria	Assistant Prof.
52.	Dr. Saleh M. Hassan smhm@ksu.edu.sa http://faculty.ksu.edu.sa/salehmh 2A144 B4	Numerical Analysis	Egyptian	Ph.D. 1998	Roorki India	Assistant Prof.
53.	Dr. Tariq A. Al-Fadhel alfadhel@ksu.edu.sa http://faculty.ksu.edu.sa/alfadhel 2A172 B4	Analysis (Dynamical Systems)	Saudi	Ph.D. 2003	Illinois USA	Assistant Prof.
54.	Dr. Hasan Altayyip saakhlaq@yahoo.com AA1131 B4	Differential Equations	Sudanese	Ph.D. 2008	Putra Malaysia	Assistant Prof.

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1.	Dr. Fatima B. Jamjoom fjamjoom@ksu.edu.sa http://faculty.ksu.edu.sa/fjamjoom 3/817 B9	Functional Analysis	Saudi	Ph.D. 1990	Reading UK	Prof.
2.	Dr. Fairouz Tchier ftchier@ksu.edu.sa http://faculty.ksu.edu.sa/tchier 2/26 B21	Application of Algebra	Canadian	Ph.D. 1996	Evall Canada	Associate Prof.
3.	Dr. Fatima M. Azmi fazmi@ksu.edu.sa http://faculty.ksu.edu.sa/Fazmi 3/29 B21	Noncommutative Geometry	Indian	Ph.D.1996	Colorado USA	Associate Prof.
4.	Dr. Abir Alharbi abir@ksu.edu.sa http://faculty.ksu.edu.sa/abiralharbi 2/25 B21	Applied Mathematics (Computational Mathematics)	Saudi	Ph.D. 1997	Florida Institute of Technology USA	Assistant Prof.
5.	Dr. Azza M. Eltahan Dr.azza_eltahan@yahoo.co.uk http://faculty.ksu.edu.sa/64499 2/30 B21	Algebra	Egyptian	Ph.D.1988	Birmingham UK	Assistant Prof.
6.	Dr. Fardous M. Toufic Fardtaw12@hotmail.com http://faculty.ksu.edu.sa/2826 2/33 B21	Numerical Analysis	Saudi	Ph.D. 1988	University College London UK	Assistant Prof.
7.	Dr. Haifa M. Jebreen hjebreen@ksu.edu.sa http://faculty.ksu.edu.sa/HaifaJebreen 3/31 B21	Functional Analysis	Saudi	Ph.D. 2004	KSU Saudi Arabia	Assistant Prof.
8.	Dr. Haila M. Alodan halodan@ksu.edu.sa http://faculty.ksu.edu.sa/alodan 3/28 B21	Geometry of Differentiable Manifolds	Saudi	Ph.D. 2001	KSU Saudi Arabia	Assistant Prof.

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9.	Dr.Hanan A. Al-Olayan Holayan@ksu.edu.sa http://faculty.ksu.edu.sa/9677 3/94 B21	Algebra	Saudi	Ph.D. 2001	KSU Saudi Arabia	Assistant Prof.
10.	Dr. Hind Albleehed bleehed@ksu.edu.sa http://faculty.ksu.edu.sa/hind 2/27 B21	Algebra (Rings Theory)	Saudi	Ph.D. 2001	KSU Saudi Arabia	Assistant Prof.
11.	Dr. Ibtesam O. Bajunaid bajunaid@ksu.edu.sa http://faculty.ksu.edu.sa/Ibajunaid 3/33 B21	Potential Theory	Saudi	Ph.D. 1999	KSU Saudi Arabia	Assistant Prof.
12.	Dr. Ishrat Jahan ijahan@ksu.edu.sa http://faculty.ksu.edu.sa/64108 2/28 B21	Analysis (Special Functions)	Indian	Ph.D. 1987	Aligarh Muslim University India	Assistant Prof.
13.	Dr. Jawaher A. Al-Mufarrij jmufarrij@ksu.edu.sa http://faculty.ksu.edu.sa/jawaher 3/32 B21	Fuzzy Topology	Saudi	Ph.D. 2009	Saudi Arabia	Assistant Prof.
14.	Dr. Maysaa' M. AlQurashy Maysaa@ksu.edu.sa http://faculty.ksu.edu.sa/maysaa 3/21 B21	Potential Theory	Saudi	Ph.D. 2004	KSU Saudi Arabia	Assistant Prof.
15.	Dr. Najla A. Al-Twaijiry Najla@ksu.edu.sa http://faculty.ksu.edu.sa/najla 3/87 B21	Functional Analysis	Saudi	Ph.D. 2007	Oxford UK	Assistant Prof.
16.	Dr. Samira Abdul-Hamid Ali Saali@ksu.edu.sa http://faculty.ksu.edu.sa/Samira 2/32 B21	Functional Analysis	Egyptian	Ph.D. 1980	Reading UK	Assistant Prof.

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18.	Dr. Zeinab Sayed Ibrahim Mansour Zeinabsg8@hotmail.com 3/817B9	Special Functions	Egyptian	Ph.D.	Cairo Egypt	Assistant Prof.

Computer Lap

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Mohammad N. Al-Ghamdi	Demonstrator	B.Sc.	On a grant	
Naser I. Al-Turkey	Demonstrator	B.Sc.	On a grant	
Salem Al-Motari	Demonstrator	B.Sc.	On a grant	
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Shaalan Al-Garney	Demonstrator	B.Sc.	On a grant	
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Assistants (Females):

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Alhanof alhomaidi	Demonstrator	B.Sc.	3/815 B9	aalhomaidhi@ksu.edu.sa
Anwar H. Al-Moallem	Demonstrator	B.Sc.	2/61 B21	Anwa2030@Yahoo.com
Areej A.Al-abduljabbar	Demonstrator	B.Sc.	3/93 B21	Al.abduljabbar@yahoo.com
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Tahani M. Al-Daba'an	Demonstrator	B.Sc.	2/57 B21	Taldabaan@ksu.edu.sa

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Staff (Females)

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