
KING FAISAL UNIVERSITY
College of Science
Mathematics and Statistics Department



UNDERGRADUATE PROGRAM IN MATHEMATICS

2019

The Department of Mathematics and Statistics

Guiding Statement

The journey of the Department of Mathematics and Statistics started from 1980 G (1400 H) as a scientific department in the Faculty of Education at King Faisal University (KFU). It started with main objective as supplying Ministry of Education with qualified teachers. Later on, by enhancing and modifying the Vision, Mission, Objectives and Study plan in a great extent and maintaining the global standards with the aspirations of the University and Country, the Department of Mathematics and Statistics started its own journey as an individual department under College of Science in the year 2002 G (1423 H). The Department of Mathematics and Statistics offering Bachelor and Master degrees in Mathematics. This master's graduate program helps many Saudis to pursue their Ph.D. in top universities in the globe. The department not only developed its own curriculum but also extended its services to other colleges in the university those who required for the basic mathematics courses. At present, it is one of the largest departments in King Faisal University, with about 80 faculty members and including supporting staff. The teaching staff is actively involved in teaching, administration and conducting high quality research in various fields of Mathematics and Statistics. The alumni of the department is contributing to the department through their inputs to improve the curriculum to meet the academic and industrial needs.

Program Structure and Organization

General Framework for the Distribution of Program Units

Category	Number of Credit hours
University Requirements	
Core Courses	4
Elective Courses	4
Total	8
College Requirements	
Core Courses	28
Elective Courses	3
Total	31

Department Requirements	
Core Courses	78
Supporting Courses	4
Elective Courses	9
Total	91
Total Credit hours of the program	130

No.	Course code and title	Contact Hours (CH)			Credit Hours (CR)	Pre-requisite	University College Or Department
		Lect. (LT)	Tutorial	Lab (LB)			
University Requirements							
Core Courses 4 credits							
1.	DEIC-101: Creed and Doctrines (1900101)	2		0	2	-	University
2.	DEIC-102: Islamic Culture (1900102)	2		0	2	-	University
Elective Courses (select two courses) 4 credits							
1.	DEIC-103: Islamic Morals and Occupational Ethics (1900103)	2		0	2	-	University
2.	DEIC-104: Studies in the Prophet's Biography (1900104)	2		0	2	-	University
3.	DEIC-105: Medical Jurisprudence (1900105)	2		0	2	-	University
4.	DEIC-106: Economy and	2		0	2	-	University

	Politics in Islam (1900106)						
5.	DEIC-107: Social System and Family Behavior (1900107)	2		0	2	-	University
6.	DEIC-108: Management and Entrepreneurship (1900108)	2		0	2	-	University
7.	DEIC-109: Health and Fitness (1900109)	2		0	2	-	University
8.	DEIC-110: Research Skills (1900110)	2		0	2	-	University
9.	DEIC-111: Voluntary Work (1900111)	2		0	2	-	University
10.	DEIC-112: Medicine: Type and Usage (1900112)	2		0	2	-	University
11.	DEIC-113: Human Rights in Islam (1900113)	2		0	2	-	University
12.	DEIC-114: Food and Nutrition (1900114)	2		0	2	-	University
College Core Requirements							
Core courses 28 credits							
1.	PHYS101: General Physics 1 (0824101)	3				-	College
2.	PHYS111: General Physics 1-Lab (0824111)			1		-	College

3.	CHEM101: General Chemistry 1 (0825101)	3				-	College
4.	CHEM111: General Chemistry 1- Lab (0825111)			1		-	College
5.	BIO101: General Biology (0826101)	3				-	College
6.	BIO111: General Biology-Lab (0826111)			1		-	College
7.	MATH101: Calculus 1 (0827101)	3	1			-	College
8.	MATH102: Introduction to computer sciences (0827102)	3				-	College
9.	MATH112: Introduction to computer sciences-Lab (0827112)			1		-	College
10.	MATH103: Introduction to statistics (0827103)	3	1			-	College
11.	Literary Appreciation (7402103)	2				-	College
12.	Arabic Editing (7402102)	2				-	College
	Total	22	2	4			
College elective courses (select one course) 3 credits							
1.	PHYS201: Mathematical Physics 1 (0824201)	3				0827101	Phys. Dep

2.	PHYS426: Astronomy (0824426)	3				0824101	Phys. Dep
3.	BIO321:Bioinformatics(0826321)	3				0826101	Bio Dep
4.	CHEM208: Inorganic Chemistry 1 (0825208)	3				0825101	Chem. Dep
5.	CHEM421:Environmental Chemistry (0825421)	3				--	Chem. Dep
Department Requirements							
	Core Courses		78 credits				
1.	MATH201: Logic and set theory (0827201)	3	1			-	Math Dep
2.	MATH202: Calculus 2 (0827202)	3	1			0827101	Math Dep
3.	MATH203: Group theory (0827203)	3	-	-		0827201	Math Dep
4.	MATH204: Linear Algebra 1 (0827204)	2	1			-	Math Dep
5	MATH205: Calculus3 (0827205)	3	1			0827202	Math Dep
6.	MATH206: Principles Of Analysis (0827206)	3	1			0827101	Math Dep
7.	MATH301:	2	1			0827201	Math Dep

	Introduction to Topology (0827301)						
8.	MATH302: Real Analysis (0827302)	3	--			0827206	Math Dep
9.	MATH303: Discrete Mathematics (0827303)	3	--			0827201	Math Dep
10.	MATH304: Ordinary Differential equations (0827304)	3	--			0827202	Math Dep
11.	MATH305: Rings and fields (0827305)	3	--			0827203	Math Dep
12.	MATH306: Mathematical Programming (0827306)	2	-	-		0827102	Math Dep
13.	MATH316: Mathematical Programming- Lab (0827316)	--	--	1		-	Math Dep
14.	MATH307: Measure theory (0827307)	3	--	--		0827206	Math Dep
15.	MATH308: Numerical Analysis 1 (0827308)	3				0827202	Math Dep
16.	MATH309: Analysis of Several Variables	3				0827205	Math Dep

	(0827309)						
17.	MATH310: Probability Theory (0827310)	3				0827103	Math Dep
18.	MATH311: Linear Algebra 2 (0827311)	3				0827204	Math Dep
19.	MATH399: Summer training (0827399)	3				Completi on of 83 hours	Math Dep
20.	MATH401: Numerical Analysis 2 (0827401)	3				0827311 & 0827304	Math Dep
21.	MATH402: Special Functions (0827402)	3				0827205	Math Dep
22.	MATH403: Statistics and Applications (0827403)	3				0827310	Math Dep
23.	MATH404: Complex Analysis (0827404)	3				0827302	Math Dep
24.	MATH405: Partial Differential Equations (0827405)	3				0827304	Math Dep
25.	MATH406: Number Theory (0827406)	3				0827203	Math Dep
26.	MATH407: Research Project (0827407)	2				Completi on of 90 hours	Math Dep
	Total	71	6	1			
Supporting courses						4 credits	
1.	PHYS202:	3				0824101	Phys Dep

	General Physics 2 (0824202)						
2.	PHYS212: General Physics 2-lab (0824212)			1			Phys Dep
Elective Courses (select 3 courses) 9 credits							
1.	MATH420:Field Extensions (0827420)	3				0827203	Math Dep
2.	MATH421: Combinatorics (0827421)	3				0827303	Math Dep
3.	MATH422: Functional Analysis (0827422)	3				0827307	Math Dep
4.	MATH423: Fourier Analysis and Applications (0827423)	3				0827307	Math Dep
5.	MATH424: Differential Geometry (0827424)	3				0827309	Math Dep
6.	MATH425: Euclidean and Non Euclidean Geometry (0827425)	3				0827201	Math Dep
7.	MATH426: Stochastic Processes (0827426)	3				0827310	Math Dep
8.	MATH427:Line ar Programming (0827427)	2	1			0827311	Math Dep
9	MATH428: Financial Mathematics (0827428)	2	1			0827310	Math Dep
10.	MATH429:	3				0827304	Math Dep

	Dynamical Systems and Chaos (0827429)						
11.	MATH430: An introduction to the Optimization Theory (0827430)	3				0827205	Math Dep
12.	MATH431: Evolution of Mathematics (0827431)	3				--	Math Dep

Bachelor of Science in Mathematics(BSM) Study Plan

Level	Course Code	Course Title	Required or Elective	* Pre-Requisite Courses	Credit Hours	University, College or Department
Level 1	0824101	General Physics 1	Required	----	3	College
	0824111	General Physics 1-Lab	Required	----	1	College
	19xxxxx	University Elective Course from table 1	Elective	----	2	University
	7402103	Literary Appreciation	Required	----	2	College
	0827102	Introduction to Computer	Required	----	3	College
	0827112	Introduction to Computer-Lab	Required	----	1	College
	0827101	Calculus 1	Required	----	4	College
	Total Credit Hours					16

Level	Course Code	Course Title	Required or Elective	* Pre-Requisite Courses	Credit Hours	University, College or Department
Level 2	19xxxxx	University Elective Course from table 1	Elective	----	2	University
	7402102	Arabic Editing	Required	----	2	College
	0827103	Introduction to Statistics	Required	----	4	College
	0825101	General Chemistry 1	Required	----	3	College
	0825111	General Chemistry 1-Lab	Required	----	1	College
	0826101	General Biology	Required	----	3	College
	0826111	General Biology-Lab	Required	----	1	College
	Total Credit Hours					16

Level	Course Code	Course Title	Required or Elective	* Pre-Requisite Courses	Credit Hours	University, College or Department
Level 3	0824202	General Physics 2	Required	0824101	3	Phys. Dept.
	0824212	General Physics 2-Lab	Required	----	1	Phys. Dept.
	0827202	Calculus2	Required	0827101	4	Math. Dept.
	0827201	Logic and Set Theory	Required	----	4	Math. Dept.
	081Xxxxx	College Elective Course from table 2	Elective	----	3	College
	1900101	Creed and Doctrines	Required	----	2	University
	Total Credit Hours					17

Level	Course Code	Course Title	Required or Elective	* Pre-Requisite Courses	Credit Hours	University, College or Department
Level 4	0827203	Group Theory	Required	0827201		Math. Dept.
	0827204	Linear Algebra 1	Required	----	3	Math. Dept.
	0827205	Calculus 3	Required	0827202	34	Math. Dept.
	0827206	Principles of Analysis	Required	0827101	4	Math. Dept.
	1900102	Islamic Culture	Required	----	2	University
	Total Credit Hours					16

Level	Course Code	Course Title	Required or Elective	* Pre-Requisite Courses	Credit Hours	University, College or Department
Level 5	0827305	Rings and Fields	Required	0827203	3	Math. Dept.
	0827302	Real Analysis	Required	0827206	3	Math. Dept.
	0827304	Ordinary Differential Equations	Required	0827202	3	Math. Dept.
	0827301	Introduction to Topology	Required	0827201	3	Math. Dept.
	0827303	Discrete Mathematics	Required	0827201	3	Math. Dept.
	0827306	Mathematical Programming	Required	0827102	2	Math. Dept.
	0827316	Mathematical Programming-Lab.	Required	----	1	Math. Dept.
	Total Credit Hours					18

Level	Course Code	Course Title	Required or Elective	* Pre-Requisite Courses	Credit Hours	University, College or Department
Level 6	0827307	Measure theory	Required	0827206	3	Math. Dept.
	0827308	Numerical Analysis 1	Required	0827202	3	Math. Dept.
	0827310	Probability Theory	Required	0827103	3	Math. Dept.
	0827309	Analysis of Several Variables	Required	0827205	3	Math. Dept.
	0827311	Linear Algebra 2	Required	0827204	3	Math. Dept.
	Total Credit Hours					15
	0827399	Summer Training	Required	Passing 83 hours	3	Department

Level	Course Code	Course Title	Required or Elective	* Pre-Requisite Courses	Credit Hours	University, College or Department
Level 7	0827401	Numerical Analysis 2	Required	0827204 & 0827304	3	Math. Dept.
	0827402	Special Functions	Required	8172223	3	Math. Dept.
	0827403	Statistics and Applications	Required	0827310	3	Math. Dept.
	0827404	Complex Analysis	Required	0827302	3	Math. Dept.
	0827xxxx	Department Elective Course from table 3	Elective	----	3	Math. Dept.
	Total Credit Hours					15

Level	Course Code	Course Title	Required or Elective	* Pre-Requisite Courses	Credit Hours	University, College or Department
Level 8	0827405	Partial Differential Equations	Required	0827304	3	Math. Dept.
	0827406	Number Theory	Required	0827203	3	Math. Dept.
	0827407	Research Project	Required	Passing 90 hours	2	Math. Dept.
	0827xxxx	Department Elective Course from table 3	Elective	----	3	Math. Dept.
	0827xxxx	Department Elective Course from table 3	Elective	----	3	Math. Dept.
	Total Semester Credit Hours					14

Table 1: Students must select two courses from the University elective courses		
Course number	Course title	Credits
1900103	Islamic morals and Occupational Ethics	2
1900104	Studies in the Prophet's Biography	2
1900105	Medical jurisprudence	2
1900106	Economy and politics in Islam	2
1900107	Social system and family behavior	2
1900108	Management and Entrepreneurship	2
1900109	Health & Fitness	2
1900110	Research skills	2
1900111	Volunteer work	2
1900112	Medicine: Type and use	2
1900113	Human Rights in Islam	2
1900114	Food and Nutrition	2

Table 2: Student must select one course from college elective courses					
Course number	Course name	Lecture	tutorial	Lab	Prerequisites
0824201	Mathematical Physics 1	3			0827101
0824426	Astronomy	3			0824101
0826321	Bioinformatics	3			0826101
0825208	Inorganic Chemistry 1	3			0825101
0825421	Environmental Chemistry	3			-

Table 3 : Student must select 3 courses from department elective courses					
Course number	Course name	lecture	tutorial	Lab	Pre-requisites
0827420	Field Extensions	3			0827203
0827421	Combinatorics	3			0827303
0827430	An introduction to the Optimization Theory	3			0827205
0827424	Differential Geometry	3			0827309
0827429	Dynamical Systems and Chaos	3			0827304
0827423	Fourier Analysis and Applications	3			0827307
0827422	Functional Analysis	3			0827307
0827426	Stochastic Processes	3			0827310
0827427	Linear Programming	2	1		0827311
0827431	Evolution of Mathematics	3			
0827425	Euclidean and Non Euclidean Geometry	3			0827201
0827428	Financial Mathematics	2	1		0827310

Course Descriptions

A. Core Course Requirements:

1. Calculus 1-0827101 (4 credit hours)

This course provides the basic facts of calculus including limits, continuity, the definition of derivative, differentiation rules, implicit differentiation, the mean value theorems, definite and indefinite integral, the fundamental theorem of calculus and applications of differentiation and integration.

Pre-requisites for this course: None

Co-requisites for this course: None

Textbook: Joel R. Hass, Christopher E. Heil, Maurice D. Weir : “Thomas’ Calculus, Single Variable”, Pearson Education, 14th edition , 2017.

2. Introduction to Computer-0827102 (3 credit hours)

This course provides basic knowledge of computer usage, computer components, concepts of basic operating systems, binary number system, and representation of data on computer, use computer in mathematical programs Software (Mathematica and Matlab) and word processing software (Word and Scientific Workplace), use computer in spreadsheets, presentations, databases and usage of the Web and utilizing the web based resources.

Pre-requisites for this course: None

Co-requisites for this course: None

Textbook:

- Ashok Arora , “Computer Fundamentals and Applications” , Vikas publishing House, 2015

- Stephen J. Chapman , "Essentials of MATLAB Programming", Publisher: Cengae Learning, Third Ed, 2016

3. Introduction to Computer-Lab -0827112 (1 credit hours)

This course provides basic knowledge of computer usage, use computer in mathematical programs (Mathematica and Matlab) and use computer in Advanced Skills of word processing software (Word and Scientific Workplace), spreadsheets, presentations, databases and uses of the Web and utilizing some web-based resources.

Pre-requisites for this course: None

Co-requisites for this course: Introduction to Computer (0827102)

Textbook:Paul R. Wellin , "Programming with Mathematica, An Introduction ", publisher: Cambridge, 2013, (Hardcover).

4. Introduction to Statistics-0827103 (4 credit hours)

This course is designed to describe statistical data graphically and compute measures of centrality and dispersion, and develop concepts of sample space, probability of an event, conditional probability, statistical independence, random variables, discrete and continuous probability distributions and hypothesis testing.

Pre-requisites for this course: None

Co-requisites for this course: None

Textbook: William Mendenhall, Robert Beaver, Barbara Beaver: "Introduction to probability and statistics" Thomson Brooks/Cole – USA, 14th Edition , 2013.

5. Logic and Set Theory-0827201 (4 credit hours)

This course covers logic of statements, quantifiers, Methods of proofs, sets and operations on sets, Relations: Equivalence relations, partial order and linear order, functions and properties of functions, countable sets.

Pre-requisites for this course: None

Co-requisites for this course: None

Textbook:

1-Kevin Ferland, Discrete Mathematics and Applications, Second Edition, Textbooks in Mathematics, Taylor & Francis INC, 2017

2- Proofs and Fundamentals: A First Course in Abstract Mathematics (Undergraduate Texts in Mathematics) 2nd ed. 2011 .

6. Calculus 2-0827202 (4 credit hours)

Calculus 2 is a fundamental course that deals with the basic knowledge related to: integration techniques, hyperbolic functions and their inverses, improper integrals, sequences, series and their tests of convergence, Taylor-Maclaurin formula, power series and their derivatives and integrals, polar coordinates and conic sections.

Pre-requisites for this course: Calculus (1) 0827101

Co-requisites for this course: None

Textbook: Joel R. Hass, Christopher E. Heil, Maurice D. Weir. *Thomas' Calculus: Early Transcendentals (14th Edition)*, Pearson, 2017.

7. Group Theory-0827203 (3 credit hours)

Group theory is a fundamental course that deals with the basic knowledge related to : group structure, cyclic groups, symmetric groups, subgroups, Lagrange's theorem, co-sets, normal subgroups, factor groups, and group-isomorphism theorems.

Pre-requisites for this course: Logic and Set theory (Math 0827201)

Co-requisites for this course: None

Textbook: Marshall Hall, The Theory of Groups, Dover Books on Mathematics, 2018.

8. Linear Algebra 1 - 0827204 (3 credit hours)

This course provides the basic knowledge of solving systems of linear equations, matrix operations, vector spaces and inner product spaces, linear transformations, matrix representation of a linear transformation, eigenvalues, eigenvectors and matrix diagonalization.

Pre-requisites for this course: None

Co-requisites for this course: None

Textbook: Gilbert Strang, Introduction to linear algebra, Wellesley-Cambridge Press (US), 2016.

9. Calculus 3 - 0827205 (4 credit hours)

This course deals with the basic facts of vectors in space, dot and cross products, lines and planes in space, curves and surfaces in space, cylindrical and spherical coordinates, vector-valued functions, functions of several variables, partial and total derivatives, directional derivative and gradient, maxima and minima, Lagrange multiplier, multiple integrals and their applications and Green's theorem and curvilinear integration.

Pre-requisites for this course: Calculus 2 (0827202)

Co-requisites for this course: None

Textbook: George B. Thomas Jr., Maurice D. Weir and Joel R. Hass. Thomas' Calculus: Multivariable (14th Edition), 2017.

10. Principles of Analysis- 0827206 (4 credit hours)

This course concerns with the fundamental of complex and real numbers, countable sets, topology on the real line, convergence of real sequences and series and limits of functions and convex functions.

Pre-requisites for this course: Calculus (1) 0827101

Co-requisites for this course: None

Textbook: Abbott S., Understanding analysis, (2nd Edition) Undergraduate text in mathematics, Springer,2016.

11. Introduction to Topology - 0827301 (3 credit hours)

This course provides an introduction to Topological Spaces, Open and closed Sets, Limit Points, Interior, Exterior and boundary Points and the Closure of Sets, Subspace Topology, Bases and Subbases for Topology, Continuous Functions, Topologically Equivalent, Topological Properties, Separation Axioms, Compactness, Connectedness.

Pre-requisites for this course: Logic and Sets Theory – 0827201

Co-requisites for this course: None

Textbook: F. Croom, Principles of Topology, Dover publications, New York, ,2016.

12. Real Analysis 0827302 (3 credit hours)

This course provides basic knowledge related to uniform continuity of real functions, the main value theorem, properties of the differentiability of real functions, the intermediate value theorem, the application of the L'Hopital's rules to calculate limits, the Taylor series expansion, the Riemann integral and its properties, the convergence, and uniform convergence of a sequence or series of real functions and real power series.

Pre-requisites for this course: Principle of Analysis- 0827206

Co-requisites for this course: None

Textbook: Abbott, S. . *Understanding analysis*. (2nd Ed.). Undergraduate text in mathematics. Springer.,2016.

13. Discrete Mathematics -0827303 (3 credit hours)

This course deals with algorithms, growth of functions, complexity of algorithms, mathematical induction, strong induction and well ordering, recursive algorithms, graphs, graph models and modeling computation.

Pre-requisites for this course: Logic and Set Theory -0827201

Co-requisites for this course: None

Textbook: Kevin Ferland, Discrete Mathematics and Applications, Second Edition, Textbooks in Mathematics, Taylor & Francis INC, 2017

14. Ordinary Differential equations: 0827304 (3 credit hours)

This course deals with analytical methods for solving several classes of ODEs, Finding the solution of ODEs in a series form, Solving IVP by Laplace transformations and their inverse, solving linear systems of first order ODEs and investigating some applications of ODEs.

Pre-requisites for this course: Calculus 2 - 0827202

Co-requisites for this course: None

Textbook: William E. Boyce, Richard C. DiPrima, Douglas B. Meade. Elementary differential equations and boundary value problems. (11th edition) Wiley, 2017.

15. Rings and fields – 0827305 (3 credit hours)

This course is designed to give basic knowledge in rings, fields, (Prime and maximal) ideals, ring homomorphism, factor rings, ring- isomorphism theorems and their use in constructing fields, polynomial rings, irreducible polynomials, unique factorization domains, Principal ideal domains and Euclidean domains, algebraic and finite field extensions.

Pre-requisites for this course: Group Theory - 0827203

Co-requisites for this course: None

Textbook: Stuart A. Rankin, Abstract Algebra: Introduction to groups, Rings and Fields with Applications, World Scientific Publishing, Co Pte Ltd, 2016.

16. Mathematical Programming- 0827306 (2 credit hours)

This course provides core concepts and principles of programming (variables, comments, data types, operators, special characters, flowchart, conditional statements, loops, break, continue, switch- case,...) and of object oriented programming (class, object, methods, constructor, inheritance, super, polymorphism,...) and their use in mathematical programs.

Pre-requisites for this course: Introduction to Computer- 0827102.

Co-requisites for this course: None

Textbook: Deitel and Deitel, "Java How to Program", Prentice Hall, 11th Edition, 2017.

17. Mathematical Programming- Lab – 0827316 (1 credit hour)

This course the core concepts and principles of programming (variables, comments, data types, operators, special characters, flowchart, conditional statements, loops, break, continue, switch- case,...) and of object oriented programming (class, object, methods, constructor, inheritance, super, polymorphism,...) and their use in mathematical programs.

Pre-requisites for this course: Introduction to Computer 0827102.

Co-requisites for this course: Mathematical Programming 0827306

Textbook: Walter Savitch, Kenrick Mock, Java: An Introduction to Problem Solving & Programming, Global Edition eBook, 7th Edition, 2015.

18. Measure theory-0827307 (3 credit hours)

This course deals with the basic knowledge of measurable sets and functions, integral of functions, the relation between the Riemann and Lebesgue integral, the L^p -spaces, convergence theorems, Holder inequalities and theorems of Fubini and Tonelli.

Pre-requisites for this course: Principals of Analysis 0827206

Co-requisites for this course: None

Textbook: H.L. Royden, Patrick Fitzpatrick, Real Analysis. Fourth Edition. Pearson, 2010.

19. Numerical Analysis 1-0827308 (3 credit hours)

This course is designed to provide student with basic understanding of numerical algorithms and skills to implement algorithms to solve mathematical problems on the computer. Emphasis are addressed on numerical methods for root-finding of nonlinear equations, approximation of functions, interpolation, numerical differentiation and numerical integration.

Pre-requisites for this course: Calculus2 0827202

Co-requisites for this course: None

Textbook: Burden R.L., Faires J.D. Numerical analysis (10thed., Brooks Cole, 2016.

20. Analysis of Several Variables 0827309 (3 credit hours)

This course is designed to cover the basic knowledge related to topological properties of the Euclidean space \mathbb{R}^n , the space of linear applications from \mathbb{R}^n

to \mathbb{R}^m , the differentiability of functions defined on open subset of \mathbb{R}^n , the chain rules formula, the inversion theorem and the implicit function theorem, the extrema of real valued functions of several variables, the Lagrange multipliers and the change of variables formula.

Pre-requisites for this course: Calculus 3- 08172223

Co-requisites for this course: None

Textbook: Maria Shea Terrell, Peter D-Lax, Multivariable Calculus with Applications, Springer 2018

21. Probability Theory 0827310 (3 credit hours)

This course provides basic concepts of probability and to be able to determine the properties of probability distributions such as sample space, probability measure, conditional probability, Bayes and total probability theorems, centrality and dispersion measures, the moments of probability distributions, Chebyshev and Markov inequalities.

Pre-requisites for this course: Introduction to statistics (0827103)

Co-requisites for this course: None

Textbook: Jay Devore: "Probability and statistics for engineering and the sciences" Duxbury Press 9th Edition, 2012

22. Linear Algebra 2- 0827311 (3 credit hours)

This course provides basic understanding of eigenvectors, eigenvalues, diagonalization and triangularization, the Jordan Reduction, sequences and series of matrices, linear differential systems, quadratic and Hermitian forms, Euclidean and Hermitian spaces.

Pre-requisites for this course: Linear Algebra 1 (Math 0827204)

Co-requisites for this course: None

Textbook: Steven Roman, Advanced linear algebra, Springer, 2014

23. Numerical Analysis 2-0827401**(3 credit hours)**

This course is designed to provide student with basic understanding of numerical methods for solving initial value problems and boundary value problems for ordinary differential equations, direct methods for solving linear systems, iterative methods for solving linear systems and numerical methods for approximating eigenvalues.

Pre-requisites for this course: Linear Algebra2 (0827311) and Ordinary Differential Equations (0827304)

Co-requisites for this course: None

Textbook:

-Burden R.L., Faires J.D. Numerical analysis (10thed., Brooks Cole), 2016.

-Wen Shen, Introduction to numerical computation, World Scientific Publishing ,2015.

24. Special Functions 0827402**(3 credit hours)**

This course provides basic understanding of Gamma and Beta Functions, Hypergeometric functions, Bessel functions and confluent hypergeometric functions, Orthogonal polynomials (Legendre, Laguerre, Hermit).

Pre-requisites for this course: Calculus 3 -0827205

Co-requisites for this course: None

Textbook: Richard Beals and Doderick Wong, Special function and Orthogonal Ploynomials (Combridge Studies in Advenced Mathematics), 2016.

25. Statistics and Applications -0827403**(3 credit hours)**

This course is designed to provide student with understanding of some specific discrete and continuous distributions, central limit theorem, bivariate random variables, distribution of function of random variables and statistical estimation.

Pre-requisites for this course: Probability theory - 0827310

Co-requisites for this course: None

Textbook: Vijay Rohatgi, Ehsanes Saleh: "An introduction to probability and statistics" Wiley Series in probability and statistics, 3rd Edition, Wiley,2015.

26. Complex Analysis 0827404 (3 credit hours)

This course is designed to provide the basic knowledge of complex numbers and functions, analytic and harmonic functions, power series representation of analytic and meromorphic functions, Cauchy's theorem, applications of Cauchy's Integral Formula, zeros of Analytic function, Maximum Modulus Principal, singularities, Residue Calculus and its applications.

Pre-requisites for this course: Real Analysis -0827302

Co-requisites for this course: None

Textbook: Lars Ahlfors, Complex Analysis, 3rd Edition,2013.

27. Partial Differential Equations-0827405 (3 credit hours)

This course treats the basic concepts of partial differential equations, Order and linearity of partial differential equations, First order partial differential equations and characteristics, Conservation laws and their weak solutions, Classification of second order partial differential equations and their solutions, Existence and properties of solutions for Laplace, heat and wave equations.

Pre-requisites for this course: Ordinary Differential Equations (0827304)

Co-requisites for this course: None

Textbook: J Robert Buchanan and Zhoude Shao, A First Course in Partial Differential Equations, World scientific publishing Company, 2017.

28. Number Theory-0827406 (3 credit hours)

This course is designed to study integers, divisibility, representation of integers, prime numbers, linear Diophantine equations, systems of equations

defined by congruence, Chinese remainder theorem, Wilson and Fermat theorem.

Pre-requisites for this course: Group Theory (0827203)

Co-requisites for this course: None

Textbook: Harold M. Stark , An Introduction to Number Theory , The MIT Press , 2015.

29. Research project - 0827407 (2 credit hours)

In this course, a selected research project by the faculty member is assigned to the student in order to analyze theoretical research requiring a report consists of an appropriate description of research work.

Pre-requisites for this course: 90 completed credit hours

Co-requisites for this course: None

Textbook: Mathematical journals, Books, reviews

30- Summer Training – 0827399

An internship during the summer of the third year (after the Sixth level) where the student has to spend an average of five hours per day (Minimum 200 contact hours during the internship). The training will be done in a professional workplace on projects related to math and statistics. The student will have the following tasks: Learn about the project under investigation through literature review; work on field tasks as assigned by the staff supervisor; develop a plan for acquiring data and establish a sense of team work; write the final report on the summer training and submit it to the department; present and discuss the final report at the beginning of the Fall semester.

Pre-requisites for this course: Completion of 83 Credit hours from the BSc program

Co-requisites for this course: None

Textbook: None

B. Elective Course Requirements

1. Field Extensions-0827420 (3 credit hours)

This course provides basic knowledge of rings, fields, polynomial rings, irreducible polynomials, splitting field, algebraic and Galois field extension, finite fields and ruler and compass constructions.

Pre-requisites for this course: Group Theory 0827203

Co-requisites for this course: None

Textbook: Ian Stewart, Galois Theory, Fourth Edition, Apple Academic Press INC, 2015.

2. Combinatorics – 0827421 (3 credit hours)

This course provides basic knowledge of counting, Graphs, Generating functions, Recurrence relations, the method of characteristic roots, Equivalence relations, Group action, coloring, finite fields, coding theory.

Pre-requisites for this course: Discrete Mathematics (0827303)

Co-requisites for this course: None

Textbook: Walter D. Wallis and John C. George, Introduction to Combinatorics, Second Edition, CRC Press, Taylor & Francis group, 2017.

3. Functional Analysis 0827422 (3 credit hours)

This course provides basic knowledge of metric spaces, Banach spaces, Linear bounded operators, Inner product spaces, Open mapping theorem, Closed range theorem and Hilbert spaces.

Pre-requisites for this course: Measure Theory :0827307

Co-requisites for this course: None

Textbook: J. Muscat, Functional Analysis: An introduction to Metric spaces, Hilbert spaces and Banach spaces. Springer, 2014.

4. Fourier Analysis and applications 0827423 (3 credit hours)

This course introduces the Fourier Transform (FT) of functions in L^1 and L^2 , and their convolution. Some density theorems are needed to compute FT in L^2 ; in particular, Schwarz spaces will play a fundamental role in this study. Techniques of FT will be applied to solve some partial differential equations.

Pre-requisites for this course: Measure Theory: 0827307

Co-requisites for this course: None

Textbook: Anders Vretblad :”Fourier Analysis and Its Applications, , Graduate Texts in Mathematics 223, Springer (2008)

5. Differential Geometry 0827424 (3 credit hours)

The course deals with curves, surfaces in plane, space with various notions of curvature using exterior differential calculus and knowledge of Riemannian geometry in higher dimensions concentrating in three main parts: curves, surfaces and geodesic..

Pre-requisites for this course: Analysis of Several Variables 0827309

Co-requisites for this course: None

Textbook: M. P. doCarmo, “Differential Geometry of Curves and Surfaces”, Prentice-Hall, Saddle River NJ, 1976. Revised edition, 2016.

1. Euclidean and Non Euclidean Geometry: 0827425 (3 credit hours)

This course examines the five groups of axioms, their compatibility and mutual independence. It Introduces non Euclidean Geometry and makes a comparison of Hyperbolic and Euclidean properties.

Pre-requisites for this course: Logic and Set Theory 0827201

Co-requisites for this course: None

Textbook: Harvey, Matthew, Geometry Illuminated: An Illustrated Introduction to Euclidean and Hyperbolic Plane Geometry, Mathematical Association of America, 2015.

2. Stochastic Processes – 0827426 (3 credit hours)

This course provides the basic facts of conditional expectation, Markov chains in discrete time, classification of states, branching processes, Poisson processes, continuous time Markov chains and birth and death processes.

Pre-requisites for this course: Probability theory 0827310

Co-requisites for this course: None

Textbook: Sheldon M. Ross, "Introduction to Probability Models", Academic Press-Elsevier, 11th Edition, 2014.

3. Linear Programming 0827427 (3 credit hours)

This course is designed to formulate linear programming models, solve 2-dimension problem by graphical method, understand technics of simplex and dual algorithms to solve any linear program, solve transportation problem, solve linear programming problems by an appropriate software such as: Lindo, Cplex, Matlab, Excel,...., etc.

Pre-requisites for this course: Linear Algebra 2: 0817311

Co-requisites for this course: None

Textbook: Vanderbei, Robert J, Linear Programming: Foundations and Extensions. (Fourth Edition) Springer, 2014.

4. Financial Mathematics 0827428 (3 credit hours)

This course establishes the basics of the one-period model, hedging. returns, arbitrage and state prices, complete and incomplete markets, the multi-period binomial model for stock prices and option, and Black-Scholes option pricing formula.

Pre-requisites for this course: Probability theory: 0827310

Co-requisites for this course: None

Textbook: Ansgar Steland “Financial statistics and mathematical finance: methods, models and applications”. ISBN 978-0-470-71058-6, John Wiley & Sons, Ltd,2012

5. Dynamical Systems and Chaos: 0827429 (3 credit hours)

This course is designed to provide student with basic understanding of the dynamical systems, existence and uniqueness theorem, phase portrait, stability analysis of fixed points, bifurcation theory, the Smale horseshoe chaos, Melnikov’s method for Homoclinic orbits, Lyapounov exponents, Chaos and strange attractors, applications in biology, electric circuits and physics.

Pre-requisites for this course: Ordinary Differential Equations 0827304

Co-requisites for this course: None

Textbook: Nonlinear Dynamics and Chaotic Phenomena: An Introduction by Bhimsen K. Shivamoggi, springer,2014.

6. An introduction to optimization theory 0827430 (3 credit hours)

This course provides the basic facts related to the differentiability of real valued functions, the first and the second order conditions for minimization problems without constraints, the Lagrange multipliers, the KKT conditions for minimization problems of with constraints, the convex optimization, the gradient algorithm, the projection on closed and convex subset and the convergence of the projected gradient method.

Pre-requisites for this course: Calculus 3 : 0827205

Co-requisites for this course: None

Textbook: Chong, E.K.P. & Zak, S.H. (2013). An Introduction to Optimization. (4th Ed.). New York: John Willey & Sons.

7. Evolution of Mathematics (0827431)

(3 credit hours)

This course gives a survey of all Mathematical concepts/theorems made by savants in Medieval Islam, Solve Problems from Medieval Islam requiring mathematical modelling and Impact of Mathematics in medieval Islam on Engineering

Pre-requisites for this course: None

Co-requisites for this course: None

Textbook: Roshdi Rashed: "Encyclopedia of the history of Arabic Science, Volume 2: Mathematics and the physical sciences" Taylor & Francis e-Library (2009)

Required Physical Resources and Facilities

The Department of Mathematics and Statistics in the College of Science is comprised of 35 male and 14 female faculty members holding doctorate degrees from well-known Universities of the world (3 professors, 4 associate professors and 42 assistant professors and that is according to the KFU academic ranking). There are also many lecturers with MSc degree, mostly from USA and European Universities.

Faculty and teaching assistants	Male Section	Female Section	Total
Full time Faculty	35	14	49
Full time Lecturers	2	19	21
Full time Demonstrators	1	0	1
Total	38	33	71

In addition, resources in classroom and labs are available in the department (details in the following table).

Classrooms and Labs	Male Section	Female Section	Total
Classrooms	7	5	12
Classroom Capacity	418	455	873
Teaching Labs	4	3	7
Labs Capacity	56	94	150

The department of Mathematics and Statistics includes all of required resources to run the proposed program.