# Scheme of Studies BS, M.Sc, MS and Ph.D Mathematics

## From Fall, 2016 Semester to Onward



Department of Mathematics & Statistics Faculty of Basic and Applied Sciences International Islamic University, Islamabad Pakistan

#### <u>Minutes of the 9<sup>th</sup>meeting of the Board of Studies of the</u> <u>Department of Mathematics and Statistics</u>

The members of the board discussed all the point at length and proposed the following recommendations.

1. The following course titles are only renamed which are now in accordance with the guidelines of HEC and sister universities:

Existing Name	Proposed Name
MATH 101 Fundamentals of Mathematics	MATH 101Elements of Set Theory and Logic
MATH 202 Mechanics	MATH 231Mechanics-I
MATH 204 Elementary Differential	MATH 241 Elementary Differential Equations
Equations with Applications	
MATH 404 Statistics and Pprobility-1	MATH 472 Mathematical Statistics

- 2. The GC course "Physics-III" is approved to replace with GC-course "Elementary Statistics".
- 3. The course "Islamic world view and civilization-I" is recommended to replace with "Islamic Studies". This course is already approved for the Department of Physics and the course outlines are in accordance with HEC curriculum.
- 4. In order to maintain the ratio of 40: 60 in General and Subject courses, one extra GC course "Islamic world view and civilization-II" is recommended to replace with "Mechanics-II". The detailed course outlines of said course have already been approved from the Academe Council for "Revised Scheme of studies from fall 2007 to onward" of this department.
- 5. The board proposed the credits of projects at BS level should be equivalent to one elective course of 03 credits hours.
- 6. The board proposed that all Mathematics courses should begin with "MATH" followed by a 3 digit number. Also, it was proposed that the numbering pattern shall be as follows:
  - 1) First for the year in which course is to be offered
  - 2) Second for the subject discipline
  - 3) Third for the status of subject

Subject Name	Subject Code
Fundamental/Basic and Discreet structure	0
Calculus	1
Algebra and Number theory	2
Mechanics	3
Differential Equations	4
Topology and Geometry	5
Analysis	6
Computational Mathematics	7
Physical Applied Math and Combinatorics	8
Topics	9

The above mentioned scheme of course codes has already been approved from the Academe Council for "Revised Scheme of studies from fall 2007 to onward" of this department.

## <u>PART I</u>

# **Scheme of Studies**

From Fall, 2016 to Onward

	1 <sup>st</sup> Semester			2 <sup>nd</sup> Semester	
GC-115	Understanding of Quran-I	3	GC-112	Functional English - II	3
GC-111	Functional English – I	3	PHY-211	Waves and Oscillations	3
PHY-116	Basic Electricity and	3	GC-116	Understanding of Ouran-II	3
	Magnetism	-		······································	-
GC-151	Introduction to the Use of	3	BLC-001	Introduction to Law	3
00101	Computer	C	220 001		U
MATH 101	Elements of Set Theory	3	MATH 112	Calculus-II	3
	and Logic	C			U
MATH 111	Calculus-I	3	MATH 121	Introduction to Linear	3
	Galearab	0		Algebra	0
		18			18
	3rd Semester			4 <sup>th</sup> Semester	
GC-214	Basics of Academic	3	ECN-001	Introduction to Economics	3
00 211	Writing	U			0
GC-221	Islamic Studies	3	PSY-001	Psychology	3
GC-242	Elementary Statistics	3	MATH 222	Elementary number	3
	Liementary statistics	0		theory and Combinatorics	3
MATH 213	Calculus-III	3	MATH 241	Elementary Differential	3
		0		Equations	0
MATH 231	Mechanics-I	3	MATH-232	Mechanics-II	3
		15			15
	5 <sup>th</sup> Semester			6 <sup>th</sup> Semester	
GC-231	Pakistani Culture &	3	CS-291	Discrete Structures	3
00 201	Society	5		Discrete Structures	5
MATH 323	Linear Algebra	3	MATH 324	Group Theory	3
MATH 342	Ordinary Differential	3	MATH 333	Analytical Mechanics	3
	Equations	U		Thirdly creat Preenances	0
MATH 351	Set Topology	3	MATH 343	Partial Differential	3
		-		Equations	-
MATH 361	Real Analysis-I	3	MATH 352	Differential Geometry-I	3
MATH 362	Complex Analysis	3	MATH 363	Real Analysis-II	3
		18			18
	7 <sup>th</sup> Semester	_		8 <sup>th</sup> Semester	_
CS-001	Programming Language	3	CS-002	Software Tools	3
MATH 464	Functional Analysis-I	3	MATH 472	Mathematical Statistics	3
		~			-
MATH 471	Numerical Methods	3		Elective-III	3
	Elective-I	3		Elective-IV	3
	Elective-II	3	MATH 491	Project or Electives-V	3
		-		,	
		15			15
		_			_

## Scheme of Studies of BS Mathematics (4 years) From Fall 2016

	1 <sup>th</sup> Semester			2 <sup>nd</sup> Semester	
GC-115	Understanding of Quran-I	3	CS-291	Discrete Structures	3
MATH 323	Linear Algebra	3	MATH 324	Group Theory	3
MATH 342	Ordinary Differential	3	MATH 333	Analytical Mechanics	3
	Equations				
MATH 351	Set Topology	3	MATH 343	Partial Differential	3
				Equations	
MATH 361	Real Analysis-I	3	MATH 352	Differential Geometry-I	3
MATH 362	Complex Analysis	3	MATH 363	Real Analysis-II	3
	1 5	18		5	18
	3 <sup>rd</sup> Semester			4 <sup>th</sup> Semester	
GC-116	Understanding of Quran-	3	CS-002	Software Tools	3
	II				
CS-001	Programming Language	3	MATH 472	Mathematical Statistics	3
MATH 464	Functional Analysis-I	3		Elective-III	3
		-			-
MATH 471	Numerical Methods	3		Elective-IV	3
	Elective-I	3		Electives-V	3
	Elective-II	3		Electives-VI	3
		18			18
		10			10

## Scheme of Studies of M.Sc. Mathematics (2 years) From Fall 2016

Sr. No.	Course Code	Course Title
1.	MATH 402	Fuzzy Logics
2.	MATH 425	Introduction to Hopf Algebra
3.	MATH 426	Advanced Group Theory
4.	MATH 427	Theory of Modules
5.	MATH 428	Galois Theory
6.	MATH 429	Rings and Fields
7.	MATH 434	Analytical Dynamics
8.	MATH 435	Fluid Mechanics-I
9.	MATH 436	Fluid Mechanics-II
10.	MATH 437	Quantum Mechanics
11.	MATH 444	Integral Equations
12.	MATH 453	Algebraic Geometry
13.	MATH 454	Advanced Topology
14.	MATH 455	Algebraic Topology
15.	MATH 456	Differential Geometry-II
16.	MATH 457	Riemannian Geometry
17.	MATH 458	Theory of Manifolds
18.	MATH 465	Measure and Integration
19.	MATH 466	Functional Analysis-II
20.	MATH 473	Numerical Analysis
21.	MATH 474	Operations Research
22.	MATH 475	Optimization Theory
23.	MATH 476	Mathematical Modeling and Simulation
24.	MATH 481	Elasticity Theory
25.	MATH 482	Electromagnetism
26.	MATH 483	Combinatorics and Graph Theory
27.	MATH 484	Special Relativity
28.	CS 111	Programming Fundamentals
29.	CS 212	Data Structures and Algorithms
30.	CS 314	Theory of Automata
31.	CS 322	Computer Communications and Networks
32.	CS 361	Computer Graphics

## List of Elective Courses BS/M.Sc. Mathematics From Fall 2016

#### Scheme of Studies for MS Mathematics Programs From Fall 2016

4 Courses hours	1 <sup>st</sup> Semester	12 credit	4 courses hours	<b>2<sup>nd</sup> Semester</b> 12	credit
MATH 691 hours	<b>3<sup>rd</sup> Semester</b> MS Dissertation-I	3 credit	MATH 691 credit hours	<b>4<sup>th</sup> Semester</b> MS Dissertation-II	3

#### Eligibility:

M.Sc./BS-(4years) (Mathematics or Physics) with minimum CGPA 2.50/4.00 or 60% marks in annual system and appropriate NTS/GAT (General) with minimum 50% score.

#### List of Core Courses for MS Mathematics

Sr. No.	Course Code	Course Title
1.	MATH 521	Advanced Linear Algebra
2.	MATH 522	Theory of Abstract Algebra
3.	MATH 541	Advanced Partial Differential Equations
4.	MATH 542	Advanced Mathematical Methods
5.	MATH 543	Advanced Integral Equations
6.	MATH 551	Topological Vector Spaces
7.	MATH 561	Advanced Mathematical Analysis
8.	MATH 571	Numerical Solutions of Ordinary Differential Equations

Note: <u>Out of eight courses student will have to study at least four courses from the list of core courses</u>.

Sr. No.	<b>Course Code</b>	Course Title
1.	MATH 523	Semigroup Theory
2.	MATH 524	Theory of Group Actions
3.	MATH 525	Loop Groups
4.	MATH 526	Nilpotent and Soluble Groups
5.	MATH 527	Commutative Algebra
6.	MATH 528	Lie Algebras
7.	MATH 529	The Classical Theory of Fields
8.	MATH 531	Newtonian Fluids Mechanics
9.	MATH 532	Solid Mechanics
10.	MATH 544	Perturbation Methods
11.	MATH 545	Variational Inequalities
12.	MATH 552	Theory of Complex Manifolds
13.	MATH 562	Theory of Several Complex Variables
14.	MATH 563	Banach Algebras
15.	MATH 564	C *-Algebras
16.	MATH 565	Von Neumann Algebras
17.	MATH 566	Spectral Theory in Hilbert Spaces
18.	MATH 572	Numerical Solutions of Partial Differential Equations
19.	MATH 573	Mathematical Modeling and Simulation
20.	MATH 574	Numerical Optimization
21.	MATH 581	Elastodynamics
22.	MATH 582	Heat and Mass Transfer
23.	MATH 583	General Relativity
24.	MATH 584	Electrodynamics
25.	MATH 585	Plasma Theory
26.	MATH 586	Cosmology
27.	MATH 691	MS Dissertation (06 credit hours)

### List of Elective Courses for MS Mathematics from Fall 2016

#### Scheme of Studies for Ph.D Mathematics Programs From Fall 2016

3 Courses	1 <sup>st</sup> Semester	9	3 Courses	2 <sup>nd</sup> Semester	9
MATH 891	<b>3<sup>rd</sup> Semester</b> Ph.D. Thesis	9	MATH 891	<b>4<sup>th</sup> Semester</b> Ph.D. Thesis	9
MATH 891	<b>5<sup>th</sup>Semester</b> Ph.D. Thesis	9	MATH 891	<b>6<sup>th</sup> Semester</b> Ph.D. Thesis	9

#### **Eligibility**:

• 18 years of education in Mathematics with minimum CGPA 3.00/4.00 or 65% marks in annual system. GRE/GAT (Subject) with minimum 60% score.

Details of PHD program are given in Procedure for regulating post graduate studies in Department of Mathematics.

#### List of Core Courses for PhD Mathematics

Sr. No.	Course Code	Course Title
1.	MATH 821	Group Rings
2.	MATH 841	Advanced Perturbation Methods
3.	MATH 861	Advances in Analysis
4.	MATH 881	Advanced Heat Transfer

Note: Out of four courses student will have to study at least two courses from the list of core courses.

Sr. No.	Course Code	Course Title
1.	MATH 721	Near Rings
2.	MATH 722	Advanced Ring Theory-I
3.	MATH 723	Commutative Semigroup Rings
4.	MATH 724	Theory of Semirings
5.	MATH 725	Fuzzy Algebra
6.	MATH 726	Non-Associative Algebra
7.	MATH 727	Rough Set Theory and its Applications
8.	MATH 728	Linear Representations of Finite groups
9.	MATH 731	Advanced Analytical Dynamics-I
10.	MATH 732	Non-Newtonian Fluids
11.	MATH 733	Momentum and Thermal Boundary Layer Theory
12.	MATH 734	Statistical Mechanics
13.	MATH 741	Group Theoretic Methods
14.	MATH 742	Nonlinear Differential Equations
15.	MATH 751	Topological Algebras
16.	MATH 752	Geometry of Surfaces
17.	MATH 761	Fixed Point Theory
18.	MATH 762	Ordered Vector Spaces
19.	MATH 763	Banach Lattices
20.	MATH 764	Approximation Theory
21.	MATH 765	Applied Functional Analysis
22.	MATH 771	Advanced Numerical Analysis
23.	MATH 772	Advanced Optimization Theory
24.	MATH 773	Stochastic Processes
25.	MATH 774	Multivariate Methods and Analysis
26.	MATH 775	Finite Element Analysis
27.	MATH 781	Nonlinear Waves
28.	MATH 782	Magnetohydrodynamics
29.	MATH 783	Advanced Electrodynamics
30.	MATH 784	Advanced Plasma Theory
31.	MATH 785	Convective Heat Transfer: Viscous Fluids
32.	MATH 786	Astrophysics
33.	MATH 787	Advanced Elastodynamics
34.	MATH 788	Advanced Quantum Theory

## List of Elective Courses for MS/PhD Mathematics From Fall 2016

Sr. No.	<b>Course Code</b>	Course Title
1.	MATH 822	Theory of Group Graphs
2.	MATH 823	LA-Semigroups
3.	MATH 824	Advanced Ring Theory-II
4.	MATH 825	Hopf Algebra and Quantum Groups
5.	MATH 826	Algebraic Number Theory
6.	MATH 827	Homological Algebras
7.	MATH 831	Advanced Analytical Dynamics-II
8.	MATH 832	Spectral Methods in Fluid Dynamics
9.	MATH 842	Group Analysis of Partial Differential Equations
10.	MATH 843	Advanced Nonlinear Differential Equations
11.	MATH 851	Advanced Algebraic Geometry
12.	MATH 862	Non-Standard Analysis
13.	MATH 863	Numerical Ranges of Operators on Normal Spaces
14.	MATH 864	Strict Convexity
15.	MATH 871	Modeling and Simulation of Dynamical Systems
16.	MATH 872	Advanced Finite Element Analysis
17.	MATH 873	Advanced Multivariate Methods and Analysis
18.	MATH 882	Advanced Magnetohydrodynamics
19.	MATH 883	Convective Heat Transfer: Porous Media
20.	MATH 884	Robotics
21.	MATH 892	Topics in Algebra
22.	MATH 893	Topics in Mechanics
23.	MATH 894	Topics in Differential Equations
24.	MATH 895	Topics in Topology
25.	MATH 896	Topics in Analysis
26.	MATH 897	Topics in Computational Mathematics
27.	MATH 898	Topics in Applied Mathematics
28.	MATH 891	PhD Thesis (9 credit hours)

## List of Elective Courses for Ph. D. Mathematics From Fall 2016