# 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

## Minutes of the $9^{\text {th }}$ meeting of the Board of Studies of the Department of Mathematics and Statistics

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 <br> Equations with Applications | MATH 241 Elementary Differential Equations |
| 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 | $\mathbf{0}$ |
| Calculus | $\mathbf{1}$ |
| Algebra and Number theory | $\mathbf{2}$ |
| Mechanics | $\mathbf{3}$ |
| Differential Equations | $\mathbf{4}$ |
| Topology and Geometry | $\mathbf{5}$ |
| Analysis | $\mathbf{6}$ |
| Computational Mathematics | $\mathbf{7}$ |
| Physical Applied Math and Combinatorics | $\mathbf{8}$ |
| Topics | $\mathbf{9}$ |

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.

## PART I

## Scheme of Studies

## From Fall, 2016 to Onward

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

|  | $1^{\text {st }}$ Semester |  |  | 2 ${ }^{\text {d }}$ 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 Magnetism | 3 | GC-116 | Understanding of Quran-II | 3 |
| GC-151 | Introduction to the Use of Computer | 3 | BLC-001 | Introduction to Law | 3 |
| MATH 101 | Elements of Set Theory and Logic | 3 | MATH 112 | Calculus-II | 3 |
| MATH 111 | Calculus-I | 3 | MATH 121 | Introduction to Linear Algebra | 3 |
|  |  | 18 |  |  | 18 |
| GC-214 | $3{ }^{\text {rd }}$ Semester |  | ECN-001 | $4^{\text {th }}$ Semester | 3 |
|  | Basics of Academic Writing | 3 |  | Introduction to Economics |  |
| GC-221 | Islamic Studies | 3 | PSY-001 | Psychology | 3 |
| GC-242 | Elementary Statistics | 3 | MATH 222 | Elementary number theory and Combinatorics | 3 3 |
| MATH 213 | Calculus-III | 3 | MATH 241 | Elementary Differential Equations | 3 |
| MATH 231 | Mechanics-I | $\begin{aligned} & 3 \\ & 15 \\ & \hline \end{aligned}$ | MATH-232 | Mechanics-II | 3 <br> 15 |
| GC-231 | $5^{\text {th }}$ Semester |  | CS-291 | $6^{\text {th }}$ Semester |  |
|  | Pakistani Culture \& Society | 3 |  | Discrete Structures | 3 |
| MATH 323 | Linear Algebra | 3 | MATH 324 | Group Theory | 3 |
| MATH 342 | Ordinary Differential Equations | 3 | MATH 333 | Analytical Mechanics | 3 |
| MATH 351 | Set Topology | 3 | MATH 343 | Partial Differential Equations | 3 |
| 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 |
|  | $7^{\text {th }}$ Semester |  |  | $8^{\text {th }}$ 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 M.Sc. Mathematics (2 years) From Fall 2016

|  | $1^{\text {th }}$ Semester |  |  | 2 ${ }^{\text {nd }}$ 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 Equations | 3 | MATH 333 | Analytical Mechanics | 3 |
| MATH 351 | Set Topology | 3 | MATH 343 | Partial Differential Equations | 3 |
| MATH 361 | Real Analysis-I | 3 | MATH 352 | Differential Geometry-I | 3 |
| MATH 362 | Complex Analysis | $\begin{aligned} & 3 \\ & 18 \end{aligned}$ | MATH 363 | Real Analysis-II | $\begin{aligned} & 3 \\ & 18 \end{aligned}$ |
|  | $3{ }^{\text {rd }}$ Semester |  |  | $4^{\text {th }}$ Semester |  |
| GC-116 | Understanding of QuranII | 3 | CS-002 | Software Tools | 3 |
| 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 |

List of Elective Courses BS/M.Sc. Mathematics 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 |
|  |  |  |

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

| $1{ }^{\text {st }}$ Semester |  |  | $2^{\text {nd }}$ Semester |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 4 Courses hours |  | 12 credit | 4 courses hours | $12$ | credit |
| MATH 691 hours | 3 rd Semester <br> MS Dissertation-I | 3 credit | MATH 691 credit hours | $4^{\text {th }}$ Semester <br> 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: Out of eight courses student will have to study at least four courses from the list of core courses.

List of Elective Courses for MS Mathematics from Fall 2016

| Sr. No. | Course Code | 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) |
|  |  |  |

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

| 3 Courses ${ }^{1{ }^{\text {st }} \text { Semester }}$ |  | 9 | $2^{\text {nd }}$ Semester |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 3 Courses |  | 9 |
| MATH 891 | $3^{\text {rd }}$ Semester <br> Ph.D. Thesis |  | 9 | MATH 891 | $4^{\text {th }}$ Semester Ph.D. Thesis | 9 |
| MATH 891 | $5^{\text {th }}$ Semester <br> Ph.D. Thesis | 9 | MATH 891 | $6^{\text {th }}$ Semester 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.

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

| 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 |
|  |  |  |
| 1 |  |  |
| 1. |  |  |

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

| Sr. No. | Course Code | 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) |
|  |  |  |

