St. Xavier's College (Autonomous)
Ahmedabad
M.Sc. (Mathematics)

Subject Title
Semester I

Sr. No.	Paper No.	Subject Name	Hours /week	Credits
1	MA1801	Metric Space	4	4
2	MA1802	Measure and Integration	4	4
3	MA1803	Complex Analysis -I	4	4
4	MA1804	Ordinary Differential Equation	4	4
6	MA1805L	Practical based on papersMA1801 and MA1802	6	4
7	MA1806L	Practical based on papers MA1803 and MA1804	6	4

Subject Title
Semester II

Sr. No.	Paper No.	Subject Name	Hours /week	Credits
1	MA2801	Number Theory	4	4
2	MA2802	Real Analysis	4	4
3	MA2803	Complex Analysis -II	4	4
4	MA2804	Partial Differential Equation	4	4
6	MA2805L	Practical based on papers MA2801 and MA2802	6	4
7	MA2806L	Practical based on papers MA2803 and MA2804	6	4

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St. Xavier's College (Autonomous)
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M.Sc. (Mathematics)

MA1801 – Metric Spaces

Hours: 4/Week **Credits: 4**

Objectives and outcome: The objective of this course is to give a very streamlined development of a course in metric space topology emphasizing only the most useful concepts, concrete spaces and geometric ideas, which are useful in almost all courses of mathematics.

Unit I: Metric and Metric Spaces, Metric from an inner product and a norm, Open balls and Open sets, Equivalent metrics, Interior of a set, Subspace topology. Omit proofs of Cauchy-Schwarz, Young's, Hölder's and Minkowski Inequalities.

Unit II: Convergence of a sequence, Limit and Cluster points, Bolzano Weierstrass Theorem, Cauchy sequences and Completeness, Bounded sets, Dense sets, Basis, Boundary of a set.

Unit III: Continuous functions, Equivalent definition of continuity, Distance between two sets, Urysohn's Lemma for metric space, Gluing Lemma, Topological property, Uniform continuity, Limit of a function, Open and closed maps.

Unit IV: Compact spaces and their properties, Continuous functions on Compact spaces, Characterization of compact metric spaces, Connected spaces, Product of two connected spaces, Path connected spaces.

Text book:

Chapter 1 to 5 from "Topology of Metric Spaces", S. Kumaresan, Narosa Publishing House, 2005.

Reference books:

1. "Introduction to Real Analysis", R. G. Bartle and D. R. Sherbert, (3rd edition), John Wiley & Sons (ASIA), 2000
2. "Principles of Mathematical Analysis", Walter Rudin, (3rd edition), International Student Edition, McGraw-Hill, 1985.
3. "Various Articles on Topology", S. Kumaresan available at http://math.mu.ac.in/mtts/downloads.html/

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St. Xavier's College (Autonomous)
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MA1802- Measure and Integration

Hours: 4/Week **Credits: 4**

Objectives and outcome: The initial objective of the course is to introduce the concept of Lebesgue measure for bounded subsets of $\mathbb{R}$. This concept of Lebesgue measure is later used in developing the theory of (Lebesgue) integration which provides stronger (and better) results as compared to the theory of Riemann integration.

Unit I: The structure of open sets in $\mathbb{R}$, Length of open sets and closed sets, Inner and outer measure of bounded sets, Measurable sets and some of its properties. Further properties of measurable sets, Non-measurable sets, Definition and the properties of Measurable functions.

Unit II: A quick review of the definition of Riemann integral, Lebesgue integral for bounded functions and its comparison with Riemann integral, properties of Lebesgue integral for bounded functions.

Unit III: The Lebesgue integral of non-negative and unbounded functions, its properties, Lebesgue dominated convergence theorem, Fatou's Lemma and its consequences like Monotone convergence theorem and the countable additivity of the Lebesgue integral, A very brief introduction to Lebesgue integral on $(-\infty, \infty)$ and in plane.

Unit-IV: Square integrable functions, the Schwarz and Minkowski's inequality, Completeness of $L^2[a, b]$, Dense sets in $L^2[a, b]$, definition and introduction to Fourier series of integrable functions.

Text book:

The course is based on the book "Methods of Real Analysis" by Richard Goldberg, Oxford & IBH Publishing Company, 1964.
Unit-I Chapter - V (Theorem 5.4 F) Chapter – XI (Section - 11.1 & 11.2) Chapter – XI (Section - 11.3 & 11.4)
Unit-II Chapter – VII (Section - 7.1 & 7.2) Chapter – XI (Section - 11.5 & 11.6)
Unit-III Chapter – XI (Section - 11.7 & 11.8, 11.10A, 11.10B, 11.10C)
Unit-IV Chapter – XI (Section - 11.9) Chapter – XII (Section - 12.1)

Reference books:

1. "Theory of Functions of a real variable" Volume-I by I. P. Natanson, Frederic Ungar Publishing Co., New York 1964.
2. "Real Analysis" by H. L. Royden (3rd edition), Pearson Prentice Hall (2007).
3. "Measure and Integration" by I. K. Rana, Narosa Publishing House (1997).
4. "Measure and Integration", D. De Barra, Wiely Eastern Limited, 1981.
5. "Measure Theory", P. R. Halmos, Van Nostrand Publishers, 1979.
6. "Real and complex Analysis", Walter Rudin, Tata-Mc Graw-Hill Publishing Co. Ltd.,1987.
7. "Lebesgue Integration", J. H. Williamson, Holt, Rienhart and Winston Inc., 1962.
8. "Measure and Integration", Stein and Shakarchi, Princeton Lectures in Analysis, Princeton University Press.
9. "Mathematical Analysis an Introduction", Andrew Browder, Springer Undergraduate Texts in Mathematics, 1999.
10. "Introduction to measure theory", De Barra G. Van Nostrand Reinhold Co., 1974

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St. Xavier's College (Autonomous)
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MA1803-Complex Analysis – I

Hours: 4/Week **Credits: 4**

Objectives and outcome: The main aim is to make students familiar with complex numbers, their properties and the study of functions of a complex variable. It is expected that on successful completion of this course the students will be able to handle complex numbers and complex valued functions of complex variables with Mathematical Maturity.

Unit I: Basic Definitions and notations, Algebraic properties, Polar coordinates and Euler's formula, Products and Quotients in exponential form. Roots of complex Numbers. Continuous complex functions, Limits Involving Point at Infinity.

Unit II: Differentiable complex functions, Cauchy Riemann equations. Harmonic functions of two variables, Reflection principle.

Unit III: Elementary functions, Contours, Contour integrals, Anti-derivatives.

Unit IV: Cauchy-Goursat theorem, Simply connected domain, Multiply connected domains, Cauchy's integral formula and its Extension, Liouville's theorem, Fundamental theorem of Algebra, Maximum moduli principle of functions.

Text book: The course is roughly covered by "Complex variables and Applications" (8^{th} edition) J. W. Brown and R. V. Churchill, McGraw Hills. International Edition 2009. ISBN: 978-007-126328-3. OR MHID: 007-126328-4.

Reference books:

1. "Introduction to Functions of Complex Variable", C. J. Hamilton, Marcel Dekker Inc. New York.
2. "Complex Analysis", I. Stewart and David Tall, Cambridge University Press.
3. "Complex Analysis", J. C. Duncan, John Wiley & Sons, London.
4. "Complex Analysis", Lars Ahlfors, McGraw Hills. Indian Edition.
5. "Functions of One Complex Variable", John B. Conway, Narosa Publishing house, 2002.
6. "Foundations of Complex Analysis", S. Ponnusamy, Narosa Publishing house, 2005.
7. "Complex Variables (Theory and applications)", H. S. Kasana, Prentice-Hall of India Pvt. Ltd., 2006.
8. "Compex Analysis for Mathematics and Engineering", John H. Mathews and Russel Howell, Narosa Publishing house.
9. "Theory & problems of CompLex Analysis", Murray R. Spiegel, McGraw-Hill Co. (Metric Editions)
10. "Complex Analysis", Serge Lang, (Third Edition), Springer
11. "Principles of Mathematical Analysis", Walter Rudin, McGraw-Hill, India.
12. "The Elements of Complex Analysis", (Second Edition), Choudhary, B.,Wiley Eastern Ltd., New Delhi, 1992
13. "An introduction to complex analysis", A. R. Shastri, Macmillan.
14. "Theory of complex functions", R. Remmert,Springer.

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St. Xavier's College (Autonomous)
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MA1804 - Ordinary Differential Equations

Hours: 4/Week **Credits: 4**

Objectives and outcome: The objective of this course is to continue the study of ordinary differential equations begun in B.Sc., with an emphasis on second degree equations which occur in applications.

Unit I: Review of second order linear equations. Series solutions of first order equations, Second order linear equations, ordinary points.

Unit II: Second order linear equations: regular singular points, Gauss's hypergeometric equation, the point at infinity.

Unit-III: Hermite polynomials, Chebyshev polynomials and the minimax property. Legendre polynomials, properties of Legendre polynomials.

Unit-IV: Bessel functions, properties of Bessel functions; Bessel's integral formula. Existence and uniqueness of solutions: the method of successive approximations, Picard's theorem, systems of equations.

Text book:

"Differential Equations with Applications and Historical Notes" (2nd Edition), G. F. Simmons, Tata McGraw-Hill Publishing Co. Ltd., 2008.
Chapter 5 (Omit Appendices C and E),
Chapter 8 (Omit Appendices A and B),
Chapter 13.

Reference books:

1. "Introduction to Ordinary Differential Equations", A. L. Rabenstein, Academic Press.
2. "Advanced Engineering Mathematics" (8th Edition) Erwin Kreyszig, Wiley-India, 2008.
3. "An Introduction to Ordinary Differential Equations", E. A. Coddington, Prentice Hall of India, 2001.
4. "Text Book of Ordinary Differential Equations", S. G. Deo, V. Lakshmikantham and V. Raghavendra, Tata McGraw Hill Book Co., 1997.
5. "Differential Equations", S. L. Ross, John Wiley & Sons, 2004.
6. "Ordinary differential equations", Birkhoff G and Rota G.C.,Boston, 1962
7. "An introduction to Differential Equations", Saber N. Elaydi, Springer verlag, Second edition, 1995
8. "Ordinary Differential Equations", V.I. Arnold ,Prentice-Hall of India, New Delhi, 1998
9. "Ordinary Differential Equation?, Walter.
10. "Theory of ordinary differential Equations", E.A. Codington, N. Levinson, Tata McGraw-Hill, India.
11. "Lectures on ordinary differential equations", Hurewicz W., M.I.T. Press
12. "I. N., Elements of Partial Differential Equations", Sneddon, McGraw-Hill Publ. Co., 1957.
13. "Introduction to Ordinary Differential Equations", Rabenstein, A. L., Academic Press.
14. "Ordinary Differential Equations: A First Course", Somasundaram, D.,Narosa Publ. House, New Delhi, 2002.

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St. Xavier's College (Autonomous)
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MA1805L (Practicals based on MA1801 and MA1802)

Hours: 6/Week **Credits: 4**

Objectives and outcome: The objective here is to acquaint students to develop and consolidate their problem solving skills with the problems related to the notions that they have familiarize themselves in Metric Space and Measure and Integration courses. It is expected that on successful completion of this course the students will be able to handle problems related to the topics mentioned in the title with enhanced Mathematical Maturity.

Problems based on following topic (but not limited to) should be cover

Unit I:

1. Matric space including inner product and norm.
2. Open & closed sets, Interior of a set, closure of set, cluster points, Boundary of set.
3. Complete, bounded and dense set.
4. Convergence, divergent and Cauchy Sequence.

Unit II:

5. Continuous functions & Uniform continuity
6. Compact space & their properties
7. Connected space & their Properties
8. Open, closed map and fixed point theorem on continuous function.

Unit III:

9. Inner and outer measure of bounded sets.
10. Measurable sets and some of its properties.
11. Properties of measurable sets, Non-measurable sets.
12. Measurable functions.

Unit IV:

13. Riemann integral and Lebesgue integral for bounded functions.
14. Properties of Lebesgue integral for bounded functions.
15. The Lebesgue integral of non-negative and unbounded functions, its properties, Lebesgue dominated convergence theorem.
16. Fatou's Lemma and its consequences like Monotone convergence theorem and the countable additivity of the Lebesgue integral.

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St. Xavier's College (Autonomous)
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MA1806L (Practicals based on MA1803 and MA1804)

Hours: 6/Week **Credits: 4**

Objectives and outcome: The objective here is to acquaint students to develop and consolidate their problem solving skills with the problems related to the notions that they have familiarize themselves in Complex Analysis-I and Ordinary Differential Equation courses. It is expected that on successful completion of this course the students will be able to handle problems related to the topics mentioned in the title with enhanced Mathematical Maturity.

Problems based on following topic (but not limited to) should be cover

Unit I:

1. Problems based on Finding Argument, Sketching the sets, Finding roots and sketching them. Also problems on finding limit involving infinity.
2. Problems based on C-R equations and the sufficient condition for differentiability. Also in Polar Form.
3. Rough sketches of images of Horizontal and Vertical lines under the exponential map e^z. Examples on Finding Harmonic Conjugate. Examples on Reflection Principle.
4. Examples based on $e^z, Log\ z, z^c$.

Unit II:

5. Problems based on trigonometric, Hyperbolic functions and their inverses.
6. Examples on Contour Integrals and their upper bound. Examples based on deformation of paths.
7. Examples based on Cauchy Integral Formula and its Extension.
8. Examples based on Maximum Modulus Principle. And Miscellaneous Problems.

Unit III:

9. First order linear equation, Second order linear homogeneous equation with constant coefficient, The use of a known solution to find another solution
10. Second order linear nonhomogeneous equation (Method of undetermined coefficients and Method of variation of parameters)
11. Second order linear equation by Power series method and Frobenius method-I.
12. Second order linear equation by Power series method and Frobenius method-II

Unit IV:

13. Hermite polynomials, Chebyshev polynomials and Legendre polynomials
14. Bessel functions-I
15. Bessel functions-II
16. The Picard's method of successive approximations.

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St. Xavier's College (Autonomous)
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M.Sc. (Mathematics)

MA2801-Number Theory

Hours: 4/Week **Credits: 4**

Objectives and outcome: The objective of this course is to continue the study of Number Theory begun in B.Sc., with an emphasis with the properties of positive integers. On this line, we cover some special structures (of numbers) such as: Euclidean domains, unique factorization domains.

Unit I: (Divisibility): Foundations, Division algorithm, greatest common divisor, Euclid's algorithm, Fundamental Theorem, Properties of primes.

Unit II: (Arithmetical Functions): The function $[x]$, multiplicative functions, Euler's (totient) function $\phi(n)$, The Mobius function $\mu(n)$, The functions $\tau(n)$ and $\sigma(n)$, Brief introduction of convolution of arithmetical functions, perfect numbers.

Unit III: (Congruences): Definitions, Chinese-Remainder theorem, Theorems of Fermat and Euler, Wilson's theorem, Lagrange's theorem,

Unit IV: (Miscellaneous Topics): Finite, infinite continued Fractions, linear Diophantine equations $ax + by = c$, Pell's equations, Pythagorean triples, brief introduction of Fermat's last theorem. The order of an integer modulo n, Primitive roots, indices. Legendre Symbol and its properties, Quadratic Reciprocity Law

Text book: "A Concise introduction to the Theory of Numbers", Alan Baker (Cambridge Uni. Press, Cambridge).

Reference books:

1. "An introduction to the Theory of Numbers (5th edition) by Ivan Nivan, H. S. Zuckerman, H.L.Montgomery (John Wiley & Sons Inc.)
2. "Elementary Number theory" (Sixth edition) by David M. Burton, Tata McGraw-Hill Publishing Co. Ltd., New Delhi
3. "Number Theory", S. G. Telang, Tata Mc Graw Hill, 1996.
4. "Elementary Theory of Numbers", C. Y. Hsiung, Allied Publishers Ltd.-India.
5. "Number Theoryz", George E. Andrews, Hindustan Publishing Corporation- Delhi.
6. "Elementary Number Theory", Gareth A. Jones & J. Mary Jones, Springer Verlag.
7. "Number Theory", J. Hunter, Oliver and Boyd-London.
8. "Beginning Number Theory", Neville Robbins, Narosa Pub. House -New Delhi.
9. "Introduction to the theory of Numbers", G. H. Hardy & E. M. Wright, Oxford Uni. Press
10. "Higher Algebra", S. Barnard & J. M. Child, Macmillan India Ltd
11. "Elements of Number Theory", I. M. Vinogradov, Dover Pub INC
12. "Elementary Number Theory in Nine chapters", James J. Tattersall, Cambridge Uni Press
13. "A first course in Theory of Numbers", K. C. Chowdhary, Asian Books Pvt Ltd New Delhi
14. "1001 problems in Classical Number Theory", Jean Marie De Konick Armed Mercier, AMS
15. "An Excursion in Mathematics", M. R. Modak, S. A. Katre, V. V. Acharya and V. M. Sholapurkar, Bhaskaracharya Pratishthana, Pune.

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St. Xavier's College (Autonomous)
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MA2802-Real Analysis

Hours: 4/Week **Credits: 4**

Objectives and Outcome: The main objective of the course is to study the differential properties of functions of finite variation and absolutely continuous functions and characterize the absolutely continuous functions in terms of the indefinite integral of Lebesgue integrable functions.
A part of the course is also devoted to the study of the structure of measurable functions and study of Fourier series and Fourier functions.

Unit I: Convergence in measure and the related important results, Approximations of measurable functions by bounded measurable functions and continuous functions, Weierstrass approximation theorems

Unit II: Square-summable functions, Schwarz and Minkowski's inequality, Completeness of $L^2[a,b]$, Dense subsets of $L^2[a,b]$, $L^p[a,b]$ as a generalization of $L^2[a,b]$, a quick introduction of sequence spaces l_2 and l_p.

Unit III: Monotonic function and its differentiability (assuming Vitali's covering theorem), functions of finite (bounded) variation on $[a,b]$ and its properties, Absolutely continuous functions on $[a,b]$, differential properties of absolutely continuous function.

Unit IV: The indefinite Lebesgue integral and the fundamental theorem of calculus, Definition of Fourier series and convergence problem, $(C,1)$ summability of Fourier series, the L^2 theory of Fourier series, Convergence of Fourier series.

The course is based on the following books:

1. "Theory of Functions of a real variable" Volume-I by I. P. Natanson, Frederic Ungar Publishing Co., New York 1964.
2. "Methods of Real Analysis" by Richard Goldberg, Oxford & IBH Publishing Company, 1964.

Reference books:

1. "Real Analysis" by H. L. Royden (3rd edition), Pearson Prentice Hall (2007).
2. "Measure and Integration" by I. K. Rana, Narosa Publishing House (1997).
3. "Trignomatric Series", - A. Zygmund, Cambridge University Press (1968).
4. "Fourier Series", a modern introduction Vol.1, - R. E. Edwards (Springer)
5. "Measure and Integration", G. D. De Barra, Wiely Eastern Limited, 1981.
6. "Measure Theory", P. R. Halmos, Van Nostrand Publishers,1979.
7. "Real and complex Analysis", Walter Rudin, Tata-Mc Graw-Hill Publishing Co. Ltd., 1987.
8. "Lebesgue Integration", J. H. Williamson, Holt, Rienhart and Winston Inc., 1962.

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St. Xavier's College (Autonomous)
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MA2803-Complex Analysis-II

Hours: 4/Week **Credits: 4**

Objectives and outcome: The main aim is to make students familiar with Contour Integrals and Residue Theory for finding Contour Integrals. It is expected that on successful completion of this course the students will be able to handle Contour Integrals and its divergent applications with Mathematical Maturity.

Unit I: Convergence of Taylor series, Laurent series and Uniqueness, Convergence of sequences and series, Uniform and absolute convergence of power series, Multiplication and Division of Power Series.

Unit II: Residue, Cauchy's Residue theorem, Residue at Infinity, Types of isolated singular points, Residues at poles, Zeros and poles of order m, Behavior of near removable and essential singular points.

Unit III: Evaluation of improper integrals from Fourier Analysis using Residues, Jordan's Lemma. Indented Paths, Indentation around a Branch cut, Integration along a Branch Cut, Definite integrals involving Sines and Cosines using Residues.

Unit IV: Argument Principle, Rouché's Theorem and Möbius Transformations (Bi-linear transformation).

Text book: The course is roughly covered by "Complex variables and Applications" (8^{th} edition) J. W. Brown and R. V. Churchill, McGraw Hills. International Edition 2009. ISBN: 978-007-126328-3. OR MHID: 007-126328-4.

Reference books:

1. "Introduction to Functions of Complex Variable", C. J. Hamilton, Marcel Dekker Inc. New York.
2. "Complex Analysis", I. Stewart and David Tall, Cambridge University Press.
3. "Complex Analysis", J. C. Duncan, John Wiley & Sons, London.
4. "Complex Analysis", Lars Ahlfors, McGraw Hills. Indian Edition.
5. "Functions of One Complex Variable", John B. Conway, Narosa Publishing house, 2002.
6. "Foundations of Complex Analysis", S. Ponnusamy, Narosa Publishing house, 2005.
7. "Complex Variables (Theory and applications)", H. S. Kasana, Prentice-Hall of India Pvt. Ltd., 2006.
8. "Complex Analysis", S. Lang, Springer Paperback, 2005.
9. "Complex Analysis", Stein and Shakarchi, Princeton Lectures in Analysis, Princeton University Press, 2003.

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St. Xavier's College (Autonomous)
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MA2804-Partial Differential Equation

Hours: 4/Week **Credits: 4**

Objectives and outcome: The objective of this course is to introduce partial differential equations, particularly the second order equations of mathematical physics.

Unit I: Review of curves and surfaces; genesis of first order PDE; classification of integrals; linear equations of the first order; Pfaffian differential equations; compatible systems of first order PDE, Charpit's method.

Unit II: Jacobi's method; integral surfaces through a given curve; quasi-linear equations (characteristic curves and the initial value problem), Non-linear first order PDE (characteristic curves and the initial value problem).

Unit III: Genesis of second order PDE; classification of second order PDE. Introduction to the initial and boundary value problems, One dimensional wave equation: vibrations of an infinite string;, vibrations of a semi-infinite string, Vibration of a string of finite-length, Heat conduction problem, infinite rod, finite rod.

Unit IV: Riemann's method, Laplace's equation: boundary value problems; maximum and minimum principles; the Dirichlet problem for a circle, for the upper half plane, for a rectangle, Neumann's problem for the upper half plane and for a circle, Harnack's theorem; Green's function, Families of equipotential surfaces.

Text book:

"An Elementary Course in Partial Differential Equations" (2nd Edition), - T. Amaranath, Narosa Publishing House Pvt. Ltd., 2005.

Reference books:

1. "Elements of Partial Differential Equations", - I. Sneddon, McGraw-Hill Kogakusha Ltd.
2. "Methods of Mathematical Physics" Vol.2, - R. Courant and D. Hilbert, Wiley Eastern Pvt. Ltd., 1975.
3. "Fourier Series and Boundary Value Problems", R. V. Churchill, McGraw Hill Book Co., 1963.
4. "Partial differential equations An Introduction", Strauss W. A, Wiley, John and sons 1992.
5. "An introduction to PDE's", Renardy and Rogers, Springer-Verlag, 1999.
6. "Waves and reaction-diffusion equations", second edition, Smoller: Shock,1994.
7. "Partial Differential equations", Kevorkian, Wadsworth and Brooks/ cole
8. "Partial differential equations", F.John, Springer.
9. "Partial differential equations", Evans L.C., AMS, 1998.
10. "Lectures on partial differential equations", B. Folland, Tata institute of Fundamental
11. Research, Bombay, 1983. "Introduction to partial differential equations", B.Folland.
12. "Analytical and Numerical Methods for Partial differential equations", M.Junk.
13. "Elliptic Partial differential equations of second order", D.Gilbarg and N.S. Trudinger.
14. "Partial Differential Equations", Phoolan Prasad and Ravindran, R., Wiley Eastern.
15. "Partial Differential equations", R. C. McOwen, Pearson Education, 2004.

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MA2805L – (Practicals based on MA2801 and MA2802)

Hours: 6/Week **Credits: 4**

Objectives and outcome: The objective here is to acquaint students to develop and consolidate their problem solving skills with the problems related to the notions that they have familiarize themselves in Number Theory and Real Analysis courses. It is expected that on successful completion of this course the students will be able to handle problems related to the topics mentioned in the title with enhanced Mathematical Maturity.

Unit I:

1. Problems based on Division algorithm, greatest common divisor and Euclid's algorithm.
2. Problems based on Fundamental Theorem and Properties of primes.
3. Problems based on $[x]$ function, $\phi(n), \tau(n)$ and $\sigma(n)$.
4. Problems based on the Mobius function $\mu(n)$, convolution of arithmetical functions, perfect numbers.

Unit II:

5. Problems based on Congruence, Chinese-Remainder theorem, Fermat theorem and Euler theorem.
6. Problems based on Wilson's theorem and Lagrange's theorem,
7. Problem based on continued Fractions, linear Diophantine equations $ax + by = c$, Pell's equations, Pythagorean triples.
8. Problem based on the order of an integer modulo, Primitive roots, indices. Legendre Symbol and its properties and Quadratic Reciprocity Law.

Unit III:

9. Problem based on Outer and Inner measure, measurable sets and measurable functions.
10. Problem based on Sequences of measurable functions.
11. Problem based on Square-summable and p-summable functions.
12. Problem based on Holder's and Minkowski's inequality for functions and numbers.

Unit IV:

13. Problem based on Derived numbers and derivatives.
14. Problem based on Increasing functions and functions of finite variation.
15. Problem based on Cantor set and Cantor function.
16. Problem based on Fourier series.

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St. Xavier's College (Autonomous)
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MA2806L – (Practicals based on MA2803 and MA2804)

Hours: 6/Week **Credits: 4**

Objectives and outcome: The objective here is to acquaint students to develop and consolidate their problem solving skills with the problems related to the notions that they have familiarize themselves in Complex Analysis-II and Partial Differential Equation courses. It is expected that on successful completion of this course the students will be able to handle problems related to the topics mentioned in the title with enhanced Mathematical Maturity.

Unit I:

1. Examples based on finding Laurent series, Taylor series. Division of Power Series.
2. Examples based on finding Residues; three types of isolated singular points. Examples based on Cauchy's Residue theorem.
3. Examples based on Residues at Infinity and its application (i.e. Theorem on Page 238 of the Textbook).
4. Examples on finding residues at poles i.e. based on φ Method. Examples based on zeroes, poles and special method for finding Residues at a simple Pole (i.e. based on Theorem 2 on page 253).

Unit II:

5. Practical based on finding improper integrals using Residue Theory.
6. Practical based on finding integrals from Fourier Analysis and based on Indented Path Technique.
7. Practical based on finding definite integrals involving SINES and COSINES using residue theory.
8. Practical based on, Rouché's Theorem and Möbius Transformations (Bi-linear transformation). Miscellaneous Problems.

Unit III:

9. Langrage's equation and Pfaffian Differential Equations.
10. Charpit's Method and Jacobi's Method.
11. Integrals surfaces through a given circle.
12. Cauchy problem for Quasi Linear Equation and Non-Linear First order PDE.

Unit IV:

13. Method of Separation of Variables.
14. Various Initial and Boundary value problems for the Wave equation.
15. Various Initial and Boundary value problems for the Heat equation.
16. Various Initial and Boundary value problems for the Laplace equation.

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(Tentative) Subject Title
Semester III

Sr. No.	Paper No.	Subject Name	Hours/ week	Credits
1	MA3801	Abstract Algebra-I	4	4
2	MA3802	Functional Analysis	4	4
3	MA3803	Graph Theory	4	4
4	MA3804E1	Mathematical Methods	4	4
	MA3804E2	Algorithms		
	MA3804E3	Discrete Mathematics		
	MA3804E4			
5	MA3805L	Practical based on papers MA3801 and MA3802	6	4
6	MA3806L	Practical based on papers MA3803 and MA3804	6	4

(Tentative) Subject Title
Semester IV

Sr. No.	Paper No.	Subject Name	Hours /week	Credits
1	MA4801	Abstract Algebra-II	4	4
2	MA4802	Advanced Linear Algebra	4	4
3	MA4803	Operations Research	4	4
4	MA4804E1	Combinatorics	4	4
	MA4804E2	Fourier Series		
	MA4804E3	Mathematics Education		
	MA4804E4			
5	MA4805L	Practical based on papers MA4801 and MA4802	6	4
6	MA4806L	Practical based on papers MA4803 and MA4804	6	4

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