M. Phil. Syllabus (w.e.f 2008-2009)

Course	CA	ESE
Semester - I		
Algebra and Algebraic Number Theory	50	50
Analysis and Geometry	50	50
Theory of Computation and Graph Theory	50	50
Semester - II		
Dissertation work	50	50

Paper I: Algebra and Algebraic Number Theory

Unit I:

Rings and Ideals: Modules, Rings and Modules of fractions
Chapters: 1, 2 (algebras not included), and 3.

Unit II:

Primary Decomposition: Chain conditions, Notherian rings, Artin rings.
Chapters: 4, 6, 7 (7.7 – 7.10 not included) and 8

Content and treatment as in **'Introduction to Commutative Algebra'** by M.F. Atiyah, I.G. Macdonald, Addison – Wesley, 1964.

Unit III:

Algebraic Numbers, Quadratic and Cyclotomic fields.
Chapters: 2 and 3

Unit IV

Factorization into irreducibles, Ideals
Chapters: 4, 5

Content and treatment as in **'Algebraic Number Theory'** by Ian Stewart and David Tall, Addison – Wesley Publishing Company, 1964.

Books for Reference:

1. **Commutative Algebra I and II** by Zariski – Samuel, Van Nostrand, Princeton, 1960.
2. **Ideal Theory**, D.G. Northcott, Cambridge University Press, 1953.
3. **Algebraic Number Theory,** P. Samuel, Hermann Paris, 1967.
4. **Algebraic Number Theory**, S. Lang, Addison – Wesley, 1970.

Paper – II: Analysis and Geometry

Unit I:

Fourier Transforms: Formal Properties, The inversion theorem, The Plancherel theorem, The Banach algebra L^1.

Holomorphic Fourier Transforms**:** Introduction – Two theorems of Paley and Wiewer – Quasi – analytic classes – The Deujoy – Carleman theorem
Chapters: 9 and 19

Unit II

Conformal Mapping: Preservation of angles, linear fractional transformations, Normal families, The Riemann mapping theorem, The class ζ continuity at the boundary, conformal mapping of an annulus.

H^p Spaces: Sub harmonic functions – The spaces H^p and N – The theorem of F and M. Riesz – Factorization theorems – The Shift Operator – Conjugate functions – Exercises.
Chapters: 14 and 17.

Content and treatment as in **'Real and Complex Analysis'** by Walter Rudin, Third edition, McGraw-Hill Publications

Unit III

Differential forms in R^n, Line integrals.
Chapters: 1 and 2.

Unit IV

Differentiable manifolds, Integration on manifold – Stoke's theorem and Poincares Lemma.
Chapters: 3 and 4.

Content and treatment as in **'Differential Forms and Applications'** by Manfredo P. do Carmo, Springer – Verlag, 1994.

Books for reference:

1. **Theory of H^p – Spaces**, P.L.Duren, Academic Press, NewYork, 1970.
2. **Real and Abstract Analysis**, E.Hewitt and K.Stromberg, Springer – Verlag Volume II, 1965.
3. **An Introduction to Harmonic Analysis**, Y.Katznelson, John Wiley and sons, New York, 1968.
4. **Lecture Notes on Elementary Topology and Geometry**, I.M.Singer and J.A.Thorpe, Springer – Verlag, 1967.

Paper – III: Theory of computation and Graph Theory

Unit I

Introduction to Turing Machines: The Turing machine – Notation – Instantaneous description – Transition diagram – Language and Halting
Chapter 8: Sec. 8.1, 8.2

Undecidability: Language that is not recursively enumerable – An undecidable problem that is RE – Undecidable problems about Turing machines – Post's correspondence problem.
Chapter 9: Sec. 91 – 9.4

Unit II

Intractable problems: The class of P and NP – An NP-Complete problem – A restricted satisfiability problem – Additional NP-Complete problems.
Chapter 10: Sec. 10.1 – 10.5

Content and Treatment as in **Introduction to Automata Theory**, **Languages and Computation,** Second Edition, John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson Education Asia, 2001.

Unit III

Connectivity: 2-connected graphs and sub graphs – The structure of 3-connected graphs.
Chapter 3: Sec. 3.1 – 3.2

Planar graphs: Topological prerequisites – plane graphs – Drawings – Planar graphs – Kuratowski's theorem.
Chapter 4: Sec. 4.1 – 4.5
Colouring: Colouring maps and planar graphs – colouring vertices – colouring edges – List colouring – Perfect graphs.
Chapter 5: Sec. 5.1 – 5.5

Unit IV

Ramsey theory for graphs: Ramsey's original theorems – Ramsey properties and connectivity.
Chapter 9: sec. 9.1 – 9.2, 9.4

Hamilton cycles: Simple sufficient conditions – Hamilton cycles and degree sequences – Hamilton cycles in the square of a graph.
Chapter 10: Sec 10.1 – 10.3

Content and treatment as in '**Graph Theory'**, Second edition, Reinhard Diestal, Springer, 2000.

Books for reference:

1. **Elements of the Theory of Computation,** Second edition, H.R. Lewis and C.H. Papadimitriou, Pearson Education, PHI, 2003.
2. **Introduction to Languages and Theory of Computation**, Third edition, J. Martin, Tata-McGraw Hill, 2003.
3. **Introduction to Theory of Computation,** Michael Sipser, Tomson Brokecole, 1997.
4. **Graph Theory**, Frank Harary, Addison-Wesley, Reading, 1969.
5. **Graph Theory with Applications**, J.A. Bondy and U.S.R. Murty, North Holland, 1976.