DEPARTMENT OF MATHEMATICS

SAURASHTRA UNIVERSITY
RAJKOT

SYLLABUS
M.Phil (Mathematics)
(Choice Based Credit System)
WITH EFFECT FROM JUNE-2018

Revised as per University Grant Commission (UGC) New Delhi, Notification 5th May, 2016, (Minimum Standards and Procedure for award of M.Phil. / Ph.D. Degrees) Regulations – 2016

(Reaccredited "A" Grade by NAAC)
(CGPA 3.05)

Scheme of instruction and examination for students admitted from A. Y. 2018-19 and onwards.

Objectives of the Program:

The curriculum is designed according to guidelines of University Grant Commission (UGC) and National Accreditation and Assessment Council (NAAC) to achieve quality and excellence in higher education to accomplish the following objectives.

Students under M.Phil. Mathematics program should have acquired the following knowledge and skills:

1. Research Skills

a) The habit to read mathematical texts independently.
b) Comprehension of the general framework of mathematical research; an understanding of the role of axioms, assumptions, theorems, proofs, and conjectures.

2. Computational skills

a) Proficiency in basic computational methods including pure and applied branches of mathematics.
b) Proficiency in computer-aided computations.

3. Analytical skills

a) An understanding of the basic rules of logic and proficiency in using them.
b) The ability to give counter examples to prove or disprove the derived/ existing results.
c) The ability to distinguish a coherent argument from a fallacious one.
d) The ability to derive general principles from examples.
e) The ability to formulate mathematical conjectures and to test them.
f) The ability to give complete mathematical proofs based on logic and mathematical concepts.

Regulations, Teaching and Examination Scheme for M.Phil Mathematics:

1. The candidate with M.Sc(Mathematics)with at least 55% marks or an equivalent grade'B' on UGC seven point scale (50% of marks or an equivalent grade for SC/ST/OBC(non-creamy layer)/Differently abled) will be eligible for admission as per (UGC Regulations,2016 dated 05-05-2016 and corresponding ordinance of Saurashtra University of dated 25-01-2017).
2. The duration of M.Phil(Mathematics) program will be of one full time academic year divided in two consecutive semesters. The student will cannot join any other course or service during this period.
3. The student will be examined at the end of each semester by an examination called semester end examination (SEE).
4. A candidate whose term is not granted for any reason will not be allowed to appear in SEE.
5. Medium of instruction will be English.
6. **Standard of Passing**
   The standard of passing the M.Phil Program SEE will be as mentioned below:
   a. The minimum standard of passing in semester end examination (SEE) of each course and dissertation will be 50%.
   b. Class will be awarded on the basis of Earned Grade Point, SGPA and CGPA as per regulations of Saurashtra University.
   c. The dissertation will be evaluated by an external examiner recommended by honorable vice-chancellor from the panel of examiners. The same external examiner will examine the student through viva-voce examination.
7. **Marks and credits of each course**
   Marks of university examination and credit hours will be as under:
   a. The total marks for each semester will be 300.
   b. The total marks for M.Phil.(Mathematics) program will be 600.
   c. Total credits of each semester will be 12.
   d. Total credits for M.Phil. program will be 24.
   e. Each of the courses 18CMT-10001, 18CMT-10002, 18CMT-10003, 18CMT-20001 will be of 4 credits and of 100 marks.
   f. The dissertation will be of 100 marks and student will earn 4 credits.
   g. The weightage for viva-voce examination will be 100 marks and student will earn 4 credits.
   h. The total marks for dissertation will be 200 and student will earn 8 credits.

Course work:

1. The M.Phil. course work credit shall be 08 which will be distributed as follows:

Total credit for the course work: 08

a)	A course covering research methodology, computer applications, research ethics, writing research paper and research proposal.	04 Credit	Assignment of Marks 100
b)	1. To prepare a review and presentation on published research work in the relevant field. 2. Prepare a review on two books in the relevant field.	04 Credit	Assignment of Marks 100

2. The students will submit assignment in each of the above components in the form of detailed report. A student is required to score **minimum 55% of marks i.e. minimum 110 marks out of total marks 200** for the completion of course work. The assignments will be assessed by the supervisor assigned for the dissertation.
3. The mode of training shall include expert lectures/laboratory work and training/review of published research in the relevant field/preparation of assignments and counseling in consultation with the dissertation supervisors.
4. The students shall take the course work during two semesters M.Phil. program Upon successful completion of the course work, the students shall be eligible to submit the dissertation.

Objectives of course work:

Upon completion of the course students will be able to

1. Review the literature in the relevant field.
2. Develop the skill of research methodology.
3. Develop the skill of analysis of mathematical research problems.
4. Develop the skill of writing and review the research paper.

The syllabus for the course work will cover the following aspects:

Unit: 1: Research Methodology

- Fundamental Principles of counting
- Fundamentals of logic
- Set theory
- Properties of integers
- Mathematical induction
- Basic concepts of graph theory / algebra.

Unit: 2: Computer applications

- Introduction to MS Office (MS Word, MS Excel, MS Power Point)
- Introduction to Latex
- Document class, fonts and styles in Latex
- Document structure

Unit: 3: Review of literature

Student has to review

- Titles of related research field
- Journals
- Web resources

Unit: 4: Review of a research paper

- Student will prepare a brief review on two research papers.

References:

1. J. Clark and D. A. Holton, First Look at Graph Theory, Allied Publishers Limited.
2. R. P. Grimaldi, Discrete and Combinatorial Mathematics, Pearson Education Pvt. Ltd.
3. J. Gross and J. Yellen, Graph Theory and its Application, CRC press.
4. F. Harary, Graph Theory, Addison-Wesley, Massachusetts.
5. D. B. West, Introduction to Graph Theory, Prentice-Hall of India Pvt. Ltd.
6. Topics in Algebra by I. N. Herstein, Second Edition, Wiley Pub. , New York, 1975.
7. Algebra by M. Artin, Prentice-Hall of India Private Ltd., New Delhi, 1994.
8. Basic Abstract Algebra by P. B. Bhattacharya, S. K. Jain and S. R. Nagpaul, Second Edition, Cambridge University Press, 1995.
9. G. Gratzer, Math into Latex, An introduction to LATEX and AMS-LATEX, BIRKHAUSER.

Department of Mathematics

Course Structure and Scheme of Examination
For Choice based Credit System (CBCS)

Semester 1

Subject Code	Title of the Course	Course Credits	No. of Hrs. Per Week	Weightage For Semester End Examination	Duration Of SEE in hrs.
18CMT – 10001	Advanced Topics in Algebra	4	4	100	2.5
18CMT – 10002	Combinatorics and Graph Theory	4	4	100	2.5
18CMT - 10003	Seminar and Problem Session	4	4	100	-
Total		**12**	**12**	**300**	

Semester 2

Subject Code	Title of the Course	Course Credits	No. of Hrs. Per Week	Weightage For Semester End Examination	Duration Of SEE in hrs
18CMT – 20001	Some Topics in Algebraic Topology	4	4	100	2.5
18DMT – 20002	Dissertation	8 (4 for dissertation+4 for Viva-Voce)	8	200 (100 Marks for Dissertation and 100 Marks for Viva-Voce)	-
Total		**12**	**12**	**300**	

Semester – I			
18CMT-10001	**Advanced Topics in Algebra**	**4hrs/wk**	**4 Credits**

Objectives:

Upon completion of the course students will be able to

1. Understand basic principles of algebraic structures like groups, fields rings and division rings.
2. Recognize and understand the concept of Ideals.
3. Recognize and understand the concepts of Euclidean domains, Unique factorization domains, polynomial rings as well as Einstein irreducibility criterion.

Unit 1

Ideals, Prime ideals, Maximal ideals, Operations on ideals, Extension and contraction, Modules, Chain conditions, Noetherian modules, and Artinian modules.

Unit 2

Rings and Modules of fractions, Local properties , Fractions and prime ideals, Primary decomposition, First Uniqueness theorem, and Second Uniqueness theorem.

Unit 3

Integral dependence, The going-up theorem, The going-down theorem and Valuation rings.

Unit 4

Discrete valuation rings, Dedekind domains, and Fractional Ideals.

This course is covered by the relevant portions from the book 'Introduction to Commutative Algebra' by M. F. Atiyah and I. G. Macdonald, Addison-Wesley Publishing Company, 1969.

Reference Books:

1. Commutative Algebra by N. Bourbaki, Springer-Verlag, New York, 1985.
2. Commutative Algebra with a view toward Algebraic Geometry by D. Eisenbud, Springer-Verlag, 1994.
3. Lessons on Rings, Modules, and Multiplicities by D. G. Northcott, Cambridge University Press, 1968.
4. Commutative Algebra by H. Matsumura, Benjamin/Cummings Publishing Company, 1980.
5. Commutative Ring Theory by H. Matsumura, Cambridge Studies in Advanced Mathematics 8, Cambridge University Press, 1986.
6. Commutative Rings by I. Kaplansky, The University of Chicago Press, Chicago, 1974.
7. Basic Commutative Algebra by Balwant Singh, World Scientific, 2011.

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Semester – I			
18CMT-10002	**Combinatorics and Graph Theory**	**4hrs/wk**	**4 Credits**

Objectives:

1. Upon completion of the course students will be able to
2. Learn pigeonhole principle, the principle of inclusion and exclusion.
3. Understand the notion of graphs and its related concepts.
4. Learn the concept of domination and its applications.

Unit – 1: Combinatorics

- Some essential problems
- Binomial Coefficients
- Multinomial Coefficients
- The pigeonhole principle
- The principle of inclusion and exclusion

Unit – 2: Introduction to graph models

- Graphs and digraphs, Subgraphs
- Common families of graphs
- Walks and Distance
- Path, cycles and trees
- Characterizations and properties of trees
- Matrix representation
- Eulerian graph
- Hamiltonian graphs
- Plane graphs and planar graphs
- Kurtowski's two graphs

Unit – 3: Coloring of Graphs

- Vertex coloring and related results
- Edge coloring and related results.

Unit – 4: Domination in graphs

- Independent set and independence number
- Dominating set and domination number
- Bounds on the domination number

Reference Books:

1. Combinatorics and Graph Theory – John Harries, Jeffry Hirst, Michael Mossinghoff, Springer, 2008, second edition.
2. Graph Theory and Applications – Jonathan Gross and Jay Yellen, CRC Press.
3. A First Look at Graph Theory - J. Clark and D. A. Holton, World Scientific, 1969.
4. Fundamentals of Domination in Graphs – T. W. Haynes, S. T. Hedetniemi, P. J. Slater, Marcel-Dekker.

Semester – I			
18CMT-10003	**Seminar and Problem session**	**4hrs/wk**	**4 Credits**

Objectives:

Upon completion of the course students will be able to

1. Develop the ability of independent thinking for the solution of mathematical problems.
2. Develop a habit to prepare presentation on the given topic.
3. Know the current trends of research.

Some open problems will be discussed and review of some research papers will be carried out. Student will have to prepare a detailed presentation of at least 15 minutes time duration and an internal viva-voce examination will be carried out.

Semester – II			
18CMT – 20001	**Some Topics in Algebraic Topology**	**4hrs/wk**	**4 Credits**

Objectives:

Upon completion of the course students will be able to

1. Recognize and interpret the topological structures and their characterizations.
2. Identify and understand the concepts of Ideals and Filters.
3. Identify and classify the type of topology including product topology and compactifictation.
4. Understand the concepts of Banach Algebra.

Unit 1

Zero sets and their properties. C- embeded and C* - embeded subsets.

Unit 2

Ideals and Maximal Ideals in C(X). Z – Filters and Z – Ultra Filters on a topological space. Z – Ideals and related examples.

Unit 3

Fixed Ideals and Free Ideals. Characterisation of Compactness in terms of Ideals and Z - Filters.

Unit 4

Contruction of Stone- Cech Compactification using 1) Product of Spaces and 2) Zero Sets. Properties of Stone – Cech Compactification.

Unit 5

Some special Banach Algebras

Reference Books:

1. Rings of Continuous functions(Chapter -1,2,3,4 and 6) by L. Gillman and M. Jerison, Springer Verlag (1986).
2. General Topology by S. Willard, Addison – Wesley Publishing Company (1970) (Chapter 6, Article no.19).
3. Introduction to Topology and Modern Analysis by G. F. Simmons, Tata McGraw - Hill (2004) (Chapter no. 14).

Semester – II			
18DMT – 20002	**Dissertation**	**8hrs/wk**	**8 Credits**

Objectives:

Upon completion of the course students will be able to

1. Develop a skill of systematic writing and presentation.
2. Develop the ability of independent thinking for the analysis and solution of mathematical problems.
3. Know the current trends of research available in the topic of own interest.

Student will prepare a dissertation under the guidance of a faculty of the department on any topic of mathematics. This dissertation will be examined according to rules and regulations imposed time to time by Saurashtra University. The external viva will be conducted after recommendation of external referee.