MANGALORE  UNIVERSITY

M.Sc. Mathematics Choice Based Credit System (Semester Scheme) Programme
from the academic year 2019-20

**Preamble:**

The syllabi for the M.Sc. Mathematics Choice Based Credit System (Semester Scheme) Programme in use at present were introduced from the academic year 2016-17. To enable the programmes to be on par with global standards and to provide hands on experience, Lab components have been added. Hence the following revised and restructured syllabi for the M.Sc. Mathematics Programme have been prepared as per the regulations of the University. The Practical Lab introduced are of 2 credits each in first 3 semesters. In the syllabi, all the hard core and soft core courses have been retained from the syllabus of 2016-17. The first paper in each of the second and the third semesters is an "Open Elective" paper, which is offered only to the students of other departments. The syllabi takes into consideration the recommendations of U.G.C. Curriculum Development Committee and it is meant to be introduced from the academic year 2019-20*.

*Revised as per the Special BOS meeting on 25.01.2020 with inclusion of one open elective course and three soft core courses in Third semester and three soft core courses in Fourth semester to take the lead in the competitive/emulating industry/market based on the recent developments/inventions in the society.*

**Programme Outcome:**
- Provide a strong foundation in different areas of Mathematics, so that the students can compete with their contemporaries and excel in the various careers in Mathematics.
- Develop abstract mathematical thinking.
- Motivate and prepare the students to pursue higher studies and research, thus contributing to the ever increasing academic demands of the country.
- Enrich the students with strong communication and interpersonal skills, broad knowledge and an understanding of multicultural and global perspectives, to work effectively in multidisciplinary teams, both as leaders and team members.
- Facilitate integral development of the personality of the student to deal with ethical and professional issues, and also to develop ability for independent and lifelong learning.

**Programme Specific Outcome:**
- Students will demonstrate in-depth knowledge of Mathematics, both in theory and application. They develop problem-solving skills and apply them independently to problems in pure and applied mathematics.
- Students will attain the ability to identify, formulate and solve challenging problems in Mathematics. They assimilate complex mathematical ideas and arguments.
- Students will be able to analyse complex problems in Mathematics and propose solutions using research based knowledge
- Students will be able to work individually or as a team member or leader in uniform and multidisciplinary settings.
- Students will develop confidence for self-education and ability for lifelong learning. Adjust themselves completely to the demands of the growing field of Mathematics by lifelong learning.
- Effectively communicate about their field of expertise on their activities, with their peer and society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations.
- Crack lectureship and fellowship exams approved by UGC like CSIR – NET and SET.

**Consolidated List of Courses offered:**

**Hard Core Courses:**

**First Semester**

1. MTH 401 Algebra - I
2. MTH 402 Linear Algebra- I
3. MTH 403 Real Analysis - I

**Second Semester**

1. MTH 452 Algebra - II
2. MTH 453 Real Analysis - II
3. MTH 454 Topology

**Third Semester**

1. MTH 502 Complex Analysis - I
2. MTH 503 Measure and Integration
3. MTH 504 Multivariate Calculus and Geometry

**Fourth Semester**

4. MTP 551 Project Work
5. MTH 552 Complex Analysis – II
6. MTH 553 Functional Analysis

**Soft Core Courses:**
1. MTS 404 Numerical Analysis
2. MTS 405 Number Theory
3. MTS 455 Linear Algebra - II
4. MTS 456 Ordinary Differential Equations
5. MTS 505 Advanced Numerical Analysis
6. MTS 506 Commutative Algebra
7. MTS 507 Graph Theory
8. MTS 508 Lattice Theory
9. MTS 509 Fluid Mechanics
10. MTS 510 Theory of Partitions
11. MTS 513 Applied Algebraic Coding Theory
12. MTS 514 Operations Research
13. MTS 515 Design and Analysis of Algorithms
14. MTS 554 Partial Differential Equations
15. MTS 555 Advanced Topology
16. MTS 556 Advanced Discrete Mathematics
17. MTS 557 Algebraic Number Theory
18. MTS 558 Calculus of Variations and Integral Equations
19. MTS 559 Mathematical Statistics
20. MTS 560 Computational Geometry
21. MTS 561 Cryptography
22. MTS 562 Finite Element Method with Applications

**Open Elective Courses:**
1. MTE 451 Discrete Mathematics and Applications
2. MTE 501 Differential Equations and Applications
3. MTE 512 Mathematical Finance

**Labs (Soft core):**
1. MTL 406 Lab - 1
2. MTL 457 Lab - 2
3. MTL 511 Lab - 3

**A. The following shall be the Courses of study in the four semesters M.Sc. Mathematics Programme (CBCS-PG) from the academic year 2019-2020.**

**First Semester**

| Course Code | Course | Hard Core/ Soft Core/ Open Elective | Credits |
|---|---|---|---|
| MTH 401 | Algebra - I | HC | 4 |
| MTH 402 | Linear Algebra - I | HC | 4 |
| MTH 403 | Real Analysis -I | HC | 4 |
| MTS 404 | Numerical Analysis | SC | 4 |
| MTS 405 | Number Theory | SC | 4 |
| MTL 406 | Lab - 1 | SC | 2 |

**Second Semester**

In this semester, the course 'MTE 451' is an "Open Elective Course" which is offered only to students of other departments. The other six courses are offered to the students of the department.

| Course Code | Course | Hard Core/ Soft Core/ Open Elective | Credits |
|---|---|---|---|
| MTE 451 | Discrete Mathematics and Applications | OE | 3 |
| MTH 452 | Algebra - II | HC | 4 |
| MTH 453 | Real Analysis - II | HC | 4 |
| MTH 454 | Topology | HC | 4 |
| MTS 455 | Linear Algebra - II | SC | 4 |
| MTS 456 | Ordinary Differential Equations | SC | 4 |
| MTL 457 | Lab - 2 | SC | 2 |

**Third Semester**

In this semester, the course 'MTE 501' is an "Open Elective Course" which is offered only to students of other departments. The other courses are offered to the students of the department. The hard core courses MTH 502, MTH 503, MTH 504 and the Lab MTL 511 are compulsory. The student can choose any two soft core courses from MTS 505 to MTS 510 and MTS 513 to MTS 515 . Also, a project work which is compulsory for every student, involves self study to be carried out by the student (on a research problem of current interest or on an advanced topic not covered in the syllabus) under the guidance of a supervisor*. Project work shall be initiated in the third semester itself and the project report (dissertation) shall be submitted at the end of the fourth semester.

*Supervisor from the parent institution or from any other reputed institution/industry.

| Course Code | Course | Hard Core/ Soft Core/ Open Elective | Credits |
|---|---|---|---|
| MTE 501 | Differential Equations and Applications | OE | 3 |
| MTE 512 | Mathematical Finance | OE | 3 |
| MTH 502 | Complex Analysis -I | HC | 4 |
| MTH 503 | Measure and Integration | HC | 4 |
| MTH 504 | Multivariate Calculus and Geometry | HC | 4 |
| MTS 505 | Advanced Numerical Analysis | SC | 4 |
| MTS 506 | Commutative Algebra | SC | 4 |
| MTS 507 | Graph Theory | SC | 4 |
| MTS 508 | Lattice Theory | SC | 4 |
| MTS 509 | Fluid Mechanics | SC | 4 |
| MTS 510 | Theory of Partitions | SC | 4 |
| MTS 513 | Applied Algebraic Coding Theory | SC | 4 |
| MTS 514 | Operations Research | SC | 4 |
| MTS 515 | Design and Analysis of Algorithms | SC | 4 |
| MTL 511 | Lab - 3 | SC | 2 |

**Fourth Semester**

In this semester, the course MTP 551 is a project work which the student has taken up under the guidance of a supervisor in the third semester itself. Each student has to submit a project report (dissertation) at the end of the fourth semester. The hard core courses MTH 552 and MTH 553 are compulsory. The student can choose any two soft core courses from MTS 554 to MTS 562.

| Course Code | Course | Hard Core/ Soft Core/ Open Elective | Credits |
|---|---|---|---|
| MTP 551 | Project Work | Project | 4 |
| MTH 552 | Complex Analysis - II | HC | 4 |
| MTH 553 | Functional Analysis | HC | 4 |
| MTS 554 | Partial Deferential Equations | SC | 4 |
| MTS 555 | Advanced Topology | SC | 4 |
| MTS 556 | Advanced Discrete Mathematics | SC | 4 |
| MTS 557 | Algebraic Number Theory | SC | 4 |
| MTS 558 | Calculus of Variations and Integral Equations | SC | 4 |
| MTS 559 | Mathematical Statistics | SC | 4 |
| MTS 560 | Computational Geometry | SC | 4 |
| MTS 561 | Cryptography | SC | 4 |
| MTS 562 | Finite Element Method with Applications | SC | 4 |

## B. Scheme of Instruction and Examination
### First Semester

| Course Code | Instruction hours per week | Credits | Duration of Examination in hours | University Examination Max. Marks | Internal Assessment Max. Marks | Total Marks |
|---|---|---|---|---|---|---|
| MTH 401 | 4 | 4 | 3 | 70 | 30 | 100 |
| MTH 402 | 4 | 4 | 3 | 70 | 30 | 100 |
| MTH 403 | 4 | 4 | 3 | 70 | 30 | 100 |
| MTS 404 | 4 | 4 | 3 | 70 | 30 | 100 |
| MTS 405 | 4 | 4 | 3 | 70 | 30 | 100 |
| MTL 406 | 2 | 2 | 3 | 35 | 15 | 50 |

### Second Semester

| Course Code | Instruction hours per week | Credits | Duration of Examination in hours | University Examination Max. Marks | Internal Assessment Max. Marks | Total Marks |
|---|---|---|---|---|---|---|
| MTE 451 | 3 | 3 | 3 | 70 | 30 | 100 |
| MTH 452 | 4 | 4 | 3 | 70 | 30 | 100 |
| MTH 453 | 4 | 4 | 3 | 70 | 30 | 100 |
| MTH 454 | 4 | 4 | 3 | 70 | 30 | 100 |
| MTS 455 | 4 | 4 | 3 | 70 | 30 | 100 |
| MTS 456 | 4 | 4 | 3 | 70 | 30 | 100 |
| MTL 457 | 2 | 2 | 3 | 35 | 15 | 50 |

### Third Semester

| Course Code | Instruction hours per week | Credits | Duration of Examination in hours | University Examination Max. Marks | Internal Assessment Max. Marks | Total Marks |
|---|---|---|---|---|---|---|
| MTH 502 | 4 | 4 | 3 | 70 | 30 | 100 |
| MTH 503 | 4 | 4 | 3 | 70 | 30 | 100 |
| MTH 504 | 4 | 4 | 3 | 70 | 30 | 100 |
| MTS 505 | 4 | 4 | 3 | 70 | 30 | 100 |
| MTS 506 | 4 | 4 | 3 | 70 | 30 | 100 |
| MTS 507 | 4 | 4 | 3 | 70 | 30 | 100 |
| MTS 508 | 4 | 4 | 3 | 70 | 30 | 100 |
| MTS 509 | 4 | 4 | 3 | 70 | 30 | 100 |
| MTS 510 | 4 | 4 | 3 | 70 | 30 | 100 |
| MTS 513 | 4 | 4 | 3 | 70 | 30 | 100 |
| MTS 514 | 4 | 4 | 3 | 70 | 30 | 100 |
| MTS 515 | 4 | 4 | 3 | 70 | 30 | 100 |
| MTL 511 | 2 | 2 | 3 | 35 | 15 | 50 |

**Fourth Semester**

| Course Code | Instruction hours per week | Credits | Duration of Examination in hours | University Examination Max. Marks | Internal Assessment Max. Marks | Total Marks |
|---|---|---|---|---|---|---|
| MTP 551 | 4 | 4 | - | 70 | 30 | 100 |
| MTH 552 | 4 | 4 | 3 | 70 | 30 | 100 |
| MTH 553 | 4 | 4 | 3 | 70 | 30 | 100 |
| MTS 554 | 4 | 4 | 3 | 70 | 30 | 100 |
| MTS 555 | 4 | 4 | 3 | 70 | 30 | 100 |
| MTS 556 | 4 | 4 | 3 | 70 | 30 | 100 |
| MTS 557 | 4 | 4 | 3 | 70 | 30 | 100 |
| MTS 558 | 4 | 4 | 3 | 70 | 30 | 100 |
| MTS 559 | 4 | 4 | 3 | 70 | 30 | 100 |
| MTS 560 | 4 | 4 | 3 | 70 | 30 | 100 |
| MTS 561 | 4 | 4 | 3 | 70 | 30 | 100 |
| MTS 562 | 4 | 4 | 3 | 70 | 30 | 100 |

**Tutorials:** There shall be at least 3 hours of tutorials per week for each course having 4 credits.

**Scheme of Evaluation for Internal Assessment Marks:**

1. **Theory Course:**
   Each Theory Course shall carry 30 marks for internal assessment based on two tests of 90 minutes duration each.
2. **Project Work:**
   Project Work shall carry 30 marks for internal assessment based on two presentations by the student before a panel of faculty members of the department.
3. **Lab:**
   Each Lab shall carry 15 marks for internal assessment based on two lab tests of 90 minutes duration each.

**Pattern of Semester Examination:**

1. **Theory Paper:**
   Each question paper for the theory course shall contain EIGHT questions out of which FIVE are to be answered. All questions carry equal marks.
2. **Project Report:**
   The evaluation of a project report is by two examiners as per the regulations.
3. **Lab Exam:**
   Each Lab exam question paper shall contain TWO questions on lab programmes which are to be executed.

## C. Syllabi of Each Semester

**I Semester**

| MTH 401 | Algebra- I | 4 Credits (48 hours) |
|---|---|---|

**Course Outcome:** To introduce the concepts and to develop working knowledge on fundamentals of algebra. Students will have the knowledge and skills to apply the concepts of the course in pattern recognition in the field of computer science and also for diverse situations in physics, chemistry and other streams. This course is a foundation for next course in Algebra.

**Course Specific Outcome:** At the end of the course students will have the knowledge and skills to understand, explain in depth and apply the fundamental concepts-
- Groups
- Structure of Groups
- Rigid motions, isometries
- Rings and integral domains.

**Unit I - Groups and Subgroups:**

Binary operations, Isomorphic binary operations, Groups, Subgroups, Cyclic groups, Generating sets and Cayley digraphs, Groups of permutations, Orbits, Cycles and alternating groups, Cosets and Lagrange's theorem. **(12 Hours)**