

UNIVERSITY OF CALICUT

B.Sc. MATHEMATICS HONOURS

(MAJOR, MINOR AND GENERAL FOUNDATION COURSES)

SYLLABUS & MODEL QUESTION PAPERS

w.e.f. 2024 Admission Onwards

(CUFYUGP Regulations 2024)

B.Sc. MATHEMATICS HONOURS
(MAJOR, MINOR AND GENERAL FOUNDATION COURSES)

SYLLABUS

PROGRAMME OUTCOMES (PO):

At the end of the graduate programme at Calicut University, a student would:

| | |
|------------|--|
| PO1 | Knowledge Acquisition: Demonstrate a profound understanding of knowledge trends and their impact on the chosen discipline of study. |
| PO2 | Communication, Collaboration, Inclusiveness, and Leadership: Become a team player who drives positive change through effective communication, collaborative acumen, transformative leadership, and a dedication to inclusivity. |
| PO3 | Professional Skills: Demonstrate professional skills to navigate diverse career paths with confidence and adaptability. |
| PO4 | Digital Intelligence: Demonstrate proficiency in varied digital and technological tools to understand and interact with the digital world, thus effectively processing complex information. |
| PO5 | Scientific Awareness and Critical Thinking: Emerge as an innovative problem-solver and impactful mediator, applying scientific understanding and critical thinking to address challenges and advance sustainable solutions. |
| PO6 | Human Values, Professional Ethics, and Societal and Environmental Responsibility: Become a responsible leader, characterized by an unwavering commitment to human values, ethical conduct, and a fervent dedication to the well-being of society and the environment. |
| PO7 | Research, Innovation, and Entrepreneurship: Emerge as a researcher and entrepreneurial leader, forging collaborative partnerships with industry, academia, and communities to contribute enduring solutions for local, regional, and global development. |

PROGRAMME SPECIFIC OUTCOMES (PSO):

At the end of the B.Sc. Mathematics Honours Programme at Calicut University, a student would:

| Programme Specific Outcome (Major) | |
|---|--|
| PSO1 | Advanced Mathematical Knowledge: Understand core mathematical abstract concepts/theories and demonstrate a high level of mathematical rigor and logical reasoning |
| PSO2 | Modelling and Problem-Solving Skills: Apply mathematical techniques to solve complex problem situations across various domains and interpret the result, demonstrating critical thinking and analytical skills. |
| PSO3 | Computational Proficiency: Apply mathematical understanding to solve problems and explicitly work out step by step either by self or by software based computational tools. |
| PSO4 | Research Aptitude: Analyse mathematical abstract ideas effectively and present/communicate mathematical arguments and solutions in a clear and coherent manner leading to research in Mathematics |
| Programme Specific Outcome (Minor) | |
| PSO5 | Mathematics Proficiency: Demonstrate a strong understanding of mathematical principles and problem solving |
| PSO6 | Interdisciplinary Integration: Integrate Mathematics with relevant disciplines to develop more holistic approaches to solve problems, leading to innovative solutions and advancements in various fields. |

**MINIMUM CREDIT REQUIREMENTS OF THE DIFFERENT PATHWAYS
IN THE THREE-YEAR PROGRAMME IN CUFYUGP**

| Sl. No. | Academic Pathway | Major | Minor/ Other Disciplin es | Foundation Courses AEC: 4 MDC: 3 SEC: 3 VAC: 3 | Intern- ship | Total Credits | Example |
|---------|---|------------------------------|---------------------------------------|---|-----------------|------------------|--|
| | | Each course has 4 credits | | Each course has 3 credits | | | |
| | | | | | | | |
| 1 | Single Major (A) | 68 (17 courses) | 24 (6 courses) | 39 (13 courses) | 2 | 133 | Major: Mathematics + six courses in different disciplines in different combinations |
| 2 | Major (A) with Multiple Discipline s (B, C) | 68 (17 courses) | 12 + 12 (3 + 3 = 6 courses) | 39 (13 courses) | 2 | 133 | Major: Mathematics + Statistics and Computer Science |
| 3 | Major (A) with Minor (B) | 68 (17 courses) | 24 (6 courses) | 39 (13 courses) | 2 | 133 | Major: Mathematics Minor: Physics |
| 4 | Major (A) with Vocational Minor (B) | 68 (17 courses) | 24 (6 courses) | 39 (13 courses) | 2 | 133 | Major: Mathematics Vocational Minor: Data Analysis |
| 5 | Double Major | A: 48 | - | 12 + 9+9 +9 | 2 | 133 | |

| | | | | | |
|---|--------|---|---|--|--------------------------------------|
| | (A, B) | (12 courses) B: 44 (11 courses) | <p>The 24 credits in the Minor stream are distributed between the two Majors.</p> <p>2 MDC, 2 SEC, 2 VAC and the Internship should be in Major A. Total credits in Major A should be $48 + 20 = 68$ (nearly 50% of 133)</p> <p>1 MDC, 1 SEC and 1 VAC should be in Major B. Total credits in Major B should be $44 + 9 = 53$ (40% of 133)</p> | | Mathematics and Physics double major |
| Exit with UG Degree / Proceed to Fourth Year with 133 Credits | | | | | |

B.Sc. MATHEMATICS HONOURS PROGRAMME

COURSE STRUCTURE FOR PATHWAYS 1 – 4

1. Single Major

2. Major with Multiple Disciplines

3. Major with Minor

4. Major with Vocational Minor

| Semester | Course Code | Course Title | Total Hours | Hours/Week | Credits | Marks | | |
|----------|-------------------------|--|----------------|--------------|--------------|----------|----------|-------|
| | | | | | | Internal | External | Total |
| 1 | MAT1CJ101/ MAT1MN100 | Core Course 1 in Major – Differential Calculus | 60 | 4 | 4 | 30 | 70 | 100 |
| | | Minor Course 1 | 60/ 75 | 4/ 5 | 4 | 30 | 70 | 100 |
| | | Minor Course 2 | 60/ 75 | 4/ 5 | 4 | 30 | 70 | 100 |
| | ENG1FA101(2) | Ability Enhancement Course 1– English (with Theory T & Practicum P) | 30+30 (T+P) | 2+2 (T+P) | 2+1 (T+P) | 25 | 50 | 75 |
| | | Ability Enhancement Course 2 – Additional Language | 45 | 3 | 3 | 25 | 50 | 75 |
| | | Multi-Disciplinary Course 1 – Other than Major | 45 | 3 | 3 | 25 | 50 | 75 |
| | | Total | | 22/ 24 | 21 | | | 525 |
| 2 | MAT2CJ101/ MAT2MN100 | Core Course 2 in Major – Integral Calculus | 60 | 4 | 4 | 30 | 70 | 100 |
| | | Minor Course 3 | 60/ 75 | 4/ 5 | 4 | 30 | 70 | 100 |
| | | Minor Course 4 | 60/ 75 | 4/ 5 | 4 | 30 | 70 | 100 |
| | ENG2FA103(2) | Ability Enhancement Course 3– English | 30+30 | 2+2 | 2+1 | 25 | 50 | 75 |

| | | | | | | | | |
|---|-------------------------|--|----------------|--------------|--------------|----|----|-----|
| | | Ability Enhancement Course 4 – Additional Language | 45 | 3 | 3 | 25 | 50 | 75 |
| | | Multi-Disciplinary Course 2 – Other than Major | 45 | 3 | 3 | 25 | 50 | 75 |
| | | Total | | 22/ 24 | 21 | | | 525 |
| 3 | MAT3CJ201 | Core Course 3 in Major– Multi Variable Calculus (with Theory T & Practicum P) | 45+30 (T+P) | 3+2 (T+P) | 3+1 (T+P) | 30 | 70 | 100 |
| | MAT3CJ202/ MAT3MN200 | Core Course 4 in Major– Matrix Algebra | 60 | 4 | 4 | 30 | 70 | 100 |
| | | Minor Course 5 | 60/ 75 | 4/ 5 | 4 | 30 | 70 | 100 |
| | | Minor Course 6 | 60/ 75 | 4/ 5 | 4 | 30 | 70 | 100 |
| | | Multi-Disciplinary Course 3 – Kerala Knowledge System | 45 | 3 | 3 | 25 | 50 | 75 |
| | ENG3FV108(2) | Value-Added Course 1 – English | 45 | 3 | 3 | 25 | 50 | 75 |
| | | Total | | 23/ 25 | 22 | | | 550 |
| 4 | MAT4CJ203 | Core Course 5 in Major –Real Analysis I | 45+30 | 3+2 | 3+1 | 30 | 70 | 100 |
| | MAT4CJ204 | Core Course 6 in Major – Basic Linear Algebra | 60 | 4 | 4 | 30 | 70 | 100 |
| | MAT4CJ205 | Core Course 7 in Major – Fundamentals of Python and SageMath (with Theory T & Practical P) | 45+30 (T+P) | 3+2 (T+P) | 3+1 (T+P) | 30 | 70 | 100 |

| | | | | | | | | |
|---|-------------------------|---|-------|-----|-----|----|----|-----|
| | ENG4FV109(2) | Value-Added Course 2 – English | 45 | 3 | 3 | 25 | 50 | 75 |
| | | Value-Added Course 3 – Additional Language | 45 | 3 | 3 | 25 | 50 | 75 |
| | ENG4FS111 (2) | Skill Enhancement Course 1 – English | 30+30 | 2+2 | 2+1 | 25 | 50 | 75 |
| | | Total | | 24 | 21 | | | 525 |
| 5 | MAT5CJ301 | Core Course 8 in Major – Real Analysis II | 45+30 | 3+2 | 3+1 | 30 | 70 | 100 |
| | MAT5CJ302 | Core Course 9 in Major – Abstract Algebra I | 60 | 4 | 4 | 30 | 70 | 100 |
| | MAT5CJ303 | Core Course 10 in Major – Complex Analysis I | 60 | 4 | 4 | 30 | 70 | 100 |
| | | Elective Course 1 in Major | 60 | 4 | 4 | 30 | 70 | 100 |
| | | Elective Course 2 in Major | 60 | 4 | 4 | 30 | 70 | 100 |
| | | Skill Enhancement Course 2 | 45 | 3 | 3 | 25 | 50 | 75 |
| | | Total | | 24 | 23 | | | 575 |
| 6 | MAT6CJ304/ MAT8MN304 | Core Course 11 in Major – Complex Analysis II (For choosing this course as minor from other departments, students must have acquainted themselves with necessary contents of MAT5CJ303, as prerequisites) | 60 | 4 | 4 | 30 | 70 | 100 |
| | MAT6CJ305/ MAT8MN305 | Core Course 12 in Major – Elementary Number Theory | 60 | 4 | 4 | 30 | 70 | 100 |

| | | | | | | | | |
|-------------------------------|--------------------------|--|-------|-----|-----|----|----|------|
| | MAT6CJ306/ MAT8MN306 | Core Course 13 in Major – Methods of Differential Equations | 60 | 4 | 4 | 30 | 70 | 100 |
| | | Elective Course 3 in Major | 60 | 4 | 4 | 30 | 70 | 100 |
| | | Elective Course 4 in Major | 60 | 4 | 4 | 30 | 70 | 100 |
| | MAT6FS113 | Skill Enhancement Course 3 – Data Science with Python | 45 | 3 | 3 | 25 | 50 | 75 |
| | MAT6CJ349 | Internship in Major (Credit for internship to be awarded only at the end of Semester 6) | 60 | | 2 | 50 | - | 50 |
| | | Total | | 23 | 25 | | | 625 |
| Total Credits for Three Years | | | | | 133 | | | 3325 |
| 7 | MAT7CJ401 | Core Course 14 in Major – Mathematical Analysis | 45+30 | 3+2 | 3+1 | 30 | 70 | 100 |
| | MAT7CJ402 | Core Course 15 in Major –General Topology | 45+30 | 3+2 | 3+1 | 30 | 70 | 100 |
| | MAT7CJ403 | Core Course 16 in Major – Abstract Algebra II | 45+30 | 3+2 | 3+1 | 30 | 70 | 100 |
| | MAT7CJ404 | Core Course 17 in Major – Linear Algebra | 45+30 | 3+2 | 3+1 | 30 | 70 | 100 |
| | MAT7CJ405 | Core Course 18 in Major – Discrete Mathematics | 45+30 | 3+2 | 3+1 | 30 | 70 | 100 |
| | | Total | | 25 | 20 | | | 500 |
| 8 | MAT8CJ406 / MAT8MN406 | Core Course 19 in Major – Basic Measure Theory | 45+30 | 3+2 | 3+1 | 30 | 70 | 100 |

| | | | | | | | |
|--|---|------|-----|-----|----|-----|------|
| MAT8CJ407 / MAT8MN407 | Core Course 20 in Major – Number Theory | 60 | 4 | 4 | 30 | 70 | 100 |
| MAT8CJ408 / MAT8MN408 | Core Course 21 in Major – Differential Equations | 60 | 4 | 4 | 30 | 70 | 100 |
| OR (instead of Core Courses 19 to 21 in Major) | | | | | | | |
| MAT8CJ449 | Project (in Honours programme) | 360* | 13* | 12 | 90 | 210 | 300 |
| OR (instead of Core Courses 19 to 21 in Major) | | | | | | | |
| MAT8CJ499 | Project (in Honours with Research programme) | 360* | 13* | 12 | 90 | 210 | 300 |
| | Elective Course 5 in Major / Minor Course 7 | 60 | 4 | 4 | 30 | 70 | 100 |
| | Elective Course 6 in Major / Minor Course 8 | 60 | 4 | 4 | 30 | 70 | 100 |
| | Elective Course 7 in Major / Minor Course 9 / Major Course in any Other Discipline | 60 | 4 | 4 | 30 | 70 | 100 |
| OR (instead of Elective Course 7 in Major, in the case of Honours with Research Programme) | | | | | | | |
| MAT8CJ489 | Research Methodology in Mathematics | 60 | 4 | 4 | 30 | 70 | 100 |
| | Total | | 25 | 24 | | | 600 |
| Total Credits for Four Years | | | | 177 | | | 4425 |

* The teacher should have 13 hrs/week of engagement (the hours corresponding to the three core courses) in the guidance of the Project(s) in Honours programme and Honours with Research programme, while each student should have 24 hrs/week of engagement in the Project work. Total hours are given based on the student's engagement.

CREDIT DISTRIBUTION FOR PATHWAYS 1 – 4

1. Single Major

2. Major with Multiple Disciplines

3. Major with Minor

4. Major with Vocational Minor

| Semester | Major Courses | Minor Courses | General Foundation Courses | Internship/ Project | Total |
|----------------------------------|-------------------|---------------|----------------------------|---------------------|-------|
| 1 | 4 | 4 + 4 | 3 + 3 + 3 | - | 21 |
| 2 | 4 | 4 + 4 | 3 + 3 + 3 | - | 21 |
| 3 | 4 + 4 | 4 + 4 | 3 + 3 | - | 22 |
| 4 | 4 + 4 + 4 | - | 3 + 3 + 3 | - | 21 |
| 5 | 4 + 4 + 4 + 4 + 4 | - | 3 | - | 23 |
| 6 | 4 + 4 + 4 + 4 + 4 | - | 3 | 2 | 25 |
| Total for Three Years | 68 | 24 | 39 | 2 | 133 |
| 7 | 4 + 4 + 4 + 4 + 4 | - | - | - | 20 |
| 8 | 4 + 4 + 4 | 4 + 4 + 4 | - | 12* | 24 |
| * Instead of three Major courses | | | | | |
| Total for Four Years | 88 + 12 = 100 | 36 | 39 | 2 | 177 |

DISTRIBUTION OF MAJOR COURSES IN Mathematics
FOR PATHWAYS 1 – 4

1. Single Major

2. Major with Multiple Disciplines

3. Major with Minor

4. Major with Vocational Minor

| Semester | Course Code | Course Title | Hours/ Week | Credits |
|----------|--------------------------|--|----------------|---------|
| 1 | MAT1CJ101 /MAT1MN100 | Core Course 1 in Major – Differential Calculus | 4 | 4 |
| 2 | MAT2CJ101 /MAT2MN100 | Core Course 2 in Major – Integral Calculus | 4 | 4 |
| 3 | MAT3CJ201 | Core Course 3 in Major – Multi Variable Calculus | 5 | 4 |
| | MAT3CJ202 /MAT3MN200 | Core Course 4 in Major – Matrix Algebra | 4 | 4 |
| 4 | MAT4CJ203 | Core Course 5 in Major – Real Analysis I | 5 | 4 |
| | MAT4CJ204 | Core Course 6 in Major – Basic Linear Algebra | 4 | 4 |
| | MAT4CJ205 | Core Course 7 in Major – Fundamentals of Python and SageMath (P) | 5 | 4 |
| 5 | MAT5CJ301 | Core Course 8 in Major – Real Analysis II | 5 | 4 |
| | MAT5CJ302 | Core Course 9 in Major – Abstract Algebra I | 4 | 4 |
| | MAT5CJ303 | Core Course 10 in Major – Complex Analysis I | 4 | 4 |
| | | Elective Course 1 in Major | 4 | 4 |
| | | Elective Course 2 in Major | 4 | 4 |
| 6 | MAT6CJ304 / MAT8MN304 | Core Course 11 in Major – Complex Analysis II | 4 | 4 |

| | | | | |
|---|-----------------------|---|----|----|
| | MAT6CJ305 /MAT8MN305 | Core Course 12 in Major – Elementary Number Theory | 4 | 4 |
| | MAT6CJ306 /MAT8MN306 | Core Course 13 in Major – Methods of Differential Equations | 4 | 4 |
| | | Elective Course 3 in Major | 4 | 4 |
| | | Elective Course 4 in Major | 4 | 4 |
| | MAT6CJ349 | Internship in Major | - | 2 |
| Total for the Three Years | | | | 70 |
| 7 | MAT7CJ401 | Core Course 14 in Major – Mathematical Analysis | 5 | 4 |
| | MAT7CJ402 | Core Course 15 in Major – General Topology | 5 | 4 |
| | MAT7CJ403 | Core Course 16 in Major – Abstract Algebra II | 5 | 4 |
| | MAT7CJ404 | Core Course 17 in Major – Linear Algebra | 5 | 4 |
| | MAT7CJ405 | Core Course 18 in Major – Discrete Mathematics | 5 | 4 |
| | MAT8CJ406 / MAT8MN406 | Core Course 19 in Major – Basic Measure Theory | 5 | 4 |
| | MAT8CJ407 / MAT8MN407 | Core Course 20 in Major – Number Theory | 4 | 4 |
| | MAT8CJ408 / MAT8MN408 | Core Course 21 in Major – Differential Equations | 4 | 4 |
| OR (instead of Core Courses 19 - 21 in Major) | | | | |
| | MAT8CJ449 | Project (in Honours programme) | 13 | 12 |
| | MAT8CJ499 | Project (in Honours with Research programme) | 13 | 12 |
| | | Elective Course 5 in Major | 4 | 4 |
| | | Elective Course 6 in Major | 4 | 4 |

| | | | | |
|--------------------------|--|-------------------------------------|---|-----|
| 8 | | Elective Course 7 in Major | 4 | 4 |
| | OR (instead of Elective course 7 in Major, in Honours with Research programme) | | | |
| | MAT8CJ489 | Research Methodology in Mathematics | 4 | 4 |
| Total for the Four Years | | | | 114 |

ELECTIVE COURSES IN MATHEMATICS WITH SPECIALISATION

| Group No. | Sl. No. | Course Code | Title | Semester | Total Hrs | Hrs/ Week | Credits | Marks | | |
|-----------|-------------------------------|------------------|---------------------------------------|----------|-----------|-----------|---------|----------|----------|-------|
| | | | | | | | | Internal | External | Total |
| 1 | MATHEMATICAL COMPUTING | | | | | | | | | |
| | 1 | MAT5EJ301 (1) | Mathematical Foundations of Computing | 5 | 60 | 4 | 4 | 30 | 70 | 100 |
| | 2 | MAT5EJ302 (1) | Data Structures and Algorithms | 5 | 60 | 4 | 4 | 30 | 70 | 100 |
| | 3 | MAT6EJ301 (1) | Numerical Analysis | 6 | 60 | 4 | 4 | 30 | 70 | 100 |
| | 4 | MAT6EJ302 (1) | Mathematics for Digital Images | 6 | 60 | 4 | 4 | 30 | 70 | 100 |
| 2 | DATA SCIENCE* | | | | | | | | | |
| | 1 | MAT5EJ303 (2) | Convex Optimization | 5 | 60 | 4 | 4 | 30 | 70 | 100 |
| | 2 | MAT5EJ304 (2) | Applied Probability | 5 | 60 | 4 | 4 | 30 | 70 | 100 |
| | 3 | MAT6EJ303 (2) | Machine Learning I | 6 | 60 | 4 | 4 | 30 | 70 | 100 |
| | 4 | MAT6EJ304 (2) | Machine Learning II | 6 | 60 | 4 | 4 | 30 | 70 | 100 |

ELECTIVE COURSES IN MATHEMATICS WITH NO SPECIALISATION

| Sl. No | Course Code | Title | Semester | Total Hrs | Hrs/ Week | Credits | Marks | | |
|--------|-------------|----------------------------------|----------|-----------|-----------|---------|----------|----------|-------|
| | | | | | | | Internal | External | Total |
| 1 | MAT5EJ305 | Higher Algebra. | 5 | 60 | 4 | 4 | 30 | 70 | 100 |
| 2 | MAT5EJ306 | Linear Programming | 5 | 60 | 4 | 4 | 30 | 70 | 100 |
| 3 | MAT6EJ305 | Topology of Metric Spaces. | 6 | 60 | 4 | 4 | 30 | 70 | 100 |
| 4 | MAT6EJ306 | Introduction to Fourier Analysis | 6 | 60 | 4 | 4 | 30 | 70 | 100 |
| 5 | MAT8EJ401 | Advanced Topology | 8 | 60 | 4 | 4 | 30 | 70 | 100 |
| 6 | MAT8EJ402 | Partial Differential Equations | 8 | 60 | 4 | 4 | 30 | 70 | 100 |
| 7 | MAT8EJ403 | Rings and Modules | 8 | 60 | 4 | 4 | 30 | 70 | 100 |
| 8 | MAT8EJ404 | Coding Theory | 8 | 60 | 4 | 4 | 30 | 70 | 100 |
| 9 | MAT8EJ405 | Foundations of Mathematics | 8 | 60 | 4 | 4 | 30 | 70 | 100 |
| 10 | MAT8EJ406 | Operations Research | 8 | 60 | 4 | 4 | 30 | 70 | 100 |
| 11 | MAT8EJ407 | Cryptography | 8 | 60 | 4 | 4 | 30 | 70 | 100 |
| 12 | MAT8EJ408 | Introduction to Fractals* | 8 | 60 | 4 | 4 | 30 | 70 | 100 |

*These courses are beyond the minimum course requirements and their syllabi are under preparation and will be updated soon.

**

GROUPING OF MINOR COURSES IN MATHEMATICS

| Group No. | Sl. No. | Course Code | Title | Semester | Total Hrs | Hrs/ Week | Credits | Marks | | | |
|-----------|--|---------------|---|----------|-----------|-----------|---------|----------|--------------|-------|--|
| | | | | | | | | Internal | Externa I | Total | |
| 1 | Minor Group I - Mathematical Methods for Science | | | | | | | | | | |
| | 1 | MAT1MN 101 | Calculus | 1 | 60 | 4 | 4 | 30 | 70 | 100 | |
| | 2 | MAT2MN 101 | Differential Equations and Matrix Theory | 2 | 60 | 4 | 4 | 30 | 70 | 100 | |
| | 3 | MAT3MN 201 | Multi Variable Calculus | 3 | 60 | 4 | 4 | 30 | 70 | 100 | |
| 2 | Minor Group II – Foundations for Mathematical Applications | | | | | | | | | | |
| | 1 | MAT1MN 102 | Differential and Integral Calculus | 1 | 60 | 4 | 4 | 30 | 70 | 100 | |
| | 2 | MAT2MN 102 | Calculus and Matrix Algebra | 2 | 60 | 4 | 4 | 30 | 70 | 100 | |
| | 3 | MAT3MN 202 | Differential Equations and Fourier Series | 3 | 60 | 4 | 4 | 30 | 70 | 100 | |
| 3 | Minor Group III - Integrated Mathematical Methods | | | | | | | | | | |
| | 1 | MAT1MN 103 | Basic Calculus | 1 | 60 | 4 | 4 | 30 | 70 | 100 | |
| | 2 | MAT2MN 103 | Analysis and Some Counting Principles | 2 | 60 | 4 | 4 | 30 | 70 | 100 | |
| | 3 | MAT3MN 203 | Matrix Algebra and Vector Calculus | 3 | 60 | 4 | 4 | 30 | 70 | 100 | |

| 4 | Minor Group IV - Discrete Mathematics | | | | | | | | | | |
|---|---------------------------------------|---------------|--|---|----|---|---|----|----|-----|--|
| | 1 | MAT1MN 104 | Mathematical Logic, Set Theory and Combinatorics | 1 | 60 | 4 | 4 | 30 | 70 | 100 | |
| | 2 | MAT2MN 104 | Graph theory and Automata | 2 | 60 | 4 | 4 | 30 | 70 | 100 | |
| | 3 | MAT3MN 204 | Boolean Algebra and System of Equations | 3 | 60 | 4 | 4 | 30 | 70 | 100 | |
| | | | | | | | | | | | |
| | Minor Group V – Linear Algebra | | | | | | | | | | |
| | 1 | MAT1MN 105 | Matrix Theory | 1 | 60 | 4 | 4 | 30 | 70 | 100 | |
| | 2 | MAT2MN 105 | Vector Spaces and Linear Transformations | 2 | 60 | 4 | 4 | 30 | 70 | 100 | |
| | 3 | MAT3MN 205 | Optimization Techniques | 3 | 60 | 4 | 4 | 30 | 70 | 100 | |

*** Students from other disciplines can select up to one group (a total of three courses) from the first three options, as the first three groups have partially overlapped topics.**

****From the Minor Courses listed above, a maximum of one group (three courses) can be offered to students who have taken Mathematics as the major discipline.**

GROUPING OF VOCATIONAL MINOR COURSES IN MATHEMATICS

| VOCATIONAL MATHEMATICS – DATA ANALYTICS | | | | | | | | | | |
|---|--------------|---------------|---|----------|-----------|-----------|---------|----------|----------|-------|
| Pathway - I | | | | | | | | | | |
| Group No. | Sl. No. | Course Code | Title | Semester | Total Hrs | Hrs/ Week | Credits | Marks | | |
| | | | | | | | | Internal | External | Total |
| 1 | | | | | | | | | | |
| | 1 | MAT1VN 101 | Python Programming | 1 | 75 | 5 | 4 | 30 | 70 | 100 |
| | 2 | MAT2VN 101 | Linear Algebra for Machine Learning | 2 | 75 | 5 | 4 | 30 | 70 | 100 |
| | 3 | MAT3VN 201 | Introduction to Machine Learning | 3 | 75 | 5 | 4 | 30 | 70 | 100 |
| | 4 | MAT8VN 301 | Introduction to Artificial Intelligence | 8 | 75 | 5 | 4 | 30 | 70 | 100 |
| | | | | | | | | | | |
| 2 | Pathway - II | | | | | | | | | |
| | 1 | MAT1VN 102 | Statistics for Data Science | 1 | 75 | 5 | 4 | 30 | 70 | 100 |
| | 2 | MAT2VN 102 | R Programming | 2 | 75 | 5 | 4 | 30 | 70 | 100 |
| | 3 | MAT3VN 202 | Data Mining | 3 | 75 | 5 | 4 | 30 | 70 | 100 |
| | 4 | MAT8VN 302 | Data Visualization | 8 | 75 | 5 | 4 | 30 | 70 | 100 |

(i). Students in Single Major pathway can choose course/courses from any of the Minor/ Vocational Minor groups offered by a discipline other than their Major discipline.

(ii). Students in Major with Multiple Disciplines pathway can choose as one of the multiple disciplines, all the three courses from any one of the Minor/ Vocational Minor groups offered by any discipline, including their Major discipline. If they choose one of the Minor/ Vocational

Minor groups offered by their Major discipline as the first one of the multiple disciplines, then their choice as the second one of the multiple disciplines should be any one of the Minor/ Vocational Minor groups offered by a discipline other than the Major discipline. If the students choose any one of the Minor/ Vocational Minor groups in Mathematics as given above, then the title of the group will be the title of that multiple discipline.

(iii). Students in Major with Minor pathway can choose all the courses from any two Minor groups offered by any discipline. If the students choose any two Minor groups in Mathematics as given above, then the title of the Minor will be Functional Mathematics.

(iv). Students in Major with Vocational Minor pathway can choose all the courses from any two Vocational Minor groups offered by any discipline. If the students choose any two Vocational Minor groups in Mathematics as given above, then the title of the Vocational Minor will be Vocational Mathematics.

DISTRIBUTION OF GENERAL FOUNDATION COURSES IN MATHEMATICS

| Semester | Course Code | Course Title | Total Hours | Hours / Week | Credits | Marks | | |
|----------|--------------|---|-------------|--------------|---------|----------|----------|-------|
| | | | | | | Internal | External | Total |
| 1 | MAT1FM105(1) | Multi-Disciplinary Course 1 - Matrices and Basics of Probability theory | 45 | 3 | 3 | 25 | 50 | 75 |
| 1 | MAT1FM105(2) | Multi-Disciplinary Course 2 -Mathematics for Competitive Exams - Part I | 45 | 3 | 3 | 25 | 50 | 75 |
| 2 | MAT2FM106(1) | Multi-Disciplinary Course 3 -Graph Theory and LPP | 45 | 3 | 3 | 25 | 50 | 75 |
| 2 | MAT2FM106(2) | Multi-Disciplinary Course 4 – Mathematics for Competitive Exams - Part II | 45 | 3 | 3 | 25 | 50 | 75 |

| | | | | | | | | |
|---|--------------|--|----|---|---|----|----|----|
| 3 | MAT3FV109(1) | Value-Added Course 1 - History of Mathematics | 45 | 3 | 3 | 25 | 50 | 75 |
| 3 | MAT3FV109(2) | Value-Added Course 2 - Computational Logic | 45 | 3 | 3 | 25 | 50 | 75 |
| 4 | MAT4FV110(1) | Value-Added Course 3 - Statistics and Mathematics with R | 45 | 3 | 3 | 25 | 50 | 75 |
| 4 | MAT4FV110(2) | Value-Added Course 4 - The Mathematical Practices of Medieval Kerala | 45 | 3 | 3 | 25 | 50 | 75 |
| 5 | MAT5FS112 | Skill Enhancement Course 2 - Mathematical Type Setting System - LaTeX | 45 | 3 | 3 | 25 | 50 | 75 |
| 6 | MAT6FS113 | Skill Enhancement Course 3 - Data Science with Python | 45 | 3 | 3 | 25 | 50 | 75 |

COURSE STRUCTURE FOR BATCH A1(B2)

IN PATHWAY 5: DOUBLE MAJOR

A1: 68 credits in Mathematics (Major A)

B1: 68 credits in Major B

A2: 53 credits in Mathematics (Major A)

B2: 53 credits in Major B

The combinations available to the students: (A1 & B2), (B1 & A2)

Note: Unless the batch is specified, the course is for all the students of the class

| Semester | Course Title | Total Hours | Hours/ Week | Credits | Marks | | |
|----------|--|-------------|-------------|---------|----------|----------|-------|
| | | | | | Internal | External | Total |
| 1 | Core Course 1 in Major Mathematics – Differential Calculus | 60 | 4 | 4 | 30 | 70 | 100 |
| | Core Course 1 in Major B | 60/ 75 | 4/ 5 | 4 | 30 | 70 | 100 |
| | Core Course 2 in Major Mathematics – Matrix Algebra (for batch A1 only) | 60 | 4 | 4 | 30 | 70 | 100 |
| | Ability Enhancement Course 1 – English | 30+30 | 2+2 | 2+1 | 25 | 50 | 75 |
| | Ability Enhancement Course 2 – Additional Language | 45 | 3 | 3 | 25 | 50 | 75 |
| | Multi-Disciplinary Course 1 in Mathematics – Matrices and Basics of Probability theory Or Mathematics for Competitive Exams – Part I (for batch A1 only) | 45 | 3 | 3 | 25 | 50 | 75 |
| | Total | | | 24/ 25 | 21 | | |

| | | | | | | | |
|---|--|--------|---------|-----|----|----|-----|
| 2 | Core Course 3 in Major Mathematics – Integral Calculus | 60 | 4 | 4 | 30 | 70 | 100 |
| | Core Course 2 in Major B | 60/ 75 | 4/ 5 | 4 | 30 | 70 | 100 |
| | Core Course 3 in Major B – (for batch B2 only) | 60/ 75 | 4/ 5 | 4 | 30 | 70 | 100 |
| | Ability Enhancement Course 3 – English | 30+30 | 2+2 | 2+1 | 25 | 50 | 75 |
| | Ability Enhancement Course 4 – Additional Language | 45 | 3 | 3 | 25 | 50 | 75 |
| | Multi-Disciplinary Course 2 in Mathematics – Graph Theory and LPP Or Mathematics for Competitive Exams – Part II | 45 | 3 | 3 | 25 | 50 | 75 |
| | Total | | 23 / 25 | 21 | | | 525 |
| 3 | Core Course 4 in Major Mathematics – Multi Variable Calculus. | 75 | 5 | 4 | 30 | 70 | 100 |
| | Core Course 5 in Major Mathematics – Basic Linear Algebra | 60 | 4 | 4 | 30 | 70 | 100 |
| | Core Course 4 in Major B | 60/ 75 | 4/ 5 | 4 | 30 | 70 | 100 |
| | Core Course 5 in Major B | 60/ 75 | 4/ 5 | 4 | 30 | 70 | 100 |
| | Multi-Disciplinary Course 1 in B | 45 | 3 | 3 | 25 | 50 | 75 |

| | | | | | | | |
|---|---|--------|---------|-----|----|----|-----|
| | Value-Added Course 1 in Mathematics – History of Mathematics <i>Or</i> Computational Logic (for batch A1 only) | 45 | 3 | 3 | 25 | 50 | 75 |
| | Total | | 23 / 25 | 22 | | | 550 |
| 4 | Core Course 6 in Major Mathematics – Real Analysis | 45+30 | 3+2 | 2+2 | 30 | 70 | 100 |
| | Core Course 6 in Major B | 60/ 75 | 4/ 5 | 4 | 30 | 70 | 100 |
| | Core Course 7 in Major Mathematics -Abstract Algebra I | 60 | 4 | 4 | 30 | 70 | 100 |
| | Value-Added Course 2 in Mathematics – Statistics and Mathematics with R <i>Or</i> The Mathematical Practices of Medieval Kerala | 45 | 3 | 3 | 25 | 50 | 75 |
| | Value-Added Course 1 in B – | 45 | 3 | 3 | 25 | 50 | 75 |
| | Skill Enhancement Course 1 in Mathematics – Fundamentals of Python and SageMath | 30+30 | 2+2 | 3 | 25 | 50 | 75 |
| | Total | | 23/ 24 | 21 | | | 525 |
| 5 | Core Course 8 in Major – Complex Analysis | 45+30 | 3+2 | 2+2 | 30 | 70 | 100 |
| | Core Course 7 in Major B – | 60/ 75 | 4/ 5 | 4 | 30 | 70 | 100 |

| | | | | | | | |
|---|--|--------|--------|-----|----|----|------|
| | Core Course 9 in Major Mathematics – Methods of Differential Equations (for batch A1 only) | 60 | 4 | 4 | 30 | 70 | 100 |
| | Elective Course 1 in Major Mathematics | 60 | 4 | 4 | 30 | 70 | 100 |
| | Elective Course 1 in Major B | 60 | 4 | 4 | 30 | 70 | 100 |
| | Skill Enhancement Course 1 in B | 45 | 3 | 3 | 25 | 50 | 75 |
| | Total | | 24/ 25 | 23 | | | 575 |
| 6 | Core Course 10 in Major Mathematics – Elementary Number Theory | 60 | 4 | 4 | 30 | 70 | 100 |
| | Core Course 8 in Major B – | 60/ 75 | 4/ 5 | 4 | 30 | 70 | 100 |
| | Core Course 9 in Major B – (for batch B2 only) | 60 | 4 | 4 | 30 | 70 | 100 |
| | Elective Course 2 in Major Mathematics | 60 | 4 | 4 | 30 | 70 | 100 |
| | Elective Course 2 in Major B | 60 | 4 | 4 | 30 | 70 | 100 |
| | Skill Enhancement Course 2 in Mathematics – Mathematical Type Setting System - LaTeX (for batch A1 only) | 45 | 3 | 3 | 25 | 50 | 75 |
| | Internship in Major Mathematics (Credit for internship to be awarded only at the end of Semester 6) | 60 | | 2 | 50 | - | 50 |
| | Total | | 24/ 25 | 25 | | | 625 |
| | | | | 133 | | | 3325 |

CREDIT DISTRIBUTION FOR BATCH A1 (B2)

IN PATHWAY 5: DOUBLE MAJOR

| Semester | Major Courses in Mathematics | General Foundation Courses in Mathematics | Internship/Project in Mathematics | Major Courses in B | General Foundation Courses in B | AE C | Total |
|----------------------------------|------------------------------|---|-----------------------------------|--------------------|---------------------------------|-------|-------|
| 1 | 4 + 4 | 3 | - | 4 | - | 3 + 3 | 21 |
| 2 | 4 | 3 | - | 4 + 4 | - | 3 + 3 | 21 |
| 3 | 4 + 4 | 3 | - | 4 + 4 | 3 | - | 22 |
| 4 | 4 + 4 | 3 + 3 | - | 4 | 3 | - | 21 |
| 5 | 4 + 4 + 4 | - | - | 4 + 4 | 3 | - | 23 |
| 6 | 4 + 4 | 3 | 2 | 4 + 4 + 4 | - | - | 25 |
| Total for Three Years | 48 | 18 | 2 | 44 | 9 | 12 | 133 |
| | 68 | | | 53 | | 12 | 133 |
| | | | | | | | |
| | Major Courses in Mathematics | Minor Courses | | | | | |
| 7 | 4 + 4 + 4 + 4 + 4 | - | | | - | - | 20 |
| 8 | 4 + 4 + 4 | 4 + 4 + 4 | 12* | | - | - | 24 |
| * Instead of three Major courses | | | | | | | |
| Total for Four Years | 88 + 12 = 100 | 12 | | | | | 177 |

COURSE STRUCTURE FOR BATCH B1(A2)

IN PATHWAY 5: DOUBLE MAJOR

A1: 68 credits in Mathematics (Major A)

B1: 68 credits in Major B

A2: 53 credits in Mathematics (Major A)

B2: 53 credits in Major B

Note: Unless the batch is specified, the course is for all the students of the class

| Semester | Course Title | Total Hours | Hours/Week | Credits | Marks | | |
|----------|--|-------------|------------|---------|----------|----------|-------|
| | | | | | Internal | External | Total |
| 1 | Core Course 1 in Major Mathematics – Differential Calculus | 60 | 4 | 4 | 30 | 70 | 100 |
| | Core Course 1 in Major B | 60/ 75 | 4/ 5 | 4 | 30 | 70 | 100 |
| | Core Course 2 in Major B (for batch B1 only) | 60/ 75 | 4/ 5 | 4 | 30 | 70 | 100 |
| | Ability Enhancement Course 1 – English | 60 | 4 | 3 | 25 | 50 | 75 |
| | Ability Enhancement Course 2 – Additional Language | 45 | 3 | 3 | 25 | 50 | 75 |
| | Multi-Disciplinary Course 1 in B – (for batch B1 only) | 45 | 3 | 3 | 25 | 50 | 75 |
| | Total | | | 23 / 25 | 21 | | |
| 2 | Core Course 3 in Major Mathematics – Integral Calculus | 60 | 4 | 4 | 30 | 70 | 100 |
| | Core Course 3 in Major B – | 60/ 75 | 4/ 5 | 4 | 30 | 70 | 100 |
| | Core Course 2 in Major Mathematics – Elementary Number Theory (for batch A2 only). | 60 | 4 | 4 | 30 | 70 | 100 |
| | Ability Enhancement Course 3 – English | 60 | 4 | 3 | 25 | 50 | 75 |

| | | | | | | | |
|---|--|--------|--------|-----|----|----|-----|
| | Ability Enhancement Course 4 – Additional Language | 45 | 3 | 3 | 25 | 50 | 75 |
| | Multi-Disciplinary Course 1 Matrices and Basics of Probability theory or Mathematics for Competitive Exams - Part I | 45 | 3 | 3 | 25 | 50 | 75 |
| | Total | | 24/ 25 | 21 | | | 525 |
| 3 | Core Course 5 in Major Mathematics – Multi Variable Calculus | 45+30 | 3+2 | 3+1 | 30 | 70 | 100 |
| | Core Course 4 in Major Mathematics – Elementary Linear Algebra | 45+30 | 3+2 | 3+1 | 30 | 70 | 100 |
| | Core Course 4 in Major B | 60/ 75 | 4/ 5 | 4 | 30 | 70 | 100 |
| | Core Course 5 in Major B | 60/ 75 | 4/ 5 | 4 | 30 | 70 | 100 |
| | Multi-Disciplinary Course 2 in B – | 45 | 3 | 3 | 25 | 50 | 75 |
| | Value-Added Course 1 in B – (for batch B1 only) | 45 | 3 | 3 | 25 | 50 | 75 |
| | Total | | 23/25 | 22 | | | 550 |
| 4 | Core Course 6 in Major Mathematics – Real Analysis | 45+30 | 3+2 | 3+1 | 30 | 70 | 100 |
| | Core Course 6 in Major B | 60/ 75 | 4/ 5 | 4 | 30 | 70 | 100 |
| | Core Course 7 in Major B – (for batch B1 only) | 60/ 75 | 4/ 5 | 4 | 30 | 70 | 100 |

| | | | | | | | |
|---|---|--------|---------|-----|----|----|-----|
| | Value-Added Course 1 in Mathematics – History of Mathematics or Computational Logic | 45 | 3 | 3 | 25 | 50 | 75 |
| | Value-Added Course 2 in B – | 45 | 3 | 3 | 25 | 50 | 75 |
| | Skill Enhancement Course 1 in Mathematics – Fundamentals of Python and SageMath | | 4 | 3 | 25 | 50 | 75 |
| | Total | | 22 / 24 | 21 | | | 525 |
| 5 | Core Course 7 in Major Mathematics – Abstract Algebra I | 60 | 4 | 4 | 30 | 70 | 100 |
| | Core Course 8 in Major B – | 60/ 75 | 4/ 5 | 4 | 30 | 70 | 100 |
| | Core Course 9 in Major B – (for batch B1 only) | 60 | 4 | 4 | 30 | 70 | 100 |
| | Elective Course 1 in Major Mathematics | 60 | 4 | 4 | 30 | 70 | 100 |
| | Elective Course 1 in Major B | 60 | 4 | 4 | 30 | 70 | 100 |
| | Skill Enhancement Course 1 in B | 45 | 3 | 3 | 25 | 50 | 75 |
| | Total | | 24/ 25 | 23 | | | 575 |
| 6 | Core Course 8 in Major Mathematics – Methods of Differential Equations | 60 | 4 | 4 | 30 | 70 | 100 |
| | Core Course 10 in Major B – | 60/ 75 | 4/ 5 | 4 | 30 | 70 | 100 |
| | Core Course 9 in Major Mathematics – Complex Analysis (for batch A2 only) | 45+30 | 3+2 | 2+2 | 30 | 70 | 100 |

| | | | | | | | |
|-------------------------------|---|----|--------|-----|----|----|------|
| | Elective Course 2 in Major Mathematics | 60 | 4 | 4 | 30 | 70 | 100 |
| | Elective Course 2 in Major B | 60 | 4 | 4 | 30 | 70 | 100 |
| | Skill Enhancement Course 2 in B – (for batch B1 only) | 45 | 3 | 3 | 25 | 50 | 75 |
| | Internship in Major B (Credit for internship to be awarded only at the end of Semester 6) | 60 | | 2 | 50 | - | 50 |
| | Total | | 24/ 25 | 25 | | | 625 |
| Total Credits for Three Years | | | | 133 | | | 3325 |

CREDIT DISTRIBUTION FOR BATCH B1(A2)

IN PATHWAY 5: DOUBLE MAJOR

| Semester | Major Courses in B | General Foundation Courses in B | Internship/Project in B | Major Courses in Mathematics | General Foundation Courses in Mathematics | AEC | Total |
|----------------------------------|--------------------|---------------------------------|-------------------------|------------------------------|---|-------|-------|
| 1 | 4 + 4 | 3 | - | 4 | - | 3 + 3 | 21 |
| 2 | 4 | - | - | 4 + 4 | 3 | 3 + 3 | 21 |
| 3 | 4 + 4 | 3 + 3 | - | 4 + 4 | - | - | 22 |
| 4 | 4 + 4 | 3 | - | 4 | 3 + 3 | - | 21 |
| 5 | 4 + 4 + 4 | 3 | - | 4 + 4 | - | - | 23 |
| 6 | 4 + 4 | 3 | 2 | 4 + 4 + 4 | - | - | 25 |
| Total for Three Years | 48 | 18 | 2 | 44 | 9 | 12 | 133 |
| | 68 | | | 53 | | 12 | 133 |
| | | | | | | | |
| | Major Courses in B | Minor Courses | | | | | |
| 7 | 4 + 4 + 4 + 4 + 4 | - | | | - | - | 20 |
| 8 | 4 + 4 + 4 | 4 + 4 + 4 | 12* | | - | - | 24 |
| * instead of three Major courses | | | | | | | |
| Total for Four Years | 88 + 12 = 100 | 12 | | | | | 177 |

EVALUATION SCHEME

1. The evaluation scheme for each course contains two parts: internal evaluation (about 30%) and external evaluation (about 70%). Each of the Major and Minor courses is of 4-credits. It is evaluated for 100 marks, out of which 30 marks is from internal evaluation and 70 marks, from external evaluation. Each of the General Foundation course is of 3-credits. It is evaluated for 75 marks, out of which 25 marks is from internal evaluation and 50 marks, from external evaluation.

2. The 4-credit courses (Major and Minor courses) are of two types: (i) courses with only theory and (ii) courses with 3-credit theory and 1-credit Practical/Practicum.

In 4-credit courses with only theory component, out of the total 5 modules of the syllabus, one open-ended module with 20% content is designed by the faculty member teaching that course, and it is internally evaluated for 10 marks. The internal evaluation of the remaining 4 theory modules is for 20 marks.

In 4-credit courses with 3-credit theory and 1-credit Practical/Practicum components, out of the total 5 modules of the syllabus, 4 modules are for theory and the fifth module is for Practical/Practicum. The Practical/Practicum component is internally evaluated for 20 marks. The internal evaluation of the 4 theory modules is for 10 marks.

3. All the 3-credit courses (General Foundational Courses) in Mathematics are with only theory component. Out of the total 5 modules of the syllabus, one open-ended module with 20% content is designed by the faculty member teaching that course, and it is internally evaluated for 5 marks. The internal evaluation of the remaining 4 theory modules is for 20 marks.

| Sl. No. | Nature of the Course | | Internal Evaluation in Marks (About 30% of the Total) | | External Exam on 4 Modules (Marks) | Total Marks |
|---------|----------------------|--|---|------------------------|------------------------------------|-------------|
| | | | Open-ended Module / Practical/Practicum | On the other 4 Modules | | |
| 1 | 4-credit course | only theory (5 modules) | 10 | 20 | 70 | 100 |
| 2 | 4-credit course | Theory (4 modules) + Practical/Practicum | 20 | 10 | 70 | 100 |
| 3 | 3-credit course | only theory (5 modules) | 5 | 20 | 50 | 75 |

1. MAJOR AND MINOR COURSES

1.1. INTERNAL EVALUATION OF THEORY COMPONENT

| Sl. No. | Components of Internal Evaluation of Theory Part of a Major / Minor Course | Internal Marks for the Theory Part of a Major / Minor Course of 4-credits | | | |
|---------|--|---|-------------------|------------------------------|---------------------|
| | | Theory Only | | Theory + Practical/Practicum | |
| | | 4 Theory Modules | Open-ended Module | 4 Theory Modules | Practical/Practicum |
| 1 | Test paper/ Mid-semester Exam | 10 | 4 | 5 | - |
| 2 | Seminar/ Viva/ Quiz | 6 | 4 | 3 | - |
| 3 | Assignment | 4 | 2 | 2 | - |
| Total | | 20 | 10 | 10 | 20* |
| | | 30 | | 30 | |

* Refer the table in section 1.2 for the evaluation of Practical/Practicum component

1.2. EVALUATION OF PRACTICAL/PRACTICUM COMPONENT

The evaluation of Practical/Practicum component in Major and Minor courses is completely by internal evaluation.

- Continuous evaluation of Practical/Practicum by the teacher-in-charge shall carry a weightage of 50%.
- The end-semester Practical/Practicum examination and viva-voce, and the evaluation of Practical/Practicum records shall be conducted by the teacher in-charge and an internal examiner appointed by the Department Council.
- The process of continuous evaluation of Practical/Practicum courses shall be completed before 10 days from the commencement of the end-semester examination.
- Those who passed in continuous evaluation alone will be permitted to appear for the end-semester examination and viva-voce.

The scheme of continuous evaluation and the end-semester examination and viva-voce of Practical/Practicum component shall be as given below:

| Sl. No. | Evaluation of Practical/Practicum Component of Credit-1 in a Major / Minor Course | Marks for Practical/Practicum | Weightage |
|-------------|---|-------------------------------|-----------|
| 1 | Continuous evaluation of Practical/Practicum/exercise performed in Practical/Practicum classes by the students | 10 | 50% |
| 2 | End-semester examination and viva-voce to be conducted by teacher-in-charge along with an additional examiner arranged internally by the Department Council | 7 | 35% |
| 3 | Evaluation of the Practical/Practicum records submitted for the end semester viva-voce examination by the teacher-in-charge and additional examiner | 3 | 15% |
| Total Marks | | 20 | |

1.3. EXTERNAL EVALUATION OF THEORY COMPONENT

External evaluation carries 70% marks. Examinations will be conducted at the end of each semester. Individual questions are evaluated in marks and the total marks are converted into grades by the University based on 10-point grading system (refer section 5).

PATTERN OF QUESTION PAPER FOR MAJOR AND MINOR COURSES

| Duration | Type | Total No. of Questions | No. of Questions to be Answered | Marks for Each Question | Ceiling of Marks |
|-------------|-----------------------|------------------------|---------------------------------|-------------------------|------------------|
| 2 Hours | Short Answer | 10 | 8 – 10 | 3 | 24 |
| | Paragraph/ Problem | 8 | 6 – 8 | 6 | 36 |
| | Essay | 2 | 1 | 10 | 10 |
| Total Marks | | | | | 70 |

2. INTERNSHIP

- All students should undergo Internship of 2-credits during the first six semesters in Research Institutions, Universities, firm, industry or organization, or training in labs with faculty and researchers of their own institution or other Higher Educational Institutions (HEIs) or research institutions.
- Internship can be for enhancing the employability of the student or for developing the research aptitude.
- Internship can involve hands-on training on a particular skill/ equipment/ software. It can be a short project on a specific problem or area. Attending seminars or workshops related to an area of learning or skill can be a component of Internship.

A faculty member/ scientist/ instructor of the respective institution, where the student does the Internship, should be the supervisor of the Internship

2.1. GUIDELINES FOR INTERNSHIP

1. Internship can be in Mathematics or allied disciplines.
2. There should be minimum 60 hrs. of engagement from the student in the Internship.
3. Summer vacations and other holidays can be used for completing the Internship.
4. In B.Sc. Mathematics Honours programme, institute/ industry visit or study tour is a requirement for the completion of Internship. Visit to minimum one national research institute, research laboratory and place of scientific importance should be part of the study tour. A brief report of the study tour has to be submitted with photos and analysis.
5. The students should make regular and detailed entries in to a personal log book through the period of Internship. The log book will be a record of the progress of the Internship and the time spent on the work, and it will be useful in writing the final report. It may contain mathematical results, ideas, expressions, experimental conditions, rough work and calculation, computer file names etc. All entries should be dated. The Internship supervisor should periodically examine and countersign the log book.
6. The log book and the typed report must be submitted at the end of the Internship.
7. The institution at which the Internship will be carried out should be prior-approved by the Department Council of the college where the student has enrolled for the UG Honours programme.

2.2. VALUATION OF INTERNSHIP

- The evaluation of Internship shall be done internally through continuous assessment mode by a committee internally constituted by the Department Council of the college where the student has enrolled for the UG Honours programme.
- The credits and marks for the Internship will be awarded only at the end of semester 6.
- The scheme of continuous evaluation and the end-semester viva-voce examination based on the submitted report shall be as given below:

| Sl. No. | Components of Evaluation of Internship | | Marks for Internship 2 Credits | Weightage |
|---------|--|------------------------------------|--------------------------------|-----------|
| 1 | Continuous evaluation of internship through interim presentations and reports by the committee internally constituted by the Department Council | Acquisition of skill set | 10 | 40% |
| 2 | | Interim Presentation and Viva-voce | 5 | |
| 3 | | Punctuality and Log Book | 5 | |
| 4 | Report of Institute Visit/ Study Tour | | 5 | 10% |
| 5 | End-semester viva-voce examination to be conducted by the committee internally constituted by the Department Council | Quality of the work | 6 | 35% |
| 6 | | Presentation of the work | 5 | |
| 7 | | Viva-voce | 6 | |
| 8 | Evaluation of the day-to-day records, the report of internship supervisor, and final report submitted for the end semester viva-voce examination before the committee internally constituted by the Department Council | | 8 | 15% |
| | Total Marks | | 50 | |

3. PROJECT

3.1. PROJECT IN HONOURS PROGRAMME

- In Honours programme, the student has the option to do a Project of 12-credits instead of three Core Courses in Major in semester 8.
- The Project can be done in the same institution/ any other higher educational institution (HEI)/ research centre/ training centre.
- The Project in Honours programme can be a short research work or an extended internship or a skill-based training programme.
- A faculty member of the respective institution, where the student does the Project, should be the supervisor of the Project.

3.2. PROJECT IN HONOURS WITH RESEARCH PROGRAMME

- Students who secure 75% marks and above (equivalently, CGPA 7.5 and above) cumulatively in the first six semesters are eligible to get selected to Honours with Research stream in the fourth year.
- A relaxation of 5% in marks (equivalently, a relaxation of 0.5 grade in CGPA) is allowed for those belonging to SC/ ST/ OBC (non-creamy layer)/ Differently-Abled/ Economically Weaker Section (EWS)/ other categories of candidates as per the decision of the UGC from time to time.
- In Honours with Research programme, the student has to do a mandatory Research Project of 12-credits instead of three Core Courses in Major in semester 8.
- The approved research centres of University of Calicut or any other university/ HEI can offer the Honours with Research programme. The departments in the affiliated colleges under University of Calicut, which are not the approved research centres of the University, should get prior approval from the University to offer the Honours with Research programme. Such departments should have minimum two faculty members with Ph.D., and they should also have the necessary infrastructure to offer Honours with Research programme.
- A faculty member of the University/ College with a Ph.D. degree can supervise the research project of the students who have enrolled for Honours with Research. One such faculty member can supervise maximum five students in Honours with Research stream.

The maximum intake of the department for Honours with Research programme is fixed by the department based on the number of faculty members eligible for project supervision, and other academic, research, and infrastructural facilities available.

- If a greater number of eligible students are opting for the Honours with Research programme than the number of available seats, then the allotment shall be based on the existing rules of reservations and merits.

3.3. GUIDELINES FOR THE PROJECT IN HONOURS PROGRAMME

AND HONOURS WITH RESEARCH PROGRAMME

1. Project can be in Mathematics or allied disciplines.
2. Project should be done individually.
3. Project work can be of theoretical/ experimental /computational in nature.

4. There should be minimum 360 hrs. of engagement from the student in the Project work in Honours programme as well as in Honours with Research programme.
5. There should be minimum 13 hrs./week of engagement (the hours corresponding to the three core courses in Major in semester 8) from the teacher in the guidance of the Project(s) in Honours programme and Honours with Research programme.
6. The various steps in project works are the following:
 - Wide review of a topic.
 - Investigation on a problem in a systematic way using appropriate techniques.
 - Systematic recording of the work.
 - Reporting the results with interpretation in a standard documented form.

Presenting the results before the examiners.

7. During the Project the students should make regular and detailed entries in to a personal log book through the period of investigation. The log book will be a record of the progress of the Project and the time spent on the work, and it will be useful in writing the final report. It may contain mathematical models and results, ideas, mathematical expressions, rough work and calculation, computer file names etc. All entries should be dated. The Project supervisor should periodically examine and countersign the log book.
8. The log book and the typed report must be submitted at the end of the Project. A copy of the report should be kept for reference at the department. A soft copy of the report too should be submitted, to be sent to the external examiner in advance.
9. It is desirable, but not mandatory, to publish the results of the Project in a peer reviewed journal.
10. The project report shall have an undertaking from the student and a certificate from the research supervisor for originality of the work, stating that there is no plagiarism, and that the work has not been submitted for the award of any other degree/ diploma in the same institution or any other institution.
11. The project proposal, institution at which the project is being carried out, and the project supervisor should be prior-approved by the Department Council of the college where the student has enrolled for the UG Honours programme.

3.4. EVALUATION OF PROJECT

- The evaluation of Project will be conducted at the end of the eighth semester by both internal and external modes.
- The Project in Honours programme as well as that in Honours with Research programme will be evaluated for 300 marks. Out of this, 90 marks is from internal evaluation and 210 marks, from external evaluation.
- The internal evaluation of the Project work shall be done through continuous assessment mode by a committee internally constituted by the Department Council of the college where the student has enrolled for the UG Honours programme. 30% of the weightage shall be given through this mode.
- The remaining 70% shall be awarded by the external examiner appointed by the University.
- The scheme of continuous evaluation and the end-semester viva-voce of the Project shall be as given below:

| Sl. No | Components of Evaluation of Project | Marks for the Project (Honours/ Honours with Research) | Weightage |
|--------|---|--|-----------|
| 1 | Continuous evaluation of project work through interim presentations and reports by the committee internally constituted by the Department Council | 90 | 30% |
| 2 | End-semester viva-voce examination to be conducted by the external examiner appointed by the university | 150 | 50% |
| 3 | Evaluation of the day-to-day records and project report submitted for the end-semester viva-voce examination conducted by the external examiner | 60 | 20% |
| | Total Marks | 300 | |

INTERNAL EVALUATION OF PROJECT

| Sl. No | Components of Evaluation of Project | Marks for the Project (Honours/ Honours with Research) |
|-------------|---|---|
| 1 | Skill in doing project work | 30 |
| 2 | Interim Presentation and Viva- Voce | 20 |
| 3 | Punctuality and Log book | 20 |
| 4 | Scheme/ Organization of Project Report | 20 |
| Total Marks | | 90 |

EXTERNAL EVALUATION OF PROJECT

| Sl. No | Components of Evaluation of Project | Marks for the Project (Honours/ Honours with Research) 12 credits |
|-------------|---|---|
| 1 | Content and relevance of the Project, Methodology, Quality of analysis, and Innovations of Research | 50 |
| 2 | Presentation of the Project | 50 |
| 3 | Project Report (typed copy), Log Book and References | 60 |
| 4 | Viva-Voce | 50 |
| Total Marks | | 210 |

4. GENERAL FOUNDATION COURSES

All the General Foundation Courses (3-credits) in Mathematics are with only theory component.

4.1. INTERNAL EVALUATION

| Sl. No. | Components of Internal Evaluation of a General Foundation Course in Mathematics | Internal Marks of a General Foundation Course of 3-credits in Mathematics | |
|---------|---|---|-------------------|
| | | 4 Theory Modules | Open-ended Module |
| 1 | Test paper/ Mid-semester Exam | 10 | 2 |
| 2 | Seminar/ Viva/ Quiz | 6 | 2 |
| 3 | Assignment | 4 | 1 |
| Total | | 20 | 5 |
| | | 25 | |

4.2. EXTERNAL EVALUATION

External evaluation carries about 70% marks. Examinations will be conducted at the end of each semester. Individual questions are evaluated in marks and the total marks are converted into grades by the University based on 10-point grading system (refer section 5)

PATTERN OF QUESTION PAPER FOR GENERAL FOUNDATION COURSES

| Duration | Type | Total No. of Questions | No. of Questions to be Answered | Marks for Each Question | Ceiling of Marks |
|-------------|--------------------|------------------------|---------------------------------|-------------------------|------------------|
| 1.5 Hours | Short Answer | 10 | 8 – 10 | 2 | 16 |
| | Paragraph/ Problem | 5 | 4 – 5 | 6 | 24 |
| | Essay | 2 | 1 | 10 | 10 |
| Total Marks | | | | | 50 |

5. LETTER GRADES AND GRADE POINTS

- Mark system is followed for evaluating each question.
- For each course in the semester letter grade and grade point are introduced in 10-point indirect grading system as per guidelines given below.
- The Semester Grade Point Average (SGPA) is computed from the grades as a measure of the student's performance in a given semester.
- The Cumulative GPA (CGPA) is based on the grades in all courses taken after joining the programme of study.
- Only the weighted grade point based on marks obtained shall be displayed on the grade card issued to the students.

LETTER GRADES AND GRADE POINTS

| Sl. No. | Percentage of Marks (Internal & External Put Together) | Description | Letter Grade | Grade Point | Range of Grade Points | Class |
|---------|---|---------------|-----------------|----------------|-----------------------------|------------------------------------|
| 1 | 95% and above | Outstanding | O | 10 | 9.50 – 10 | First Class with Distinction |
| 2 | Above 85% and below 95% | Excellent | A+ | 9 | 8.50 – 9.49 | |
| 3 | 75% to below 85% | Very Good | A | 8 | 7.50 – 8.49 | |
| 4 | 65% to below 75% | Good | B+ | 7 | 6.50 – 7.49 | First Class |
| 5 | 55% to below 65% | Above Average | B | 6 | 5.50 – 6.49 | |
| 6 | 45% to below 55% | Average | C | 5 | 4.50 – 5.49 | Second Class |
| 7 | 35% to below 45% aggregate (internal and external put together) with a minimum of 30% in external valuation | Pass | P | 4 | 3.50 – 4.49 | Third Class |
| 8 | Below an aggregate of 35% or below 30% in external evaluation | Fail | F | 0 | 0 – 3.49 | Fail |
| 9 | Not attending the examination | Absent | Ab | 0 | 0 | Fail |

- When students take audit courses, they will be given Pass (P) or Fail (F) grade without any credits.
- The successful completion of all the courses and capstone components prescribed for the three-year or four-year programme with 'P' grade shall be the minimum requirement for the award of UG Degree or UG Degree Honours or UG Degree Honours with Research, as the case may be.

5.1. COMPUTATION OF SGPA AND CGPA

- The following method shall be used to compute the Semester Grade Point Average (SGPA):

The SGPA equals the product of the number of credits (C_i) with the grade points (G_i) scored by a student in each course in a semester, summed over all the courses taken by a student in the semester, and then divided by the total number of credits of all the courses taken by the student in the semester,

$$\text{i.e. SGPA } (S_i) = \sum_i (C_i \times G_i) / \sum_i (C_i)$$

where C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the i^{th} course in the given semester. Credit Point of a course is the value obtained by multiplying the credit (C_i) of the course by the grade point (G_i) of the course.

ILLUSTRATION – COMPUTATION OF SGPA

| Semester | Course | Credit | Letter Grade | Grade point | Credit Point (Credit x Grade) |
|----------|----------|--------|--------------|-------------|----------------------------------|
| I | Course 1 | 3 | A | 8 | 3 x 8 = 24 |
| I | Course 2 | 4 | B+ | 7 | 4 x 7 = 28 |
| I | Course 3 | 3 | B | 6 | 3 x 6 = 18 |
| I | Course 4 | 3 | O | 10 | 3 x 10 = 30 |
| I | Course 5 | 3 | C | 5 | 3 x 5 = 15 |
| I | Course 6 | 4 | B | 6 | 4 x 6 = 24 |
| | Total | 20 | | | 139 |
| | SGPA | | | | 139/20 = 6.950 |

The Cumulative Grade Point Average (CGPA) of the student shall be calculated at the end of a programme. The CGPA of a student determines the overall academic level of the student in a programme and is the criterion for ranking the students.

CGPA for the three-year programme in CUFYUGP shall be calculated by the following formula.

CGPA for the four-year programme in CUFYUGP shall be calculated by the following formula.

- The SGPA and CGPA shall be rounded off to three decimal points and reported in the transcripts.
- Based on the above letter grades, grade points, SGPA and CGPA, the University shall issue the transcript for each semester and a consolidated transcript indicating the performance in all semesters.

