

Programme Template

1. Name of the Programme and Code	MT6 (B Tech and M Tech in Mathematics and Computing)
2. Degree (UG/PG)	UG
3. Minimum Duration of the Programme (Specify for FT and PT, if applicable)	10 Semesters (FT)
4. Maximum Duration of the Programme (Specify for FT and PT, if applicable)	14 Semesters (FT)
5. Capacity (Max. Student Strength) of the Programme	33
6. Number of Regular Faculty Members Involved as Teaching Faculty in the Programme	35
7. Minimum Credit Requirements for the Degree	180
8. Articulate the Program Learning Outcomes (PLO) [For example see: Objectives vs. Outcomes and Student Outcomes] PLO1. Analyze and communicate mathematical ideas, acquire mathematical logic and reasoning, and draw logical conclusions. PLO2. Formulate and analyze mathematical concepts, solve challenging abstract and real-world problems within and across disciplines. PLO3. Identify and analyze how Mathematics influences and drives advancements in Technology and Industry PLO4. Engage in a learning process for cutting-edge research across wide range of areas PLO5. Engaging in a year-long project to obtain knowledge about the current research areas, and thinking independently about research challenges and novel solutions.	

9. Map PLOs with Institute Learning Outcomes (ILOs) of the Degree

[Indicate '1' for weak, '2' for good, and '3' for excellent relation. Leave the cell blank to indicate no relation]

	PLO1	PLO2	PLO3	PLO4	PLO5
ILO1	3	2	2	1	1
ILO2	1	2	2	1	1
ILO3	2	3	2	3	2
ILO4	1	2	1	2	2
ILO5	1	2	3	2	3

10. Number of Department Core and Department Elective Credits

$$(DC = 51 + DE = 12) = 63$$

11. Number of Programme Core and Program Elective Credits

$$(PC = 8 + PE 12) + \text{Professional Ethics 1} = 21 \text{ (Excluding projects} = 24)$$

12. Number of Open Credits

$$9 \text{ (OC} = 3 + \text{OE} = 6)$$

13. Number of Project Core Credits

$$18 \text{ (MTP)} + 3 \text{ (Cornerstone project)} + 3 \text{ (internship)} = 24$$

14. Details of Creative Expression and Ethical Reasoning (CEER) Component in the Programme [Only for UG]

Number of Credits Assigned	3
Courses Involved and Credits Accounted <i>[e.g., If one module in AMLXXX with contact hours YY satisfies Z credits, then write AMLXXX (Z credits)]</i>	Will be decided after the course templates are finalized.

15. Details of Emerging Trends (ETT) Component in the Programme

[Only for UG]

Number of Credits Assigned	3
Courses Involved and Credits Accounted [e.g., <i>If one module in AMLXXX with contact hours YY satisfies Z credits, then write AMLXXX (Z credits)</i>]	Will be decided after the course templates are finalized.

16. Details of Environment and Sustainability (E&S) Component in the Programme [Only for UG]

Number of Credits Assigned	5
Courses Involved and Credits Accounted [e.g., <i>If one module in AMLXXX with contact hours YY satisfies Z credits, then write AMLXXX (Z credits)</i>]	ES1 and ES2 courses, to be chosen from courses offered by Environmental Science/Civil/Design.

17. Details of Research/Technical Communication Component in the Programme [Only for PG]

Number of Credits Assigned	
Courses Involved and Credits Accounted [e.g., <i>If one module in AMLXXX with contact hours YY satisfies Z credits, then write AMLXXX (Z credits)</i>]	N/A

18. Details of Professional Ethics Component in the Programme [Only for PG]

Number of Credits Assigned	
Courses Involved and	N/A

Credits Accounted [e.g., If one module in AMLXXX with contact hours YY satisfies Z credits, then write AMLXXX (Z credits)]			
19. Details of External Connect Component in the Programme [Only for PG]			
Number of Credits Assigned			
Courses Involved and Credits Accounted [e.g., If one module in AMLXXX with contact hours YY satisfies Z credits, then write AMLXXX (Z credits)]		N/A	
20. List of prescribed courses in all baskets (BS, GE, DC/PC, DE/PE, ...)			
Basic Sciences (BS)	General Engineering (GE)	Departmental/Programme Core (DC/PC)	Departmental/Programme Elective (DE/PE)
MTL100	COL100	Discrete Mathematical Structures (3-1-0)	(List for DE is given below)
MTL101	Introduction to Electrical Engineering (EE)	Introduction to PDE and applications (3-1-0)	
Introduction to Electrodynamics (Physics)	Engineering Visualization (ME)	Numerical Analysis and Computation (3-1-0)	
Structural Insights into Atoms and	Programming with Data Structures	Numerical Analysis Computing Laboratory (0-0-4)	

Molecules (Chemistry)	(CSE)		
Biology for Engineers: Microbes in Health and Disease (Biology)	Introductory Data Science (CSE)	Algebra (3-1-0)	
Physics Lab	GE Free	Analysis and Design of Algorithms (3-1-0 or 3-0-2)	
Chemistry lab		Topics in Analysis (3-1-0)	
BS Free		Optimization Methods and Applications (3-1-0)	
		Introduction to Probability and Stochastic Processes (3-1-0)	
		DC for ES1 (3-0-0)	
		DC for ES2 (2-0-0)	
		PC 1 (3-1-0)	
		PC2 (3-1-0)	
		MTP (20 Credits)	
		Professional Ethics (1-0-0) 1	
		Cornerstone Project (0-0-6) 3	
		Summer internship/minor project (0-0-6) 3	

Apart from the core courses listed above, students are required to do 3 more core courses from the following list of courses (called as flexible core or FC). If a student chooses to do more than 3 flexible core courses from the list, then the extra credits will be counted towards fulfilment of Departmental Electives (DE/PE).

1. Advanced Linear Algebra (3-1-0)
2. Introduction to Number Theory (3-1-0)
3. Computational Methods for Differential Equations (3-0-2)
4. Statistical Inference (3-1-0)
5. Operating Systems (3-0-2)
6. Theory of Computation (3-1-0)
7. Functional Analysis and Applications (3-1-0)
8. Topology (3-1-0)

The department electives and program electives (DE/PE) are as follows.
This list will evolve and be updated in due course.

Probability/OR/Stats:

1. Advanced Probability Theory (MTL794)
2. Multivariate Statistics (MTL766)
3. Financial Mathematics (MTL732)
4. Stochastic of Finance (MTL733)
5. Numerical Optimization (MTL704)
6. Game Theory (MTL763)
7. Stochastic Processes and Applications (MTL725)
8. Statistical Learning
9. Markov Decision Processes and Applications
10. Introductory Actuarial Mathematics (MTL734)
11. Multiple Decision Procedures in Ranking and Selection (MTL855)
12. Mathematical Modeling of Credit Risk (MTL843)

Pure Maths:

1. Numerical Linear Algebra
2. Algebraic Geometry (MTL755)
3. Algebraic Number Theory (MTL863)
4. Advanced Number Theory (MTL735)
5. Analytic Number Theory (MTL736)
6. Cryptography (MTL730)
7. Harmonic Analysis
8. Mathematical Theory of Coding (MTL744)
9. Fourier Analysis (MTL743)
10. Learning Theory (MTL799)
11. Commutative Algebra (MTL738)
12. Introduction to Algebraic Topology (MTL757)
13. Lie Algebra
14. Lie Groups (MTL756 broken into these two)
15. Algebraic Groups
16. Measure Integral and Probability (MTL270)
17. Category Theory (MTL728)
18. Introduction to Chaotic Dynamical Systems (MTL731)
19. Fractal Geometry (MTL741)
20. Symbolic Dynamics (MTL751)
21. Basic Ergodic Theory (MTL761)
22. Representation of Finite Groups (MTL739)
23. Abstract Harmonic Analysis (MTL 850)
24. Operator Theory (MTL742)
25. Differential Geometry (MTL737)
26. Computational Algebra and its Applications (MTL729)

Applied Maths:

1. Advanced Matrix Theory
2. Applied Numerical Analysis (MTL851)

3. Finite Elements Theory and Applications (MTL781)
4. Modern Methods for PDE (MTL792)
5. Methods of Applied Mathematics (MTL746)
6. Wavelets and Applications (MTL773)
7. Numerical Methods for PDE (MTL795)
8. Interpolation and Approximation (MTL854)
9. Boundary Elements Methods with Computer Implementation (MTL888)
10. Principles of Computer Graphics (MTL754)
11. Numerical Methods for Hyperbolic PDEs (MTL793)
12. Boundary Value Problems (MTL260)
13. Stochastic Differential Equations and Its Applications (MTL796)

Theoretical Computer Science:

1. Graph Theory (MTL768)
2. Combinatorics (MTL146)
3. Advanced Algorithms (MTL760)
4. Graph Algorithms (MTL776)
5. Parameterized Algorithms for NP-hard Problems (MTL780)
6. Fuzzy Sets and Applications (MTL717)
7. Mathematical Theory of Logic (MTL747)
8. Computational Geometry
9. Natural language Processing (MTL785)
10. Mathematical Foundation of Artificial Intelligence (MTL811)
11. Advanced Graph Theory
12. Computational Complexity
13. Computational Social Choice
14. Combinatorial Optimization (MTL770)
15. Data Mining (MTL782)
16. Data Structures for Applied Mathematics (MTL750)

Other department Electives:

- COL728 Compiler Design 3 0 3 4.5
 ELL365 Embedded Systems 3 0 0 3
 ELL715 Digital Image Processing 3 0 2 4
 ELL786 Multimedia Systems 3 0 0 3
 ELL789 Intelligent Systems 3 0 0 3
 ELL792 Computer Graphics 3 0 0 3
 ELL793 Computer Vision 3 0 0 3
 ELL884 Deep Learning for Natural Language Processing 3 0 0 3

21. Nominal Semester-wise Academic Plan

B. Tech. and M. Tech in Mathematics and Computing

Semester I

MTL100 - Calculus (3-1-0) 4
GE1 - (EE) (3-1-0) 4
GE2.1 - (COL0100 + COL0101) (0-0-2 + 1-0-1) 2.5
BS1 - (Physics) (3-0-0) 3
BSLAB1 (Physics) (0-0-4) 2
Total Credits: 15.5 + Language and Life skills

Semester II

MTL101 - Linear Algebra and Differential Equations (3-1-0) 4
MTL180 - Discrete Mathematics (3-1-0) 4
GE2.2 - (COL0102) (1-0-1) 1.5
GE3 - (Visualization (2 credits) + Product realization (2 credits)) 4
BS2 - (Chemistry) (3-0-0) 3
BSLAB2 (Chemistry) (0-0-4) 2
Total Credits: 18.5

Semester III

MTL2003 - Optimization methods and Applications (3-1-0) 4
MTL2006: Probability and Stochastic Processes (3-1-0) 4
MTL2005 - Algebra (3-1-0) 4
GE4 COL2016(Data Structures) (3-0-2) 4
ES1 (3-0-0) 3
Total Credits: 19

Semester IV

MTL2007: Numerical Methods and Computation (3-0-2) 4
MTL2042 - Analysis and Design of Algorithms (3-1-0) 4
MTL2022- Topics in Analysis (3-1-0) 4
GE5 AIL2001 (Data Science) (3-1-0) 4
HUL1 (3-0-0) 3
ES2 (2-0-0) 2
Total Credits: 21

Semester V

MTL3030: Introduction to PDE and Applications (3-1-0) 4
MTP3029 - Computational Laboratory (0-0-4) 2
FC1 (3-1-0) 4
DE1 (3-0-0) 3
HUL2 (3-0-0) 3
BS3 (Biology) (2-0-0) 2
BS3 Lab (Biology) (0-0-2) 1
Total credits: 19

Semester VI

FC2 (3-1-0) 4
FC3 (3-1-0) 4
DE2 (3-0-0) 3
BS4 (Free) (3-1-0) 3
GE6 (Free) (3-1-0) 4
HUL3 (3-0-0) 3
Total Credits: 21

Semester VII

PC1 (3-1-0) 4
PE1 (3-0-0) 3
DE3 (3-0-0) 3
DE4 (3-0-0) 3
OC1 (3-0-0) 3
SSW1 (3-0-0) 3
Total credits: 19

Semester VIII

PC2 (3-1-0) 4
PE2 (3-0-0) 3
PE3 (3-0-0) 3
OE1 (3-0-0) 3
Professional Ethics (1-0-0) 1
Cornerstone Project (0-0-6) 3
Total credits: 17

Summer Internship/Minor Project (0-0-6) 3

Semester IX

MTP1 (0-0-8) 4
OE2 (3-0-0) 3
PE4 (3-0-0) 3
SSW2 (3-0-0) 3
Teaching Practicum
Total credits: 13

Semester X

MTP2 (0-0-28) 14
Teaching Practicum
Total credits: 14

Note:

- Non-graded units and contact hours are distributed across all semesters.

22.Average Contact Hours per Faculty <i>per Week</i> , for this Programme	1.51 (Only for DC/PC and DE/PE)
23.Average Credit Students per Faculty per Semester, for this Programme	49.97 (Only for DC/PC and DE/PE)
24.If the program is a revision of an existing program, please list the major changes made.	The number of total credits has been reduced to 180 from 190. Core credits are decreased and brought down to 59. A new basket of flexible core is introduced to provide more choice to choose the flexible core courses. Tutorials and/or lab components are added in all core and flexible core courses. The cornerstone project is introduced. A course of professional ethics is brought in.
25.Please elaborate on,	
a. How has flexibility for the students increased?	Less core courses, more electives. Some freedom in selecting core courses (flexible core basket) as well.
b. How have engagement and interaction with the student increased?	More practical and tutorial components have been introduced.
c. How is hands-on learning emphasized in the program?	