Course Booklet

Minor

in

Mathematics and Computing

Applicable from Academic Year 2025-2026 Onward

Department of Mathematics

Indian Institute of Technology Guwahati

Guwahati 781039, Assam, India

Updated Version on 04.01.2026

Minor in Mathematics and Computing

Curriculum

The minor programme in mathematics is meant for the B.Tech. students of all disciplines (except B.Tech. in Mathematics and Computing) who have interest in mathematics and want to learn more than what are already covered in their basic compulsory mathematics courses. Courses like MA2091M and MA2092M will be also directly helpful for those who want to use this programme only for industry internships or industry placements. The other courses will help the students to learn mathematics apart from helping them to learn critical thinking and improve reasoning ability.

Semester	Course Title	L-T-P-C
II	MA1092M Modern Algebra	3-0-0-6
III	MA2091M Mathematical Statistics	3-0-0-6
IV	MA2092M Scientific Computing	3-0-0-6
V	MA3091M Real Analysis	3-0-0-6
VI	MA3092M Differential Geometry	3-0-0-6

List of UG Programmes or Disciplines who are **NOT eligible** for **Minor in Mathematics**		
Sl. No.	UG Programme	Justification
1	B.Des. (Bachelor of Design)	These students do not take any mathematics course in first semester and so they will not have basic knowledge required for the courses in the minor programme.
2	B.Tech. in Mathematics and Computing	UG students can opt a minor discipline which does not have huge overlap with their major discipline. These students do all these courses in their major discipline, namely, Mathematics and Computing.

Course Number & Title: **MA1092M Modern Algebra**
L-T-P-C: 3-0-0-6
Full Semester Course (Yes/No): Yes
Half Semester Course (Yes/No): No Offered During (Pre/ Post Mid-Semester): Not Applicable
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades
Kind of Proposal (New Course / Revision of Existing Course): Revision of Existing Course
Offered as (Compulsory / Elective): Compulsory
Offered to: Second Semester Opted Students from B.Tech. All Disciplines except Mathematics and Computing; B.S. in BMSE
Offered in (Monsoon/ Winter / Any): Winter
Offered by (Name of Academic Division): Mathematics
Pre-Requisite: NIL
Preamble / Objectives (Optional): *This course teaches basics of algebraic structures like, group, ring, field and also very basic properties of integers.*
Course Content/ Syllabus: Formal properties of integers, equivalence relations, congruences, Groups, group homomorphisms, subgroups, cosets, Lagrange's theorem , normal subgroups, quotient groups, permutation groups; cyclic groups, Groups actions, orbits, stabilizers, Cayley's theorem, conjugacy, class equation, Sylow's theorems and applications, Rings, ring homomorphisms, ideals, integral domains, Principal ideal domains, Euclidean domains, unique factorization domains, polynomial rings; Fields, characteristic of a field, field extensions, algebraic extensions, finite fields.
Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".

Texts: (Format: Authors, *Book Title in Italics font,* Volume/Series, Edition Number, Publisher, Year.)

1.	J. A. Gallian, *Contemporary Abstract Algebra*, Eighth Edition, Cengage India, 2019.
2.	D. S. Dummit & R. M. Foote, Abstract Algebra, Third Edition, Wiley, 2011.

References: (Format: Authors, *Book Title in Italics font,* Volume/Series, Edition Number, Publisher, Year.)

1.	I. N. Herstein, *Topics in Algebra*, Wiley, 2004.
2.	J. B. Fraleigh, *A First Course in Abstract Algebra*, Seventh Edition, Pearson, 2013.

Approval

	Committee	Meeting Number	Date of the Meeting
1.	IUPC	164, 165	15.10.2025,
2.	Senate	190, 191	16.10.2025,

Course Number & Title: **MA2091M Mathematical Statistics**

L-T-P-C: 3-0-0-6

Full Semester Course (Yes/No): Yes

Half Semester Course (Yes/No): No Offered During (Pre/ Post Mid-Semester): Not Applicable

Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades

Kind of Proposal (New Course / Revision of Existing Course): Revision of Existing Course

Offered as (Compulsory / Elective): Compulsory

Offered to: Third Semester
Opted Students from B.Tech. All Disciplines except Mathematics and Computing; B.S. in BMSE

Offered in (Monsoon/ Winter / Any): Monsoon

Offered by (Name of Academic Division): Mathematics

Pre-Requisite: NIL

Preamble / Objectives (Optional): *This course teaches both probability and statistics.*

Course Content/ Syllabus:

Probability - probability spaces, random variables and random vectors, functions of random vectors, univariate and multivariate distributions, mathematical expectations, moment generating functions, convergence in probability and in distribution and related results; Sampling distributions; Point estimation - estimators, sufficiency, completeness, minimum variance unbiased estimation, maximum likelihood estimation, method of moments, Cramer-Rao inequality, consistency; Interval estimation; Testing of hypotheses - tests and critical regions, Neymann-Pearson lemma, uniformly most powerful tests, likelihood ratio tests; Correlation and linear regression.

Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".

Texts: (Format: Authors, *Book Title in Italics font,* Volume/Series, Edition Number, Publisher, Year.)

1.	R. V. Hogg, J. W. McKean and A. T. Craig, *Introduction to Mathematical Statistics*, Eighth Edition, Pearson, 2020.
2.	B. L. S. Prakasa Rao, *A First Course in Probability and Statistics*, World Scientific/Cambridge University Press India, 2009.

References: (Format: Authors, *Book Title in Italics font,* Volume/Series, Edition Number, Publisher, Year.)

1.	V. K. Rohatgi and A. K. Saleh, *An Introduction to Probability and Statistics*, Third Edition, Wiley, 2015.
2.	G. Casella and R. L. Berger, *Statistical Inference*, Second Edition, Cengage Learning, 2006.

Approval

	Committee	Meeting Number	Date of the Meeting
1.	IUPC	164, 165	15.10.2025,
2.	Senate	190, 191	16.10.2025,

Course Number & Title: **MA2092M Scientific Computing**

L-T-P-C: 3-0-0-6

Full Semester Course (Yes/No): Yes

Half Semester Course (Yes/No): No Offered During (Pre/ Post Mid-Semester): Not Applicable

Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades

Kind of Proposal (New Course / Revision of Existing Course): Revision of Existing Course

Offered as (Compulsory / Elective): Compulsory

Offered to: Fourth Semester
Opted Students from B.Tech. All Disciplines except Mathematics and Computing; B.S. in BMSE

Offered in (Monsoon/ Winter / Any): Winter

Offered by (Name of Academic Division): Mathematics

Pre-Requisite: NIL

Preamble / Objectives (Optional): *This course teaches various numerical methods and techniques for solving nonlinear equations, differential equations, finding integrals, etc.*

Course Content/ Syllabus:

Errors; Iterative methods for nonlinear equations; Polynomial interpolation, spline interpolations; Numerical integration based on interpolation, quadrature methods, Gaussian quadrature; Initial value problems for ordinary differential equations - Euler method, Runge-Kutta methods, multi-step methods, predictor-corrector method, stability and convergence analysis; Finite difference schemes for partial differential equations - Explicit and implicit schemes; Consistency, stability and convergence; Stability analysis (matrix method and von Neumann method), Lax equivalence theorem; Finite difference schemes for initial and boundary value problems (FTCS, Backward Euler and Crank-Nicolson schemes, ADI methods, Lax Wendroff method, upwind scheme).

Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".

Texts: (Format: Authors, *Book Title in Italics font,* Volume/Series, Edition Number, Publisher, Year.)

1.	D. Kincaid and W. Cheney, *Numerical Analysis: Mathematics of Scientific Computing*, Third Edition, American Mathematical Society, 2009.
2.	G. D. Smith, *Numerical Solutions of Partial Differential Equations*, Third Edition, Clarendon Press, 1986.

References: (Format: Authors, *Book Title in Italics font,* Volume/Series, Edition Number, Publisher, Year.)

1.	K. E. Atkinson, *An Introduction to Numerical Analysis*, Second Edition, Wiley, 1989.
2.	S. D. Conte and C. de Boor, *Elementary Numerical Analysis - An Algorithmic Approach*, McGraw Hill, 1981.
3.	R. Mitchell and S. D. F. Griffiths, *The Finite Difference Methods in Partial Differential Equations*, John Wiley, 1980.

Approval

	Committee	Meeting Number	Date of the Meeting
1.	IUPC	164, 165	15.10.2025,
2.	Senate	190, 191	16.10.2025,

Course Number & Title: **MA3091M Real Analysis**			
L-T-P-C: 3-0-0-6			
Full Semester Course (Yes/No): Yes			
Half Semester Course (Yes/No): No Offered During (Pre/ Post Mid-Semester): Not Applicable			
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades			
Kind of Proposal (New Course / Revision of Existing Course): Revision of Existing Course			
Offered as (Compulsory / Elective): Compulsory			
Offered to: Fifth Semester Opted Students from B.Tech. All Disciplines except Mathematics and Computing; B.S. in BMSE			
Offered in (Monsoon/ Winter / Any): Monsoon			
Offered by (Name of Academic Division): Mathematics			
Pre-Requisite: NIL			
Preamble / Objectives (Optional): *This course teaches metric space, some parts of several variable real analysis, and measure theory and integration.*			
Course Content/ Syllabus: Metrics and norms - metric spaces, normed vector spaces, convergence in metric spaces, completeness, pointwise and uniform convergence of sequence of functions; Functions of several variables - differentiability, chain rule, Taylor's theorem, inverse function theorem, implicit function theorem; Introduction to Lebesgue measure and integral - measureable sets, measurable functions, Lebesgue integral, dominated convergence theorem, monotone convergence theorem.			
Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".			
Texts: (Format: Authors, *Book Title in Italics font,* Volume/Series, Edition Number, Publisher, Year.)			
1.	N. L. Carothers, *Real Analysis*, Cambridge University Press, 2000.		
2.	J. E. Marsden and M. J. Hoffman, *Elementary Classical Analysis*, Second Edition, W. H. Freeman, 1993.		
References: (Format: Authors, *Book Title in Italics font,* Volume/Series, Edition Number, Publisher, Year.)			
1.	M. Capinski and E. Kopp, *Measure, Integral and Probability*, Second Edition, Springer, 2007.		
Approval			
	Committee	Meeting Number	Date of the Meeting
1.	IUPC	164, 165	15.10.2025,
2.	Senate	190, 191	16.10.2025,

Course Number & Title: **MA3092M Differential Geometry**

L-T-P-C: 3-0-0-6

Full Semester Course (Yes/No): Yes

Half Semester Course (Yes/No): No Offered During (Pre/ Post Mid-Semester): Not Applicable

Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades

Kind of Proposal (New Course / Revision of Existing Course): Revision of Existing Course

Offered as (Compulsory / Elective): Compulsory

Offered to: Sixth Semester
Opted Students from B.Tech. All Disciplines except Mathematics and Computing; B.S. in BMSE

Offered in (Monsoon/ Winter / Any): Winter

Offered by (Name of Academic Division): Mathematics

Pre-Requisite: NIL

Preamble / Objectives (Optional): *This course teaches geometry of curves and surfaces.*

Course Content/ Syllabus:

Local theory of plane and space curves, curvature and torsion formulas, Serret-Frenet formulas, fundamental Theorem of space curves; Regular surfaces, change of parameters, differentiable functions, tangent plane, differential of a map; First and second fundamental form; Orientation, Gauss map and its properties, Euler's theorem on principal curvatures; Isometries, Gauss's Theorema Egregium; Parallel transport, geodesics, Gauss-Bonnet theorem and its applications to surfaces of constant curvature.

Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".

Texts: (Format: Authors, *Book Title in Italics font,* Volume/Series, Edition Number, Publisher, Year.)

1.	J. McCleary, *Geometry from a Differentiable Viewpoint*, Cambridge University Press, 1994.
2.	A. Pressley, *Elementary Differential Geometry*, Springer, 2002.

References: (Format: Authors, *Book Title in Italics font,* Volume/Series, Edition Number, Publisher, Year.)

1.	M. P. Do Carmo, *Differential Geometry of Curves and Surfaces*, Prentice Hall, 1976.

Approval

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1.	IUPC	164, 165	15.10.2025,
2.	Senate	190, 191	16.10.2025,