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UNIVERSITY OF CALCUTTA · CCF (NEP 2020) UG SYLLABUS

Mathematics Major (Honours) · Semester 6

Semester-wise syllabus · 4-Year Major · DSCC and SEC papers

What this file contains

- DSCC-13: Metric Space and Complex Analysis-I
- DSCC-14: Multivariate Calculus-II and Applications of Calculus
- DSCC-15: Numerical Analysis (Theory + Practical)
- Course structure page and question pattern

Source and note

The pages that follow are taken unchanged from the official University of Calcutta syllabus for Mathematics under the Curriculum and Credit Framework for Undergraduate Programmes (CCF, NEP 2020). PALMATHS has only selected the pages for this programme and semester and added this cover so students can find them quickly. Always check the University of Calcutta website (caluniv.ac.in) for later notifications, corrections or changes in paper options. PALMATHS is an independent coaching centre and is not part of, or endorsed by, the University of Calcutta.

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University of Calcutta



Syllabus for four-year (Eight Semester) B. Sc. Honours and Honours with Research Course with Mathematics Major

&

Mathematics as a Minor subject

and

Syllabus for three-year (Six Semester) Multidisciplinary Course with Mathematics

Under

Curriculum and Credit Framework (CCF)

Odd Semester : July to December

Even Semester : January to June

The syllabus for the 4 Year B.A./B.Sc. Honours and Honours with Research Course with Mathematics Major is effective from the academic year **2023-24**.

The syllabus for the 3 Year Multidisciplinary Course with Mathematics is effective from the academic year **2023-24**.

Semesterwise Courses at a glance

Semester	Course	Paper Code	Name of Paper	Credit	Page
ONE (I)	MAJOR	MTHM-DSCC 1	Calculus, Geometry & Vector Analysis	3TH+1TU = 4	10
	MAJOR	MTHM-SEC 1	C language with Mathematical Applications	3TH+1TU = 4	73
	MINOR	MMTH-MN1	Calculus, Geometry & Vector Analysis	3TH+1TU = 4	10
	MDC	MMTH-MDC-CC1	Calculus, Geometry & Vector Analysis	3TH+1TU = 4	10
	MDC	MMTH-SEC	C language with Mathematical Applications	3TH+1TU = 4	73
	IDC	MTHD-IDC	Mathematics in Daily Life	2TH+1TU = 3	92
TWO (II)	MAJOR	MTHM-DSCC 2	Basic Algebra	3TH+1TU=4	12
	MAJOR	MTHM-SEC 2.1 or MTHM-SEC 2.2	Python Programming and Introduction to Latex or Artificial Intelligence	3TH+1TU=4	75
	MINOR	MMTH-MN2	Basic Algebra	3TH+1TU=4	12
	MDC	MMTH-MDC-CC2	Basic Algebra	3TH+1TU=4	12
	MDC	MMTH-SEC	C language with Mathematical Applications	3TH+1TU=4	73
	IDC	MTHD-IDC	Mathematics in Daily Life	2TH+1TU=3	92
THREE (III)	MAJOR	MTHM-DSCC 3	Real Analysis	3TH+1TU=4	14
	MAJOR	MTHM-DSCC 4	Ordinary Differential equations - I & Group Theory - I	3TH+1TU=4	16
	MAJOR	MTHM-SEC 3	Linear Programming & Rectangular Games	3TH+1TU=4	78
	MINOR	MMTH-MN1	Calculus, Geometry & Vector Analysis	3TH+1TU=4	10
	MDC	MMTH-MDC-CC3	Ordinary Differential equations & Group Theory	3TH+1TU=4	80
	MDC	MMTH-SEC	C language with Mathematical Applications	3TH+1TU=4	73
	MDC	MMTH-MDC-mn1	Calculus, Geometry & Vector Analysis	3TH+1TU=4	10
	IDC	MTHD-IDC	Mathematics in Daily Life	2TH+1TU=3	92
FOUR (IV)	MAJOR	MTHM-DSCC 5	Theory of Real Functions	3TH+1TU=4	18
	MAJOR	MTHM-DSCC 6	Mechanics - I	3TH+1TU=4	20
	MAJOR	MTHM-DSCC 7	Multivariate Calculus - I & Partial Differential Equation - I	3TH+1TU=4	22
	MAJOR	MTHM-DSCC 8	Group Theory - II & Ring Theory - I	3TH+1TU=4	25
	MINOR	MMTH-MN2	Basic Algebra	3TH+1TU=4	12
	MDC	MMTH-MDC-CC4	Mechanics	3TH+1TU=4	82
	MDC	MMTH-MDC-CC5	Advanced Calculus	3TH+1TU=4	84
	MDC	MMTH-MDC-mn2	Basic Algebra	3TH+1TU=4	12
FIVE (V)	MAJOR	MTHM-DSCC 9	Probability & Statistics	3TH+1TU=4	27
	MAJOR	MTHM-DSCC 10	Ring Theory - II & Linear Algebra - I	3TH+1TU=4	29
	MAJOR	MTHM-DSCC 11	Riemann Integration & Series of Functions	3TH+1TU=4	31
	MAJOR	MTHM-DSCC 12	Mechanics - II	3TH+1TU=4	33
	MINOR	MMTH-MN3	Ordinary Differential equations & Group Theory	3TH+1TU=4	80
	MINOR	MMTH-MN4	Mechanics	3TH+1TU=4	82
	MDC	MMTH-MDC-CC6	Statistics & Numerical Analysis	3TH+1TU=4	86
	MDC	MMTH-MDC-CC7	Mathematical Methods	3TH+1TU=4	88
	MDC	MMTH-MDC-mn3	Ordinary Differential equations & Group Theory	3TH+1TU=4	80
	MDC	MMTH-MDC-mn4	Mechanics	3TH+1TU=4	82
SIX (VI)	MAJOR	MTHM-DSCC 13	Metric Space & Complex Analysis - I	3TH+1TU=4	35
	MAJOR	MTHM-DSCC 14	Multivariate Calculus - II & Applications of Calculus	3TH+1TU=4	37
	MAJOR	MTHM-DSCC 15	Numerical Analysis	3TH+1P=4	39
	MINOR	MMTH-MN3	Ordinary Differential equations & Group Theory	3TH+1TU=4	80
	MINOR	MMTH-MN4	Mechanics	3TH+1TU=4	20
	MDC	MMTH-MDC-CC7	Mathematical Methods	3TH+1TU=4	88
	MDC	MMTH-MDC-CC8	Discrete Mathematics	3TH+1TU=4	90
	MDC	MMTH-MDC-mn5	Advanced Calculus	3TH+1TU=4	84
	MDC	MMTH-MDC-mn6	Statistics & Numerical Analysis	3TH+1TU=4	86

Course Structure for
4-year B.A./B.Sc. Honours & Honours with Research, with Mathematics Major

Semester	Paper Code	Name of Paper	Credit	Page No.
I	MTHM-DSCC 1	Calculus, Geometry & Vector Analysis	3TH+1TU = 4	10
	MTHM-SEC 1	C language with Mathematical Applications	3TH+1TU = 4	73
II	MTHM-DSCC 2	Basic Algebra	3TH+1TU=4	12
	MTHM-SEC 2.1 or MTHM-SEC 2.2	Python Programming & Introduction to Latex or *Artificial Intelligence	3TH+1TU=4	75
III	MTHM-DSCC 3	Real Analysis	3TH+1TU=4	14
	MTHM-DSCC 4	Ordinary Differential equations - I & Group Theory - I	3TH+1TU=4	16
	MTHM-SEC 3	Linear Programming & Rectangular Games	3TH+1TU=4	78
IV	MTHM-DSCC 5	Theory of Real Functions	3TH+1TU=4	18
	MTHM-DSCC 6	Mechanics - I	3TH+1TU=4	20
	MTHM-DSCC 7	Multivariate Calculus–I & Partial Differential Equation - I	3TH+1TU=4	22
	MTHM-DSCC 8	Group Theory - II & Ring Theory - I	3TH+1TU=4	25
V	MTHM-DSCC 9	Probability & Statistics	3TH+1TU=4	27
	MTHM-DSCC 10	Ring Theory - II & Linear Algebra - I	3TH+1TU=4	29
	MTHM-DSCC 11	Riemann Integration & Series of Functions	3TH+1TU=4	31
	MTHM-DSCC 12	Mechanics - II	3TH+1TU=4	33
VI	MTHM-DSCC 13	Metric Space & Complex Analysis-I	3TH+1TU=4	35
	MTHM-DSCC 14	Multivariate Calculus II & Applications of Calculus	3TH+1TU=4	37
	MTHM-DSCC 15	Numerical Analysis	3TH+1P=4	39
VII	MTHM-DSCC 16	Group Theory-III & Linear Algebra-II	3TH+1TU=4	41
	MTHM-DSCC 17	Complex Analysis - II & Measure Theory - I	3TH+1TU=4	43
	MTHM-DSCC 18	Generalised functions, Integral Transforms Integral Equations	3TH+1TU=4	45
	MTHM-DSCC 19	Topology - I	3TH+1TU=4	47
	MTHM-DSCC 20	Functional Analysis - I	3TH+1TU=4	49
VIII		**Honours**		
	MTHM-DSCC 21	Ordinary Differential Equation - II & Partial Differential Equation - II	3TH+1TU=4	51
	MTHM-DSCC 22	Graph Theory	3TH+1TU=4	53
	MTHM-DSCC 23.1 or MTHM-DSCC 23.2	Mechanics - III or Measure Theory - II	3TH+1TU=4 3TH+1TU=4	55 57
	MTHM-DSCC 24.1 or MTHM-DSCC 24.2	Operations Research & Stochastic Process or Differential Geometry	3TH+1TU=4 3TH+1TU=4	59 61
	MTHM-DSCC 25.1 or MTHM-DSCC 25.2	Fluid Mechanics & Computational Mathematics or Functional analysis - II & Topology - II	3TH+1P=4 3TH+1TU=4	63 66
		Honours with Research		
	MTHM-RM1	Research Methodology - I	3TH +1Viva =4	68
	MTHM-RM2	Research Methodology - II	3TH +1Viva =4	70
		Research Internship	4	107
		Dissertation/Project	8	108

***Refer to Notification No. CSR/36/2023 and Notification No. CSR/35/2024 for the Syllabus and Question Pattern for the paper "Artificial Intelligence".**

4-yr Credit Distribution | MDC Credit Distribution | Course Overview

Major | Minor | MDC | Question Pattern

Metric Space & Complex Analysis - I

Semester : VI Credit : 4	Paper Code : MTHM-DSCC 13-TH Full Marks : 100 (Theory : 75 & Tutorial : 25)
Minimum number of classes required : 60	

4-yr Credit Distribution | MDC Credit Distribution | Course Overview

Major | Minor | MDC | Question Pattern

Course Outcome

CO1 : To understand concepts such as open balls, open sets, closed sets, bounded sets, uniform continuity, and isometries.

CO2 : To learn about convergent sequences and completeness of metric spaces.

CO3 : To learn about compactness, connectedness, and the contraction mapping principle.

CO4 : To study limits, continuity, and differentiability of functions of a complex variable.

CO5 : To understand analytic functions and elementary functions of a complex variable.

CO6 : To learn bilinear transformations and their properties.

CO7 : To study power series, including their convergence and representation of analytic functions.

CO8 : To understand properties of harmonic functions and the Milne-Thomson method.

Group A : Metric space [Marks : 45] [35 classes]

- Definition and examples of metric spaces. Open ball. Open set. Closed set defined as complement of open set. Interior point and interior of a set. Limit point and closure of a set. Boundary point and boundary of a set. Properties of interior, closure and boundary. Bounded set and diameter of a set. Distance between two sets. Subspace of a metric space.
- Continuous mappings. Uniform continuity. Isometry.
- Convergent sequence. Sequential criterion of continuity. Cauchy sequence. Every convergent sequence is Cauchy and bounded, but the converse is not true. Completeness. Cantor's intersection theorem. $\mathbb{R}$ is a complete metric space. $\mathbb{Q}$ is not complete. Completion of metric spaces. Nowhere dense set, Baire Category theorem.
- Compactness, Sequential compactness. Concept of Lebesgue number. Lebesgue covering lemma. Equivalence of compactness and sequential compactness of a metric space. Heine-Borel theorem in $\mathbb{R}$. Total boundedness and its properties. A metric space is compact if and only if the space is complete and totally bounded (statement only).
- Concept of connectedness and some examples of connected metric spaces, connected subsets of $\mathbb{R}, \mathbb{C}$.
- Contraction mappings, Banach Fixed point Theorem and its applications.

Group B : Complex Analysis - I [Marks : 30] [25 classes]

- Stereographic projection. Regions in the complex plane. Limits, limits involving the point at infinity. Continuity of functions of a complex variable.

- Derivatives, differentiation formulae, Cauchy-Riemann equations, sufficient conditions for differentiability. Analytic function, entire function, exponential function, logarithmic function, trigonometric functions, hyperbolic functions.
- Möbius transformation and its properties.
- Power series : Cauchy-Hadamard theorem. Determination of radius of convergence. Uniform and absolute convergence of power series. Analytic functions represented by power series. Uniqueness of power series.
- Harmonic functions and its properties, Milne Thompson method.

References

[1] P. K. Jain and K. Ahmad, Metric Spaces, Narosa Publishing House.

[2] S. Kumaresan, Topology of Metric Spaces, 2nd Ed., Narosa Publishing House, 2011.

[3] M. N. Mukherjee, Elements of Metric Space, Academic Publisher.

[4] S. Shirali & H. L. Vasudeva, Metric Spaces, Springer Verlag, London, 2006.

[5] R. P. Agarwal, K. Perera and S. Pinelas; An Introduction To Complex Analysis, Springer-Verlag, 2011.

[6] L. V. Ahlfors, Complex Analysis(Third Edition), McGraw-Hill, New York, 1979.

[7] J. Bak and D. J. Newman, Complex Analysis, 2nd Ed., Undergraduate Texts in Mathematics, Springer-Verlag New York, Inc., NewYork, 1997.

[8] J. W. Brown and R. V. Churchill, Complex Variables and Applications, 8th Ed., McGraw– Hill International Edition, 2009.

[9] J. B. Conway, Functions of One Complex Variable; Narosa Publishing, New Delhi, 1973.

[10] T. W. Gamelin, Complex Analysis; Springer International Edition, 2001.

[11] R. E. Greene & S. G. Krantz, Function Theory of One Complex Variable, Third Edition, Graduate Studies in Mathematics, Volume 40, AMS, 2006.

[12] S. Lang, Complex Analysis (Fourth edition), Springer-Verlag, 1999.

[13] R. Narasimhan, Complex Analysis in one variable; Birkhauser, Boston, 1984.

[14] S. Ponnusamy, Foundations of Complex Analysis, second edition; Narosa Publishing, New Delhi, 2005.

[15] H. A. Priestly, Introduction to complex analysis, 2nd Ed., Oxford University Press, 2003.

[16] E. M. Stein and R. Shakarchi, Complex Analysis, Princeton University Press, Princeton, New Jersey, 2003.

[17] D. G. Zill & P. D. Shanahan, A First Course in Complex Analysis, Jones & Bartlett Publishers Inc., 2003.

4-yr Credit Distribution | MDC Credit Distribution | Course Overview

Major | Minor | MDC | Question Pattern

Multivariate Calculus - II & Applications of Calculus

Semester : VI	Paper Code : MTHM-DSCC 14-TH
Credit : 4	Full Marks : 100 (Theory : 75 & Tutorial : 25)
Minimum number of classes required : 60	

4-yr Credit Distribution | MDC Credit Distribution | Course Overview
Major | Minor | MDC | Question Pattern

Course Outcome

CO1 : To understand the continuity and differentiability of functions of several variables.

CO2 : To learn how to compute double and triple integrals.

CO3 : To study the divergence and curl of vector fields and apply line integrals.

CO4 : To understand and apply Green's Theorem, Stokes' Theorem, and the Divergence Theorem.

CO5 : To learn curvature, concavity, points of inflection, envelopes, rectilinear asymptotes, curve tracing.

Group A : Multivariate Calculus - II [Marks : 45] [35 classes]

- Functions from $\mathbb{R}^n$ $(n > 1)$ to $\mathbb{R}^m$ $(m \geq 1)$. Continuity and differentiability of such functions. Jacobian matrix. A function $f : \mathbb{R}^n \to \mathbb{R}^m$ is differentiable if and only if its every component is differentiable,
- Inverse function theorem (statement only), implicit function theorem (statement only).
- Level sets, tangent spaces.
- Definition of vector field, divergence and curl, the Laplacian, vector identities.
- **Integrals over curves and surfaces :** Line integrals, fundamental theorem for line integrals - simply connected domains, conservative fields, the potential function, irrotational fields, independence of path, oriented surfaces, parametrised surfaces, area of a surface, surface integrals, volume integrals.
- **Integral theorems of vector analysis :** Green's theorem in plane, Stoke's theorem, Gauss' Divergence theorem. (Emphasis should be given on problem solving instead of rigorous theoretical treatment)

Group B : Applications of Calculus [Marks : 30] [25 classes]

- Tangents and normals, pedal equation of a curve, pedal of a curve.
- Curvature (Cartesian, Polar and pedal form). Curvature at the origin - Newton's theorem. Radius of curvature, Centre of curvature, evolute of a curve.
- Rectilinear asymptotes of a curve (Cartesian & parametric form only).
- Concavity, Convexity and points of inflection of a curve.
- Envelopes (Cartesian coordinates only and up to two parameters) of families of straight lines and curves.
- Singular points – nodes, cusps.
- Curve tracing in Cartesian and polar coordinates of standard curves.

References

[1] T. Apostol, Mathematical Analysis, Narosa Publishing House, 1969.

[2] H. R. Beyer, Calculus and Analysis, Wiley, 2010.

[3] R. Courant and F. John, Introduction to Calculus and Analysis, Vol II, Springer-Verlag, 1998.

[4] H. F. Davis and A. D. Snider, Introduction to Vector analysis, Universal Book Stall, 6th Ed, 1992.

[5] E. Marsden, A. J. Tromba and A. Weinstein, Basic Multivariable Calculus, Springer (SIE), 2005.

[6] W. Rudin, Principles of Mathematical Analysis, Tata McGraw-Hill.

[7] M. Spivak, Calculus on Manifolds, Westview Press; 1998.

[8] J. Stewart, Multivariable Calculus, Concepts and Contexts, 2nd Ed., Brooks/Cole, Thomson Learning, USA, 2001.

[9] M. J. Strauss, G. L. Bradley and K. J. Smith, Calculus, 3rd Ed., Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2007.

[10] G. B. Thomas and R. L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005.

4-yr Credit Distribution | MDC Credit Distribution | Course Overview

Major | Minor | MDC | Question Pattern

Numerical Analysis

Semester : VI	Paper Code : MTHM-DSCC 15-TH&P
Credit : 4	Full Marks : 100 (Theory : 75 & Practical : 25)
Minimum number of classes required : Theory 45 + Practical 15	

4-yr Credit Distribution | MDC Credit Distribution | Course Overview

Major | Minor | MDC | Question Pattern

Course Outcome

CO1 : To understand polynomial approximation, interpolation, and numerical methods for differentiation and integration.

CO2 : To learn various techniques for solving transcendental and polynomial equations.

CO3 : To study methods for solving systems of linear algebraic equations.

CO4 : To learn techniques for matrix inversion and the Power Method for finding the dominant eigenvalue and eigenvector.

CO5 : To study numerical methods for solving ordinary differential equations.

- **Representation of numbers and errors in Numerical Analysis:** Machine Numbers - floating point and fixed point, Sources of Errors, Rounding of numbers, Absolute and Relative Error, Significant digits and Error Propagation in machine arithmetic operations. Numerical Algorithms - stability and convergence.
- **Approximation:** Classes of approximating functions, polynomial approximation, The Weierstrass' polynomial approximation theorem (statement only).
- **Interpolation:** Prerequisite -Divided difference:Definition of n-th divided difference $f[x_0, x_1, ..., x_n]$ and simple properties. Finite difference operators Δ, ∇. E, μ, δ - definitions and simple relations among them. Principle of interpolation, polynomial interpolation, existence and uniqueness of interpolating polynomial. Lagrange's interpolation polynomial, Newton's divided difference interpolation polynomial, Error in polynomial interpolation. Interpolation based on evenly spaced points: Difference table, Newton's forward and backward interpolation formulae, error terms. Central Interpolation: Statements of Stirling's and Bessel's formulae. Different interpolation zones, Error estimation. Statement of Hermite's interpolation formula, its uniqueness and error (only statement).
- **Numerical differentiation:** Basic principle, Methods based on Lagrange's, Newton's forward and backward interpolation formulae.
- **Numerical Integration:** Newton-Cotes formula (deduction of closed type), Trapezoidal rule and Simpson's $\frac{1}{3}$ rule - composite form. Statement of Weddle's rule and composite Weddle's rule. Error formulae (only statements), Degree of precision.
- Numerical solution of non-linear equations: Bisection method, Secant method, Regula-falsi method, fixed point iteration, Newton-Raphson method. Condition of convergence (if any), Order of convergence, Rate of convergence of these methods. Advantages and disadvantages of the methods.
- Numerical solution of system of linear equations: Direct methods-Gaussian elimination and Gauss-Jordan methods, partial pivoting strategies, operational count. Iterative methods- Gauss-Jacobi method, Gauss-Seidel method and their convergence analysis, Advantages and disadvantages of the methods.
- **Matrix inversion** by Gaussian elimination.
- **Algebraic eigenvalue problem:** The Power method.

- **Numerical solution of initial value problems for ordinary differential equations:** Single-step difference equation methods–idea of local truncation error, consistency and convergence. Euler's method, Modified Euler method, Higher order Taylor methods, Runge-Kutta method of order four, Picard's method of successive approximation.

Problems for Practical (using C programming language)

1. Interpolation by Lagrange's formula.
2. Interpolation by Newton's forward formula.
3. Interpolation by Newton's backward formula.
4. Integration by composite Trapezoidal rule.
5. Integration by composite Simpson's $\frac{1}{3}$ rule.
6. Integration by composite Weddle's rule.
7. Solution of equation by Bisection method.
8. Solution of equation by Newton-Raphson method.
9. Solution of equation by Regula-falsi method.
10. Solution of a system of linear equations by Gaussian elimination method.
11. Solution of a system of linear equations by Gauss-Seidel method.
12. Matrix inversion by Gaussian elimination method.
13. Finding largest eigen-pair of a matrix Power method.
14. Solution of ordinary differential equation by modified Euler method.
15. Solution of ordinary differential equation by fourth order Runge-Kutta method.

References

[1] U. M. Ascher and C. Greif, A First Course in Numerical Methods, 7th Ed., PHI Learning Private Limited, 2013.

[2] K. E. Atkinson, An Introduction to Numerical Analysis, John Wiley & Sons, 1978.

[3] B. Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, India, 2007.

[4] R. L. Burden and J. D. Faires, Numerical Analysis, 9th Ed., Thomson.

[5] C. F. Gerald and P. O. Wheatley, Applied Numerical Analysis, Pearson Education, India, 2008.

[6] A. Gupta and S. Bose, An Introduction to Numerical Analysis, Academic Publishers, 2009.

[7] M. K. Jain, S. R. K. Iyengar and R. K. Jain, Numerical Methods for Scientific and Engineering Computation, 6th Ed., New age International Publisher, India, 2007.

[8] J. H. Mathews and K. D. Fink, Numerical Methods using Matlab, 4th Ed., PHI Learning Private Limited, 2012.

[9] J. B. Scarborough, Numerical Mathematical Analysis, John Hopkins University Press, 1966.

4-yr Credit Distribution | MDC Credit Distribution | Course Overview

Major | Minor | MDC | Question Pattern

MTHM-DSCC 10-TH	**Ring Theory-II & Linear Algebra-I**
Group A : **Ring Theory - II** (Marks : 40)	(a) Short answer type questions: 5 questions are to be attempted out of 8 questions each carrying 3 marks. Each question may have further parts. (b) Long answer type questions: 5 questions are to be attempted out of 8 questions each carrying 5 marks. Each question may have further parts.
Group B : **Linear Algebra - I** (Marks : 35)	(a) Short answer type questions: 5 questions are to be attempted out of 8 questions each carrying 3 marks. Each question may have further parts. (b) Long answer type questions: 4 questions are to be attempted out of 7 questions each carrying 5 marks. Each question may have further parts.
MTHM-DSCC 11-TH	**Riemann Integration & Series of functions**
Group A : **Riemann Integration** (Marks : 50)	(a) Short answer type questions: 5 questions are to be attempted out of 8 questions each carrying 3 marks. Each question may have further parts. (b) Long answer type questions: 7 questions are to be attempted out of 11 questions each carrying 5 marks. Each question may have further parts.
Group B : Series of functions (Marks : 25)	5 questions are to be attempted out of 8 questions each carrying 5 marks. Each question may have further parts.
MTHM-DSCC 12-TH	**Mechanics-II**
Group A : **Analytical Statics** (Marks : 28)	4 questions are to be attempted out of 7 questions each carrying 7 marks. Each question may have further parts.
Group B : Dynamics of particles (Marks : 15)	1 question of Particle Dynamics is to be attempted from 3 questions carrying 8 marks and 1 question of Dynamics of a system of particles is to be attempted from 3 questions carrying 7 marks. Each question may have further parts.
Group C : Dynamics of rigid body (Marks : 32)	4 questions are to be attempted out of 7 questions each carrying 8 marks. Each question may have further parts with decomposition (2+6), (3+5), (4+4) etc.

MTHM-DSCC 13-TH	**Metric Space & Complex Analysis-I**
Group A : **Metric Space** (Marks : 45)	(a) Short answer type questions: 5 questions are to be attempted out of 7 questions each carrying 3 marks. Each question may have further parts. (b) Long answer type questions: 6 questions are to be attempted out of 8 questions each carrying 5 marks. Each question may have further parts.
Group B : **Complex Analysis - I** (Marks : 30)	6 questions are to be attempted out of 9 questions each carrying 5 marks. Each question may have further parts.
MTHM-DSCC 14-TH	**Multivariate Calculus & Application of Calculus**
Group A : **Multivariate Calculus** (Marks : 50)	(a) Short answer type questions: 5 questions are to be attempted out of 8 questions each carrying 3 marks. Each question may have further parts. (b) Long answer type questions: 5 questions are to be attempted out of 8 questions each carrying 7 marks. Each question may have further parts.
Group B : **Application of Calculus** (Marks : 25)	5 questions are to be attempted out of 8 questions each carrying 5 marks. Each question may have further parts.
MTHM-DSCC 15-TH	**Numerical Analysis**
(Marks : 75)	(a) Short answer type questions: 5 questions are to be attempted out of 8 questions each carrying 3 marks. Each question may have further parts. (b) Long answer type questions: (i) 6 questions are to be attempted out of 9 questions each carrying 5 marks. These questions will be set from the topics Representation of numbers and errors in Numerical Analysis, Approximation, Interpolation, Numerical Differentiation and Numerical Integration. Each question may have further parts. (ii) 6 questions are to be attempted out of 9 questions each carrying 5 marks. These questions will be set from the topics Numerical solution of linear and nonlinear equations, matrix inversion, algebraic Eigen value problem and Numerical solution of initial value problems for ordinary differential equations. Each question may have further parts.