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UNIVERSITY OF CALCUTTA · CCF (NEP 2020) UG SYLLABUS

Mathematics Major (Honours) · Semester 4

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

What this file contains

- DSCC-5: Theory of Real Functions
- DSCC-6: Mechanics-I
- DSCC-7: Multivariate Calculus-I and PDE-I
- DSCC-8: Group Theory-II and Ring Theory-I
- 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

Theory of Real Functions

Semester : IV	Paper Code : MTHM-DSCC 5-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 develop a thorough understanding of limits and continuity of functions.

CO2 : To acquire knowledge of bounded functions, types of discontinuities, and uniform continuity.

CO3 : To study Rolle's Theorem, the Mean Value Theorems, and Taylor's Theorem, along with their applications, including the existence of local extrema of a function on an interval.

Group A : Limit & Continuity of functions [Marks : 45] [36 classes]

- Limits of functions ($\epsilon - \delta$ approach), sequential criterion for limits. Cauchy's criterion of existence of limit (statement only). Limit theorems, one sided limits. Infinite limits and limits at infinity. Important limits like $\frac{\sin x}{x}$, $\frac{\log(1+x)}{x}$, $\frac{a^x-1}{x}$ $(a > 0)$ as $x \to 0$.
- Continuity of a function on an interval and at an isolated point. Sequential criteria for continuity. Concept of oscillation of a function at a point. A function is continuous at x if and only if its oscillation at x is zero. Familiarity with the figures of some well known functions : $y = x^a\,(a = 2, 3, \frac{1}{2}, -1)$, $|x|$, $[x]$, $\sin x$, $\cos x$, $\tan x$, $\log x$, e^x. Algebra of continuous functions as a consequence of algebra of limits. Continuity of composite functions. Examples of continuous functions. Continuity of a function at a point does not necessarily imply the continuity in some neighbourhood of that point.
- Bounded functions. Neighbourhood properties of continuous functions regarding boundedness and maintenance of same sign. Continuous function on a closed interval $[a, b]$ is bounded and attains its bounds therein. Bolzano's theorem, Intermediate value theorem.
- Discontinuity of functions, types of discontinuity. Step functions. Piecewise continuity. Monotone functions. Monotone functions can have only jump discontinuity. Monotone functions can have atmost countably many points of discontinuity. Monotone bijective function from an interval to an interval is continuous and its inverse is also continuous.
- Uniform continuity. Functions continuous on a closed and bounded interval is uniformly continuous. A necessary and sufficient condition under which a continuous function on a bounded open interval I will be uniformly continuous on I. A sufficient condition under which a continuous function on an unbounded open interval I will be uniformly continuous on I(statement only). Lipschitz condition and uniform continuity.

Group B : Differentiability of functions [Marks : 30] [24 classes]

- Darboux theorem, Rolle's theorem, Mean value theorems of Lagrange and Cauchy — as an application of Rolle's theorem. Taylor's theorem on closed and bounded interval with Lagrange's and Cauchy's form of remainder. Expansion of e^x, $\log(1+x)$, $(1+x)^m$, $\sin x$, $\cos x$ with their range of validity (assuming relevant theorems). Application of Taylor's theorem to inequalities.

- Point of local extremum (maximum, minimum) of a function in an interval. Sufficient condition for the existence of a local maximum/minimum of a function at a point (statement only). Application of the principle of maximum/minimum in geometrical problems.

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

Major | Minor | MDC | Question Pattern

Mechanics - I

Semester : IV	Paper Code : MTHM-DSCC 6-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 principles of forces, including resultant forces, resultant couples, and coplanar force systems.

CO2 : To study rectilinear motion and simple harmonic motion.

CO3 : To develop the ability to solve problems related to work, power, and energy.

CO4 : To study impulsive forces and the collision of elastic bodies.

CO5 : To develop the ability to solve problems involving the motion of a particle in two dimensions.

Statics - I

- Idea about Physical Independence, Principle of Forces, Principle of transmissibility of a force, Principle of action and reaction and Principle of parallelogram law of forces, Composition and resolution of forces, Concurrent forces in a plane, Composition and resolution of forces, Equilibrium of three forces acting at a point, Lami's theorem, Moment of a force about a point and an axis, Varignon's theorem, Resultant forces and resultant couple, Coplanar forces: Its reduction and conditions of equilibrium. [8 classes]

Particle Dynamics - I

- Law of gravitation, Concept of inertial frame, Newton's laws of motion, Concept of equation of motion of a particle, Rectilinear motion in a given force field, Simple harmonic motion, damped and forced oscillations, Concept of resonance, motion of elastic strings, Rectilinear motion under uniform gravity, Rectilinear motion in a resisting medium where resistance is proportional to velocity. [18 classes]
- Work, power, energy, Conservative forces, Potential energy, Existence of Potential energy function, Conservative field and Principle of conservation of energy.
  . [6 classes]
- Impulse of a force, Impulsive force, Principle of conservation of linear momentum, Collision of elastic bodies: Coefficient of restitution, Newton's law of collision, Direct and oblique impact of a smooth sphere with a fixed plane, Direct and oblique impact of two smooth spheres. [8 classes]
- Motion of a particle in a plane (2D Cartesian): Angular velocity and angular acceleration, Expressions for components of velocity and acceleration, Tangential and normal components of velocity and acceleration, Motion of a projectile in a resisting medium under gravity. Motion of a particle in a plane (2D Polar): Expressions for components of velocity and acceleration, Central forces and central orbits, Motion under inverse square law, Times of describing the arcs of central orbits for a particle moving under inverse square law, Kepler's laws on planetary motion, Motion of artificial satellites, Tangential and normal components of velocity and acceleration, Constrained motion of a particle on smooth curve. [20 classes]

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[1] D. Chernilevski, E. Lavrova and V. Romanov, Mechanics for Engineers, MIR Publishers, 1984.

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[3] R. Douglas Gregory, Classical mechanics, Cambridge University Press, 2006.

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

Major | Minor | MDC | Question Pattern

Multivariate Calculus - I and Partial Differential Equations - I

Semester : IV	Paper Code : MTHM-DSCC 7-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 learn the concepts of limits, continuity, differentiability, and partial derivatives of functions of two or more variables.

CO2 : To learn how to compute directional derivatives, gradients, tangent planes, and higher-order partial derivatives.

CO3 : To study homogeneous functions and implicit functions.

CO4 : To determine extrema of functions of two variables and evaluate multiple and repeated integrals.

CO5 : To understand the classification of partial differential equations (PDEs), and learn methods for solving quasilinear and semilinear equations, including Charpit's general method for nonlinear first-order PDEs.

Group A : Multivariate Calculus - I [Marks : 60] [50 classes]

- Concept of neighbourhood of a point in $\mathbb{R}^n$ $(n > 1)$, interior point, limit point, open set and closed set in $\mathbb{R}^n$ $(n > 1)$.
- Functions from R^n $(n > 1)$ to $\mathbb{R}$, limit and continuity of functions of two or more variables. Partial derivatives, related mean value theorem, sufficient condition for continuity. Differentiability, sufficient condition for differentiability.
- Directional derivatives, the gradient, maximal and normal property of the gradient, tangent planes.
- Partial derivatives of higher order, sufficient condition for equality of mixed order partial derivatives (Schwarz's and Young's theorems), differentials of higher orders, total differential for function of functions, Chain rule for one and two independent parameters.
- Euler's theorem on homogeneous functions of two and three variables, change of variables – simple problems. Taylor's theorem of two variables.
- Implicit functions, statement of the existence theorem, derivative of implicit functions – simple problems. Jacobians – elementary properties (statements only) and simple problems.
- Extrema of functions of two variables, constrained optimization problems, method of Lagrangian multipliers for two variables.
- Multiple integral: Concept of upper sum, lower sum, upper integral, lower integral and double integral (no rigorous treatment is needed). Statement of existence theorem for continuous functions.
- Iterated or repeated integral, Statement of Fubini's theorem. Change of order of integration. Areas of plane regions.
- Triple integral. Cylindrical and spherical coordinates.

- Change of variables in double integrals and triple integrals. Transformation of double and triple integrals (problems only).
- Determination of volume and surface area by multiple integrals (problems only).
- Differentiation under the integral sign, Leibnitz's rule (problems only).

Group B : Partial Differential Equations - I [Marks : 15] [10 classes]

- Definition, order and degree of PDE, classification of PDE (linear, quasilinear, semilinear and nonlinear), derivation of partial differential equations (by elimination of arbitrary constants/functions). Examples of PDEs that are central to the study of different problems in science and technology (e.g. Heat equation, Wave equation, Laplace equation, KDV equation).
- First order equations: Solution of quasi linear equations, Lagrange's method of solution. Cauchy problem for quasi linear PDE, The method of characteristics, method of characteristics for linear, semilinear equations. Solution via method of characteristics. Local existence and uniqueness theorem (statement and examples).
- Nonlinear first order partial differential equations, Charpit's general method of solution.

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

Major | Minor | MDC | Question Pattern

Group Theory - II & Ring Theory - I

Semester : IV	Paper Code : MTHM-DSCC 8-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 normal subgroups, quotient groups, group homomorphisms, and properties of isomorphisms.

CO2 : To learn about automorphisms, external and internal direct products, and Abelian groups.

CO3 : To acquire knowledge of ring theory, including subrings, integral domains, fields, subfields, ideals, ring homomorphisms, and congruence relations on rings.

Group A : Group theory - II [Marks : 40] [32 classes]

- Normal subgroup and its properties. Quotient group. Group homomorphisms, properties of homomorphisms, correspondence theorem and one-one correspondence between the set of all normal subgroups of a group and the set of all congruences on that group, Cayley's theorem, properties of isomorphisms. First, Second and Third isomorphism theorems.
- Automorphism, inner automorphism, automorphism groups, automorphism groups of finite and infinite cyclic groups, applications of factor groups to automorphism groups.
- External direct product and its properties, the group of units modulo n as an external direct product, internal direct product, converse of Lagrange's theorem for finite abelian group, Cauchy's theorem for finite abelian group.

Group B : Ring theory- I [Marks : 35] [28 classes]

- Definition and examples of rings, properties of rings, subrings, necessary and sufficient condition for a nonempty subset of a ring to be a subring, integral domains and fields, subfield, necessary and sufficient condition for a nonempty subset of a field to be a subfield, characteristic of a ring. Ideal, ideal generated by a subset of a ring, factor rings, operations on ideals, prime and maximal ideals. Ring homomorphisms, properties of ring homomorphisms. First, second and third isomorphism theorems, Correspondence theorem, congruence on rings, one-one correspondence between the set of ideals and the set of all congruences on a ring.

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

Major | Minor | MDC | Question Pattern

MTHM-DSCC 3-TH	**Real Analysis**
Group A : (Marks : 30)	(a) Short answer type questions: 3 questions are to be attempted out of 5 questions each carrying 3 marks. (b) Long answer type questions: 3 questions are to be attempted out of 5 questions each carrying 7 marks.
Group B : (Marks : 35)	(a) Short answer type questions: 4 questions are to be attempted out of 6 questions each carrying 2 marks. (b) Long answer type questions: 3 questions are to be attempted out of 5 questions each carrying 5 marks.
Group C : (Marks : 10)	2 questions are to be attempted out of 4 questions each carrying 5 marks.
MTHM-DSCC 4-TH	**Ordinary Differential Equations-I and Group Theory-I**
Group A : Ordinary Differential Equations (Marks : 45)	9 questions are to be attempted out of 14 questions each carrying 5 marks.
Group B : Group Theory (Marks : 30)	6 questions are to be attempted out of 9 questions each carrying 5 marks.
MTHM-SEC 3-TH	**Linear Programming & Rectangular Games**
(Marks : 75)	(a) Short answer type questions: 5 questions are to be attempted out of 8 questions each carrying 3 marks. (b) Long answer type questions: (i) 5 questions are to be attempted out of 8 questions each carrying 6 marks. (questions are to be set from first three groups, starting from LPP formulation to Two-phase method)] (ii) 5 questions are to be attempted out of 8 questions each carrying 6 marks. (questions are to be set from last three groups, starting from Duality theory to Game problems)
MTHM-DSCC 5-TH	**Theory of Real Functions**
Group A : Limit & Continuity of functions (Marks : 45)	(a) Short answer type questions: 5 questions are to be attempted out of 8 questions each carrying 3 marks. (b) Long answer type questions: 6 questions are to be attempted out of 9 questions each carrying 5 marks.
Group B : Differentiability of functions (Marks : 30)	(a) Short answer type questions: 4 questions are to be attempted out of 6 questions each carrying 3 marks. (b) Long answer type questions: 3 questions are to be attempted out of 5 questions each carrying 6 marks.

MTHM-DSCC 6-TH	**Mechanics-I**
(Marks : 75)	(a) Short answer type questions: 6 questions are to be attempted out of 9 questions each carrying 2 marks. (b) Long answer type questions: (i) 7 questions are to be attempted out of 10 questions each carrying 6 marks. (2 questions from Statics, 4 questions from Law of gravitation portion, 2 questions from Work, Power, Energy portion and 2 questions from Impulse of a force portion are to be set.) (ii) 3 questions are to be attempted out of 5 questions each carrying 7 marks. (questions are to be set from Motion of a particle in a plane)
MTHM-DSCC 7-TH	**Multivariate Calculus-I and Partial Differential Equations-I**
Group A : Multivariate Calculus - I (Marks : 60)	(a) Short answer type questions: 5 questions are to be attempted out of 8 questions each carrying 2 marks. (b) Long answer type questions: 5 questions are to be attempted out of 8 questions each carrying 10 marks.
Group B : Partial Differential Equations - I (Marks : 15)	3 questions are to be attempted out of 5 questions each carrying 5 marks.
MTHM-DSCC 8-TH	**Group Theory-II and Ring Theory-I**
Group A : Group Theory - II (Marks : 40)	8 questions are to be attempted out of 11 questions each carrying 5 marks.
Group B : Ring Theory - I (Marks : 35)	7 questions are to be attempted out of 10 questions each carrying 5 marks.
MTHM-DSCC 9-TH	**Probability and Statistics**
Group A : Probability (Marks : 45)	(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 6 marks. Each question may have further parts.
Group B : Statistics (Marks : 30)	(a) Short answer type questions: 3 questions are to be attempted out of 5 questions each carrying 3 marks. Each question may have further parts. (b) Long answer type questions: 3 questions are to be attempted out of 5 questions each carrying 7 marks. Each question may have further parts.