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UNIVERSITY OF CALCUTTA · CCF (NEP 2020) UG SYLLABUS

Mathematics Major (Honours) · Semester 5

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

What this file contains

- DSCC-9: Probability and Statistics
- DSCC-10: Ring Theory-II and Linear Algebra-I
- DSCC-11: Riemann Integration and Series of Functions
- DSCC-12: Mechanics-II
- 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

Probability & Statistics

Semester : V	Paper Code : MTHM-DSCC 9-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 random experiments, probability axioms, conditional probability, and joint probability.

CO2 : To study distribution functions of random variables, their properties, and probability mass and density functions.

CO3 : To learn about joint distributions of discrete and continuous random variables and their properties.

CO4 : To understand populations and samples, sampling distributions, and sample characteristics.

CO5 : To learn methods for estimating parameters, including the method of maximum likelihood.

CO6 : To acquire knowledge of bivariate frequency distributions and the construction of confidence intervals.

CO7 : To study hypothesis testing, including Type I and Type II errors.

Group A : Probability [Marks : 45] [35 classes]

- Random experiment, equally likely outcomes, Sample space, Events, σ-field, Probability as a set function, Probability axioms, Probability space. Conditional probability. The multiplication rule, The law of total probability and Bayes' theorem. Independence of events and trials. Joint probability, Bernoulli trial and binomial law, Poisson approximation of binomial law.
- Real random variables (discrete and continuous), distribution function of a random variable. Properties of distribution function. Probability mass / density functions and properties. Discrete distributions: Binomial, Poisson. Continuous distributions: Uniform, Normal, Exponential. Transformation of a random variable. Mathematical expectation, Mean, Variance, Moments, Quantiles, Skewness, Kurtosis, Median, Mode. Moment generating function, Characteristic function.
- Multivariate random variables, Joint distribution of discrete and continuous random variables and their properties, Joint probability mass / density functions, Marginal and Conditional distributions, Independent random variables. Conditional expectations, Expectation of function of two random variables, Moments, Covariance, Correlation coefficient, linear regression for two variables, regression curves. Bivariate normal distribution. Distribution of the sums of independent discrete / continuous random variables, Product of two random variables. Chi-square, t and F-distributions.
- Chebyshev's inequality, Convergence in Probability, Statement of weak law of large numbers and strong law of large numbers. Statement of Central limit theorem. Statement of De Moivre Laplace limit theorem, Normal approximation of the binomial distribution. Statement of Uniqueness theorem of Characteristic functions.

Group B : Statistics [Marks : 30] [25 classes]

- Populations and Samples, Random Sample, Sampling and Sampling Distributions, Distribution of the sample, Simple random sampling with and without replacement, Sample Statistic, Sample characteristics - Sample moments, Sample variance, Sampling from the normal distributions.
- Estimation of parameters: Point estimation, Interval Estimation, Mean-squared error, Properties of good estimators - unbiasedness, consistency, sufficiency, Minimum-Variance Unbiased Estimator (MVUE), Unbiased estimators for expectation and variance;
- Method of Maximum likelihood: The maximum likelihood principle, Likelihood function and Loglikelihood function, Maximum likelihood estimators for discrete and continuous models, Properties of maximum likelihood estimators.
- Bivariate frequency Distribution: Bivariate data, Correlation and covariance, Linear Regression, principle of least squares and fitting of polynomials and exponential curves.
- Confidence intervals: General principle. Confidence intervals for the mean of Normal population — for known variance and unknown variance; Confidence interval for variance of Normal population.
- Statistical hypothesis: Simple and composite hypotheses, null hypotheses, alternative hypotheses, one sided and two-sided hypotheses, The critical region and test statistic, type I error and type II error, level of significance, Power function of a test, most powerful test, Neyman-Pearson lemma (Statement only), Likelihood-ratio tests. Tests on the Mean of a Normal Distribution, Variance Known. Tests on the Mean of a Normal Distribution, Variance unknown; Tests on a Population Proportion, Chi-square test for goodness of fit.

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

Major | Minor | MDC | Question Pattern

Ring Theory - II & Linear Algebra - I

Semester : V	Paper Code : MTHM-DSCC 10-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 principal ideal domains, principal ideal rings, and Euclidean domains.

CO2 : To acquire knowledge of polynomial rings, factorization domains, ring embeddings, quotient fields, regular rings, and ideals in regular rings.

CO3 : To study vector spaces, subspaces, quotient spaces, linear span, basis and dimension, full-rank factorization, and rank inequalities.

CO4 : To learn about linear transformations, the algebra of linear transformations, isomorphisms, eigenvalues, and eigenvectors.

Group A : Ring Theory - II [Marks : 40] [32 classes]

- Principal ideal ring, principal ideal domain, prime element, irreducible element, greatest common divisor (gcd), least common multiple (lcm), expression of gcd, examples of a ring R and a pair of elements $a, b \in R$ such that $\gcd(a, b)$ does not exist, Euclidean domain, relation between Euclidean domain and principal ideal domain.
- Polynomial rings, division algorithm and consequences, factorization domain, unique factorization domain; irreducible and prime elements in a unique factorization domain; relation between principal ideal domain, unique factorization domain, factorization domain and integral domain; polynomial ring over unique factorization domain, Eisenstein criterion and unique factorization in $\mathbb{Z}[x]$.
- Ring embedding and quotient field, regular rings and their examples, properties of regular ring, ideals in regular rings.

Group B : Linear Algebra - I [Marks : 35] [28 classes]

- Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces. Subspaces of $\mathbb{R}^n$, dimension of subspaces of $\mathbb{R}^n$. Geometric significance of a subspace upto $\mathbb{R}^3$. Four fundamental subspaces associated with a matrix. The dimension of the solution space of $Ax = 0$ and the rank of A. Full rank factorization, rank inequalities, Sylvester's rank inequality.
- Linear transformations, null space, range, rank and nullity of a linear transformation, matrix representation of a linear transformation, change of coordinate matrix. Algebra of linear transformations. Isomorphisms. Isomorphism theorems, invertibility and isomorphisms. Eigen values, eigen vectors and characteristic equation of a matrix (over $\mathbb{C}$). Cayley-Hamilton theorem and its use in finding the inverse of a matrix.

References

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

Major | Minor | MDC | Question Pattern

Riemann Integration & Series of Functions

Semester : V Credit : 4	Paper Code : MTHM-DSCC 11-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 Riemann's definition of integrability, necessary and sufficient conditions for Riemann integrability, and the properties of Riemann integrable functions.

CO2 : To study improper integrals, Cauchy's principal value of improper integrals, and convergence tests.

CO3 : To learn about sequences of functions, including pointwise and uniform convergence, and the boundedness, continuity, integrability, and differentiability of the limit function under uniform convergence.

CO4 : To study series of functions, including pointwise and uniform convergence, and the boundedness, continuity, integrability, and differentiability of a series under uniform convergence.

CO5 : To learn power series and Fourier series and their applications.

Group A : Riemann integration [Marks : 50] [40 classes]

Riemann integration [32 classes]

- Partition of a closed and bounded interval and refinement of partition. Upper Darboux sum $U(P, f)$ and lower Darboux sum $L(P, f)$ and associated results. Upper integral and lower integral. Darboux's theorem. Darboux's definition of integration over a closed and bounded interval. Riemann's definition of integrability. Equivalence with Darboux definition of integrability (statement only). Necessary and sufficient condition for Riemann integrability.
- Concept of negligible set (or zero set) defined as a set covered by countable number of open intervals sum of whose lengths is arbitrary small. Examples of negligible sets : any subset of a negligible set, finite set, countable union of negligible sets. A bounded function on closed and bounded interval is Riemann integrable if and only if the set of points of discontinuity is negligible (Statement only). Example of Riemann integrable functions.
- Integrability of sum, scalar multiple, product, quotient, modulus of Riemann integrable functions. Properties of Riemann integrable functions arising from the above results.
- Function defined by definite integral $\int_a^x f(t)dt$ and its properties. Antiderivative (primitive or indefinite integral).
- Fundamental theorem of Integral Calculus. First Mean Value theorem of integral calculus. Weierstrass & Bonnet's form of second mean value theorems (statement only).

Improper integral [8 classes]

- Range of integration, finite or infinite. Necessary and sufficient condition for convergence of improper integral in both cases. Cauchy's principal value of improper integral.

- Tests of convergence : Comparison and μ-test. Absolute and non-absolute convergence and inter-relations. Statement of Abel's and Dirichlet's test for convergence of the integral of product of two functions.
- Convergence and working knowledge of Beta and Gamma function and their interrelation (statement only) [$\Gamma(n)\Gamma(1-n) = \frac{\pi}{\sin n\pi}, 0 < n < 1$, to be assumed]. Computation of the integrals $\int_0^{\pi/2} \sin^n x dx$, $\int_0^{\pi/2} \cos^n x dx$, $\int_0^{\pi/2} \tan^n x dx$ when they exist (using Beta and Gamma function).

Group B : Series of functions [Marks : 25] [20 classes]

- Sequence of functions defined on a set, Pointwise and uniform convergence. Cauchy criterion of uniform convergence. Weirstrass' M-test. Boundedness, continuity, integrability and differentiability of the limit function of a sequence of functions in case of uniform convergence.
- Series of functions defined on a set, Pointwise and uniform convergence. Cauchy criterion of uniform convergence. Weierstrass' M-test. Passage to the limit term by term. Boundedness, continuity, integrability, differentiability of a series of functions in case of uniform convergence. Dini's Theorem.
- Power series : Fundamental theorem of power series. Cauchy-Hadamard theorem. Determination of radius of convergence. Uniform and absolute convergence of power series. Properties of sum function. Differentiation and integration of power series. Abel's limit theorems. Uniqueness of power series having sum function.
- Fourier series : Trigonometric series. Statement of sufficient condition for a trigonometric series to be a Fourier series. Fourier coefficients for periodic functions defined on $[-\pi, \pi]$. Statement of Dirichlet's condition of convergence. Statement of Fourier's theorem on sum of Fourier series.

References

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

[2] S. K. Berberian, a First Course in Real Analysis, Springer Verlag, New York, 1994.

[3] R. G. Bartle and D. R. Sherbert, Introduction to Real Analysis, 3rd Ed., John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2002.

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[5] G. G. Bilodeau , P. R. Thie, G.E. Keough, An Introduction to Analysis, 2nd Ed., Jones & Bartlett, 2010.

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

Major | Minor | MDC | Question Pattern

Mechanics - II

Semester : V	Paper Code : MTHM-DSCC 12-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 the ability to solve problems related to friction and virtual work.

CO2 : To understand the concepts of stable, unstable, and neutral equilibrium.

CO3 : To learn how to determine the equations of equilibrium for an arbitrary system of forces in three dimensions.

CO4 : To solve problems involving the motion of a particle on a rough curve and the motion of particles with varying mass.

CO5 : To learn the dynamics of systems of particles and rigid bodies in detail.

Statics - II

- **Friction:** Laws of static friction, Limiting friction, Angle of friction and Cone of friction. Positions of equilibrium of a particle constrained to rest on a (i) rough plane curve and (ii) rough surface. [4 classes]
- **Virtual work:** Degrees of Freedom, Constraints, Virtual Displacement, Virtual Work, Workless Constraints, Forces which do not appear in the equation of virtual work, Forces which appear in the equation of virtual work, Principle of virtual work for any system of coplanar forces acting on a rigid body and deduction of conditions of equilibrium from the Principle of virtual work. [6 classes]
- **Stable and unstable equilibrium:** Field of forces, Conservative field, Potential energy of a system, Concepts of Stable, Unstable and Neutral equilibrium, Energy test of stability for a system having one degree of freedom, Stability when gravity is the only external force, Condition of stability of equilibrium of two heavy bodies resting one upon another, the bodies being rough enough to prevent sliding. [6 classes]
- **Arbitrary force system in three dimensions:** Axis of a couple, Resultant of any number of couples acting on a rigid body, Reduction of a system of forces acting on a rigid body, Equilibrium equations, Reduction to wrench intensity and pitch of a wrench, Poinsot's central axis, Equation of the central axis of a given system of forces, Invariants of a given system of forces. [6 classes]

Dynamics of a Particle - II

- Stability of nearly circular orbits, Disturbed orbits, Motion of a particle on rough curve, Expressions for components of velocity and acceleration referred to a set of rotating axes, Motion of a particle of varying mass including problems of mass addition (Rain-drop Problem) and mass reduction (Rocket Problem). . [8 classes]
- Dynamics of a system of particles: General theorems (Emphasis should be given on theoretical discussion only in this part): Configuration of a mechanical system and its degrees of freedom, External forces, Internal forces and two assumptions connected with these forces, Mass of a system, Centre of mass of a system and its motion, Linear momentum of a system and principle of conservation of linear momentum, Angular momentum of a system about a point and an axis, Angular momentum principle about the centre of mass, Conservation of angular momentum about a point and an axis, Kinetic energy (K.E.) of a system, The energy principle and Conservation of energy. [4 classes]

Dynamics of a rigid body

- Vector angular velocity and its existence, particle velocities in a rigid body. [2 classes]
- Moments and Products of Inertia, Moment of inertia of a body about any line through the origin of a coordinate frame, Radius of gyration, Equimomental systems, Principal axis and Momental ellipsoid, theorems of parallel and perpendicular axes (statements only). [4 classes]
- **General motion:** Deduction of the equations: $M\frac{d\vec{V}}{dt} = \vec{F}$, $\frac{d\vec{L_G}}{dt} = \vec{K_G}$ from linear and angular momentum principle, Deductions of equations of motions from D'Alembert's Principle, Independence of the motion of centre of inertia and the motion relative to the centre of inertia, Angular momentum of a rigid body and the kinetic energy of a rigid body rotating about a fixed axis, Motion of a rigid body about a fixed axis, Compound pendulum, Interchangeability of the point of suspension and centre of oscillation. [10 classes]
- **Motion of a rigid body in two dimensions:** Equations of motion of a rigid body in two dimensions in the form $M\frac{dV_x}{dt} = F_x$, $M\frac{dV_y}{dt} = F_y$, $I\frac{d\omega}{dt} = K_G$. Expressions for K.E. and angular momentum about the origin, Condition of pure rolling and sliding. [6 classes]
- **Motion under impulsive forces:** Equation of motion for impulsive forces for two dimensions, Statements of the conservation of linear and angular momentum. Problems of impulse applied to a free rod and a rod constrained to rotate about a fixed axis. [4 classes]

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[7] S. L. Loney, An Elementary Treatise on Statics, Cambridge University Press, 1917 (2nd Edition).

[8] A. S. Ramsey, Dynamics (Part I & II), CBS Publishers, 2002 (2nd Edition).

[9] J. L. Synge and B.A. Griffith, Principles of Mechanics, McGraw-Hill, 1959 (3rd Edition).

[10] S. Timoshenko and D. H. Young, Engineering Mechanics, McGraw-Hill, 2017 (5th Edition).

[11] S. T. Thornton and J. B. Marion, Classical Dynamics of Particles and Systems, Cengage Learning, 2017 (5th Edition).

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

Major | Minor | MDC | Question Pattern

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.

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.