

BOARD OF STUDIES

MATHEMATICS

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Shri Agrasen Kanya P.G. College
Varanasi
(An Autonomous College)



Syllabus of the Subject

Mathematics

For First Three Years of Under-Graduate (UG) Programme

As per guidelines of Common Minimum Syllabus prepared by Department of Higher Education, Uttar Pradesh Government according to the National Education Policy- 2020 (NEP-2020).

w.e.f. the Session 2021-2022)

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SEMESTER WISE TITLES OF THE PAPER IN UG MATHEMATICS COURSE

YEAR	SEMESTER	COURSE CODE	PAPER TITLE	THEORY/PRACTICAL	CREDIT
CERTIFICATE COURSE IN APPLIED MATHEMATICS					
FIRST YEAR	I	B030101T	Differential Calculus & Integral Calculus	THEORY	4
		B030102P	PRACTICAL	PRACTICAL	2
	II	B030201T	Matrices and Differential Equations & Geometry	THEORY	6
DIPLOMA IN MATHEMATICS					
SECOND YEAR	III	B030301T	Algebra & Mathematical Methods	THEORY	6
	IV	B030401T	Differential Equation & Mechanic	THEORY	6
DEGREE IN MATHEMATICS					
THIRD YEAR	V	B030501T	Group and Ring Theory & Linear Algebra	THEORY	5
		B030502T	Any One of The Following (i) Number Theory & Game Theory (ii) Graph Theory & Discrete Mathematics (iii) Differential Geometry & Tensor Analysis	THEORY	5
	VI	B030601T	Metric Space & Complex Analysis	THEORY	4
		B030602T	Numerical Analysis & Operations Research	THEORY	4
		B030603P	PRACTICAL	PRACTICAL	2



PROPOSED STRUCTURE OF UG MATHEMATICS SYLLABUS AS PER NEP 2020 GUIDELINES

GENERAL OVERVIEW

B.A./B.Sc. I										
PROGRAMME	YEAR	SEMESTER (15 Weeks)	PAPER	CREDIT	PERIODS Per Week	PERIODS (HOURS) Per Semester	PAPER TITLE	UNIT (Periods Per Semester)	PREREQUISITE	ELECTIVE (See Other Faculty)
CERTIFICATE COURSE IN APPLIED MATHEMATICS	FIRST YEAR	SEMESTER - I	Paper-I	4	4	4x 15= 60	Differential Calculus & Integral Calculus Part A: Differential Calculus Part B: Integral Calculus	Part A Unit I (9) Unit II (7) Unit III (7) Unit IV (7) Part B Unit V (9) Unit VI (7) Unit VII (7) Unit VIII (7)	Mathematics in 12 th	Engg and Tech (UG), Chemistry/Biochemistry/ Life Sciences(UG), Economics(GPG), Commercial(UG), BBA/BFA, B Sc (C, S)
			Paper-II Practical	2	2 Lab Periods(2 Hours Each)	2x2x 15= 60	Practical (Practicals to be done using Mathematica /MATLAB /Maple /Scilab/Maxima etc.)		Mathematics in 12 th	Engg and Tech (UG), B Sc (C, S)
			Paper-1	6	6	6 x 15= 90	Matrices and Differential Equations & Geometry Part A: Matrices and Differential Equations Part B: Geometry	Part A Unit I (12) Unit II (11) Unit III (11) Unit IV (11) Part B Unit V (12) Unit VI (11) Unit VII (11) Unit VIII (11)	Mathematics in 12 th	Engg and Tech (UG), B Sc (C, S)

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B.A./B.Sc. II

PROGRAMME	YEAR	SEMESTER (15 Weeks)	PAPER	CREDIT	PERIODS Per Week	PERIODS (HOURS) Per Semester	PAPER TITLE	UNIT (Periods Per Semester)	PREREQUISITE	ELECTIVE (For Other Faculty)
DIPLOMA IN MATHEMATICS SECOND YEAR		SEMESTER - III	Paper-1	6	6	6 x 15 = 90	Algebra & Mathematical Methods Part A: Algebra Part B: Mathematical Methods	Part A Unit I (12) Unit II (11) Unit III (11) Unit IV (11) Part B Unit V (12) Unit VI (11) Unit VII (11) Unit VIII (11)	Certificate Course in Applied Mathematics	Engg. and Tech (UG), B.Sc.(C.S.)
		SEMESTER - IV	Paper-1	6	6	6 x 15 = 90	Differential Equation & Mechanics Part A: Differential Equation Part B: Mechanics	Part A Unit I (12) Unit II (11) Unit III (11) Unit IV (11) Part B Unit V (12) Unit VI (11) Unit VII (11) Unit VIII (11)	Certificate Course in Applied Mathematics	Engg and Tech (UG), Economics(UG-PG), B.Sc (C.S.) Engineering and Technology (UG), Science (Physics-UG)

UG MATHEMATICS

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B.A./B.Sc. III

PROGRAMME	YEAR	SEMESTER (15 Weeks)	PAPER	CREDIT	PERIODS Per Week	PERIODS (HOURS) Per Semester	PAPER TITLE	UNIT (Periods Per Semester)	PREREQUISITE	ELECTIVE (For Other Faculty)
DEGREE IN MATHEMATICS THIRD YEAR	YEAR	SEMESTER - V	Paper-1	5	5	5x 15= 75	Group and Ring Theory & Linear Algebra Part A: Group and Ring Theory Part B: Linear Algebra	Part A Unit I (10) Unit II (10) Unit III (9) Unit IV (9) Part B Unit V (10) Unit VI (9) Unit VII (9) Unit VIII (9)	Certificate Course in Applied Mathematics	Engg. and Tech. (UG), Economics(UG/PG), B.Sc.(C.S.)
			Paper-2	5	5	5x 15= 75	(i) Number Theory & Game Theory Part A: Number Theory Part B: Game Theory	Part A Unit I (10) Unit II (9) Unit III (9) Unit IV (9) Part B Unit V (10) Unit VI (10) Unit VII (9) Unit VIII (9)	Diploma in Mathematics	Engg. and Tech (UG), BCA, B.Sc.(C.S.)
							(ii) Graph Theory & Discrete Mathematics Part A: Graph Theory Part B: Discrete Mathematics	Part A Unit I (10) Unit II (9) Unit III (9) Unit IV (9) Part B Unit V (10) Unit VI (10) Unit VII (9) Unit VIII (9)	Diploma in Mathematics	Engg. and Tech. (UG), B.Sc.(C.S.)
							(iii) Differential Geometry & Tensor Analysis Part A: Differential Geometry Part B: Tensor Analysis	Part A Unit I (10) Unit II (9) Unit III (9) Unit IV (9) Part B Unit V (10) Unit VI (10) Unit VII (9) Unit VIII (9)	Diploma in Mathematics	Engg. and Tech. (UG), B.Sc.(C.S.)

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SEMESTER - VI	Paper-1	4	4	4 x 15 = 60	Metric Space & Complex Analysis Part A: Metric Space Part B: Complex Analysis	Part A Unit I (8) Unit II (8) Unit III (7) Unit IV (7) Part B Unit V (8) Unit VI (8) Unit VII (7) Unit VIII (7)	Diploma in Mathematics	Engg. and Tech. (UG), B.Sc. (C.S.)
	Paper-2	4	4	4 x 15 = 60	Numerical Analysis & Operations Research Part A: Numerical Analysis Part B: Operations Research	Part A Unit I (8) Unit II (8) Unit III (7) Unit IV (7) Part B Unit V (8) Unit VI (8) Unit VII (7) Unit VIII (7)	Diploma in Mathematics	Engg. and Tech. (UG), Economics (UG/PG), BBA/BCA, B.Sc. (C.S.)
	Paper-III Practical	2	2 Lab Periods (2 Hours Each)	2x2x 15 = 60	Practical (Practicals to be done using Mathematica /MATLAB /Maple /Scilab/Maxima etc.)		Diploma in Mathematics	Engg. and Tech. (UG), B.Sc. (C.S.)

Programme Outcome/ Programme Specific Outcome

Programme Outcome:

- PO1: It is to give foundation knowledge for the students to understand basics of mathematics including applied aspect for the same.
- PO2: It is to develop enhanced quantitative skills and pursuing higher mathematics and research as well.
- PO3: Students will be able to develop solution oriented approach towards various issues related to their environment.
- PO4: Students will become employable in various govt. and private sectors
- PO5: Scientific temper in general and mathematical temper in particular will be developed in students.

Programme Specific Outcome:

- PSO1: Student should be able to possess recall basic idea about mathematics which can be displayed by them.
- PSO2: Student should have adequate exposure to many aspects of mathematical sciences.
- PSO3: Student is equipped with mathematical modeling ability, critical mathematical thinking, and problem solving skills etc.
- PSO4: Student should be able to apply their skills and knowledge in various fields of studies including, science, engineering, commerce and management etc.

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B.A. /B.Sc. I (MATHEMATICS)

Detailed Syllabus For

CERTIFICATE COURSE

IN

APPLIED MATHEMATICS

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B.A./B.Sc. I (SEMESTER-I) PAPER-I Differential Calculus & Integral Calculus

Programme Certificate Class: B.A./B.Sc.	Year: First	Semester: First
Course Code: B030101T		Subject: Mathematics
Course Title: Differential Calculus & Integral Calculus		
Course Outcomes:		
CO1: The programme outcome is to give foundation knowledge for the students to understand basics of mathematics including applied aspect for developed, advanced quantitative skills and pursuing higher mathematics and research as well.		
CO2: By the time students complete the course they will have wide ranging application of the subject and have the knowledge of real valued functions such as sequence and series. They will also be able to know about convergence of sequences and series. Also, they have knowledge about curves, arc length and evolute and trace curve in polar, Cartesian as well as parametric curves.		
CO3: The main objective of the course is to equip the student with necessary analytic and technical skills. By applying the principles of integral he learns to solve a variety of practical problems in science and engineering.		
CO4: The student is equipped with standard concepts and tools at an intermediate to advanced level that will serve him well towards taking more advanced level course in mathematics.		
Credits: 4	Course Compulsory / Elective	
Max. Marks: 25/75	Min. Passing Marks:	
Total No. of Lectures/Tutorials/Practical (in hours per week): 1:1:1: 4:4:4		
Part- A		
Differential Calculus		
Unit	Topics	No. of Lectures
I	Introduction to Indian ancient Mathematics and Mathematicians should be included under Continuous Internal Evaluation (CIE). Definition of a sequence, theorems on limits of sequences, bounded and monotonic sequences, Cauchy's convergence criterion, Cauchy sequence, limit superior and limit inferior of a sequence, subsequences, Series of non-negative terms, convergence and divergence, Comparison tests, Cauchy's integral test, Ratio tests, Root test, Raabe's logarithmic test, de Morgan and Bertrand's tests, alternating series, Leibnitz's theorem, absolute and conditional convergence.	9
II	Limit, continuity and differentiability of function of single variables, Cauchy's definition, Heine's definition, equivalence of definitions of Cauchy and Heine, Uniform continuity, Borel's theorem, boundedness theorem, Weierstrass's theorem, Intermediate value theorem, extreme value theorem, Darboux's intermediate value theorem for derivatives, Chain rule, indeterminate forms.	7
III	Rolle's theorem, Lagrange and Cauchy Mean value theorems, mean value theorems of higher order, Taylor's theorem with various forms of remainders, Successive differentiation, Leibnitz theorem, Maclaurin's and Taylor's series, Partial differentiation, Euler's theorem on homogeneous function.	7
IV	Tangent and normals, Asymptotes, Curvature, Envelope and evolutes, Tests for concavity and convexity, Points of inflection, Multiple points, Parametric representation of curves and tracing of parametric curves, Tracing of curves in Cartesian and Polar forms.	7

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Part-B
Integral Calculus

Unit	Topics	No. of Lectures
V	Definite integrals as limit of the sum, Riemann integral, Integrability of continuous and monotonic functions, Fundamental theorem of integral calculus, Mean value theorems of integral calculus, Differentiation under the sign of Integration.	9
VI	Improper integrals, their classification and convergence, Comparison test, μ -test, Abel's test, Dirichlet's test, quotient test, Beta and Gamma functions.	7
VII	Rectification, Volumes and Surfaces of Solid of revolution, Pappus theorem, Multiple integrals, change of order of double integration, Dirichlet's theorem, Liouville's theorem for multiple integrals.	7
VIII	Vector Differentiation, Gradient, Divergence and Curl, Normal on a surface, Directional Derivative, Vector Integration, Theorems of Gauss, Green, Stokes and related problems.	7

Suggested Readings (Part- A Differential Calculus):

1. R.G. Bartle & D.R. Sherbert, Introduction to Real Analysis, John Wiley & Sons
2. T.M. Apostol, Calculus Vol. I, John Wiley & Sons Inc.
3. S. Balachandra Rao & C. K. Shantha, Differential Calculus, New Age Publication.
4. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc., 2002.
5. G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2007.
6. Suggestive digital platforms web links: NPTEL/SWAYAM/MOOCs
7. Course Books published in Hindi may be prescribed by the Universities.

Suggested Readings (Part-B Integral Calculus):

1. T.M. Apostol, Calculus Vol. II, John Wiley Publication
2. Shanti Narayan & Dr. P.K. Mittal, Integral Calculus, S.Chand
3. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
4. Suggestive digital platforms web links: NPTEL/SWAYAM/MOOCs
5. Course Books published in Hindi may be prescribed by the Universities.

This course can be opted as an elective by the students of following subjects: Engg. and Tech. (UG), Chemistry/Biochemistry/Life Sciences(UG), Economics(UG/PG), Commerce(UG), BBA/BCA, B.Sc.(C.S.)

Suggested Continuous Evaluation Methods: Max. Marks: 25

SN	Assessment Type	Max. Marks
1	Class Tests	10
2	Online Quizzes/ Objective Tests	5
3	Presentation	5
4	Assignment (Introduction to Indian ancient Mathematics and Mathematicians).	5

Course prerequisites: To study this course, a student must have subject Mathematics in class 12th

Suggested equivalent online courses:

Further Suggestions:

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B.A./B.Sc. I (SEMESTER-I) Paper-II Practical

Programme: Certificate Class: B.A./B.Sc.	Year: First	Semester: First
Subject: Mathematics		
Course Code: B030102P	Course Title: Practical	
<p>Course outcomes:</p> <p>CO1: The main objective of the course is to equip the student to plot the different graph and solve the different types of equations by plotting the graph using different computer software such as Mathematica /MATLAB /Maple /Scilab/Maxima etc.</p> <p>CO2. After completion of this course student would be able to know the convergence of sequences through plotting, verify Bolzano-Weierstrass theorem through plotting the sequence, Cauchy's root test by plotting n^k roots and Ratio test by plotting the ratio of n^k and $(n+1)^k$ term.</p> <p>CO3. Student would be able to plot Complex numbers and their representations, Operations like addition, subtraction, Multiplication, Division, Modulus and Graphical representation of polar form.</p> <p>CO4: Student would be able to perform following task of matrix as Addition, Multiplication, Inverse, Transpose, Determinant, Rank, Eigenvectors, Eigenvalues, Characteristic equation and verification of the Cayley-Hamilton theorem, Solving the systems of linear equations.</p>		
Credits: 2	Core Compulsory / Elective	
Max. Marks: 25+75	Min. Passing Marks:	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 0-0-4		
Unit	Topics	No. of Lectures
	<p>Practical / Lab work to be performed in Computer Lab. List of the practicals to be done using Mathematica /MATLAB /Maple /Scilab/Maxima etc.</p> <p>1. Plotting the graphs of the following functions:</p> <p>(i) ax</p> <p>(ii) $[x]$ (greatest integer function)</p> <p>(iii) x^{2n}; $n \in \mathbb{N}$</p> <p>(iv) x^{2n-1}; $n \in \mathbb{N}$</p> <p>(v) $\frac{1}{x^{2n-1}}$; $n \in \mathbb{N}$</p> <p>(vi) $\frac{1}{x^{2n}}$; $n \in \mathbb{N}$</p> <p>(vii) $\sqrt{ax+b}$, $ax+b$, $c \pm ax+b$</p> <p>(ix) $\frac{ x }{x}$, $\sin\left(\frac{1}{x}\right)$, $x \sin\left(\frac{1}{x}\right)$, e^x, e^{-x} for $x \neq 0$.</p> <p>(x) e^{ax+b}, $\log(ax+b)$, $\frac{1}{ax+b}$, $\sin(ax+b)$, $\cos(ax+b)$, $\sin(ax+b)$, $\cos(ax+b)$.</p> <p>Observe and discuss the effect of changes in the real constants a and b on the graphs.</p> <p>(2) By plotting the graph find the solution of the equation $x = e^x$, $x^2 + 1 = e^x$, $1 - x^2 = e^x$, $x = \log_{10}(x)$, $\cos(x) = x$, $\sin(x) = x$, $\cos(y) = \cos(x)$, $\sin(y) = \sin(x)$ etc</p> <p>(3) Plotting the graphs of polynomial of degree 2,3, 4 and 5, and their first and second derivatives.</p>	

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- (4) Sketching parametric curves, e.g., Trochoid, Cycloid, Epicycloid and Hypocycloid etc.
- (5) Tracing of conic in Cartesian coordinates.
- (6) Graph of circular and hyperbolic functions.
- (7) Obtaining surface of revolution of curves.
- (8) Complex numbers and their representations, Operations like addition, Multiplication, Division, Modulus. Graphical representation of polar form.
- (9) Find numbers between two real numbers and plotting of finite and infinite subset of \mathbb{R} .
- (10) Matrix Operations: Addition, Multiplication, Inverse, Transpose, Determinant, Rank, Eigenvectors, Eigenvalues, Characteristic equation and verification of the Cayley-Hamilton theorem, Solving the systems of linear equations.
- (11) Study the convergence of sequences through plotting.
- (12) Verify Bolzano-Weierstrass theorem through plotting of sequences and hence identify convergent subsequences from the plot.
- (13) Study the convergence/divergence of infinite series by plotting their sequences of partial sum.
- (14) Cauchy's root test by plotting n -th roots.
- (15) Ratio test by plotting the ratio of n -th and $(n + 1)$ -th term.

Suggested Readings

This course can be opted as an elective by the students of following subjects: Engg. and Tech. (UG), Chemistry/Biochemistry/Life Sciences(UG), Economics(UG/PG), Commerce(UG), BBA/BCA, B.Sc.(C.S.)

Suggested Continuous Evaluation Methods: Max. Marks: 25

SN	Assessment Type	Max. Marks
1	Class Tests	10
2	Online Quizzes/ Objective Tests	5
3	Presentation	5
4	Assignment	5

Course prerequisites: To study this course, a student must have subject Mathematics in class 12th

Suggested equivalent online courses:

Further Suggestions:


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B.A./B.Sc. I (SEMESTER-II) PAPER-I Matrices and Differential Equations & Geometry

Programme: Certificate Class: B.A./B.Sc.	Year: First	Semester: Second
Subject: Mathematics		
Course Code: B0302011	Course Title: Matrices and Differential Equations & Geometry	
Course outcomes:		
CO1: The subjects of the course are designed in such a way that they focus on developing mathematical skills in algebra, calculus and analysis and give in depth knowledge of geometry, calculus, algebra and other theories.		
CO2: The student will be able to find the rank, eigen values of matrices and study the linear homogeneous and non-homogeneous equations. The course in differential equation intends to develop problem solving skills for solving various types of differential equation and geometrical meaning of differential equation.		
CO3: The subjects learn and visualize the fundamental ideas about coordinate geometry and learn to describe some of the surface by using analytical geometry.		
CO4: On successful completion of the course students have gained knowledge about regular geometrical figures and their properties. They have the foundation for higher course in Geometry.		
Credits: 6	Core Compulsory / Elective	
Max. Marks: 25+75	Min. Passing Marks:	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 6-0-0		
PART-A		
Matrices and Differential Equations		
Unit	Topics	No. of Lectures
I	Types of Matrices, Elementary operations on Matrices, Rank of a Matrix, Echelon form of a Matrix, Normal form of a Matrix, Inverse of a Matrix by elementary operations, System of linear homogeneous and non-homogeneous equations, Theorems on consistency of a system of linear equations.	12
II	Eigen values, Eigen vectors and characteristic equation of a matrix, Caley-Hamilton theorem and its use in finding inverse of a matrix, Complex functions and separation into real and imaginary parts, Exponential and Logarithmic functions Inverse trigonometric and hyperbolic functions.	11
III	Formation of differential equations, Geometrical meaning of a differential equation, Equation of first order and first degree, Equation in which the variables are separable, Homogeneous equations, Exact differential equations and equations reducible to the exact form, Linear equations.	11
IV	First order higher degree equations solvable for x, y, p, Clairaut's equation and singular solutions, orthogonal trajectories, Linear differential equation of order greater than one with constant coefficients, Cauchy- Euler form.	11



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**PART-B
Geometry**

Unit	Topics	No. of Lectures
V	General equation of second degree, System of conics, Tracing of conics, Confocal conics, Polar equation of conics and its properties.	12
VI	Three-Dimensional Coordinates, Projection and Direction Cosine, Plane (Cartesian and vector form), Straight line in three dimension.	11
VII	Sphere, Cone and Cylinder.	11
VIII	Central conicoids, Paraboloids, Plane section of conicoids, Generating lines, Confocal conicoids, Reduction of second degree equations.	11

Suggested Readings (PART-A Matrices and Differential Equations):

1. Stephen H. Friedberg, A.J Insel & L.E. Spence, Linear Algebra, Person
2. B. Rai, D.P. Choudhary & H. J. Freedman, A Course in Differential Equations, Narosa
3. D.A. Murray, Introductory Course in Differential Equations, Orient Longman
4. Suggested digital platform: NPTEL/SWAYAM/MOOCs
5. Course Books published in Hindi may be prescribed by the Universities.

Suggested Readings (Part-B Geometry):

1. Robert J.T Bell, Elementary Treatise on Coordinate Geometry of three dimensions, Macmillan India Ltd.
2. P.R. Vittal, Analytical Geometry 2d & 3D, Pearson.
3. S.L. Loney, The Elements of Coordinate Geometry, McMillan and Company, London.
4. R.J.T. Bill, Elementary Treatise on Coordinate Geometry of Three Dimensions, McMillan India Ltd., 1994.
5. Suggested digital platform: NPTEL/SWAYAM/MOOCs
6. Course Books published in Hindi may be prescribed by the Universities.

This course can be opted as an elective by the students of following subjects: Engg. and Tech. (UG), Economics(UG/PG), Commerce(UG), BBA/BCA, B.Sc.(C.S.)

Suggested Continuous Evaluation Methods: Max. Marks: 25

SN	Assessment Type	Max. Marks
1	Class Tests	10
2	Online Quizzes/ Objective Tests	5
3	Presentation	5
4	Assignment	5

Course prerequisites: To study this course, a student must have subject Mathematics in class 12th

Suggested equivalent online courses:

Further Suggestions:



B.A. /B.Sc. II (MATHEMATICS)

Detailed Syllabus For

DIPLOMA IN MATHEMATICS

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B.A./B.Sc.II (SEMESTER-III) PAPER-I Algebra & Mathematical Methods

Programme: Diploma	Year: Second	Semester: Third
Class: B.A./B.Sc.		
Subject: Mathematics		
Course Code: B0303011	Course Title: Algebra & Mathematical Methods	
<p>Course outcomes:</p> <p>CO1: Group theory is one of the building blocks of modern algebra. Objective of this course is to introduce students to basic concepts of Group, Ring theory and their properties.</p> <p>CO2: A student learning this course gets a concept of Group, Ring, Integral Domain and their properties. This course will lead the student to basic course in advanced mathematics and Algebra.</p> <p>CO3: The course gives emphasis to enhance students' knowledge of functions of two variables, Laplace Transforms, Fourier Series.</p> <p>CO4: On successful completion of the course students should have knowledge about higher different mathematical methods and will help him in going for higher studies and research.</p>		
Credits: 6	Core Compulsory / Elective	
Max. Marks: 25+75	Min. Passing Marks:	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 6-0-0		
Part- A		
Algebra		
Unit	Topics	No. of Lectures
I	<p>Introduction to Indian ancient Mathematics and Mathematicians should be included under Continuous Internal Evaluation (CIE).</p> <p>Equivalence relations and partitions, Congruence modulo n, Definition of a group with examples and simple properties, Subgroups, Generators of a group, Cyclic groups.</p>	12
II	<p>Permutation groups, Even and odd permutations, The alternating group, Cayley's theorem, Direct products, Coset decomposition, Lagrange's theorem and its consequences, Fermat and Euler theorems</p>	11
III	<p>Normal subgroups, Quotient groups, Homomorphism and isomorphism, Fundamental theorem of homomorphism, Theorems on isomorphism.</p>	11
IV	<p>Rings, Subrings, Integral domains and fields, Characteristic of a ring, Ideal and quotient rings, Ring homomorphism, Field of quotient of an integral domain.</p>	11

**Part- B
Mathematical Methods**

Unit	Topics	No. of Lectures
V	Limit and Continuity of functions of two variables, Differentiation of function of two variables, Necessary and sufficient condition for differentiability of functions two variables, Schwarz's and Young theorem, Taylor's theorem for functions of two variables with examples, Maxima and minima for functions of two variables, Lagrange multiplier method, Jacobians.	12
VI	Existence theorems for Laplace transforms, Linearity of Laplace transform and their properties, Laplace transform of the derivatives and integrals of a function, Convolution theorem, inverse Laplace transforms, Solution of the differential equations using Laplace transforms.	11
VII	Fourier series, Fourier expansion of piecewise monotonic functions, Half and full range expansions, Fourier transforms (finite and infinite), Fourier integral.	11
VIII	Calculus of variations-Variational problems with fixed boundaries- Euler's equation for functionals containing first order derivative and one independent variable, Extremals, Functionals dependent on higher order derivatives, Functionals dependent on more than one independent variable, Variational problems in parametric form.	11

Suggested Readings(Part-A Algebra):

1. J.B. Fraleigh, A first course in Abstract Algebra, Addison-weley
2. I. N. Herstein, Topics in Algebra, John Wiley & Sons
3. Suggested digital platform: NPTEL/SWAYAM/MOOCs
4. Course Books published in Hindi may be prescribed by the Universities.

Suggested Readings (Part- B Mathematical Methods):

1. T.M. Apostol, Mathematical Analysis, Person
2. G.F. Simmons, Differential Equations with Application and Historical Notes, Tata -McGrawHill
3. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
4. Suggested digital platform:NPTEL/SWAYAM/MOOCs
5. Course Books published in Hindi may be prescribed by the Universities.

This course can be opted as an elective by the students of following subjects: Engg. and Tech. (UG), B.Sc.(C.S.)

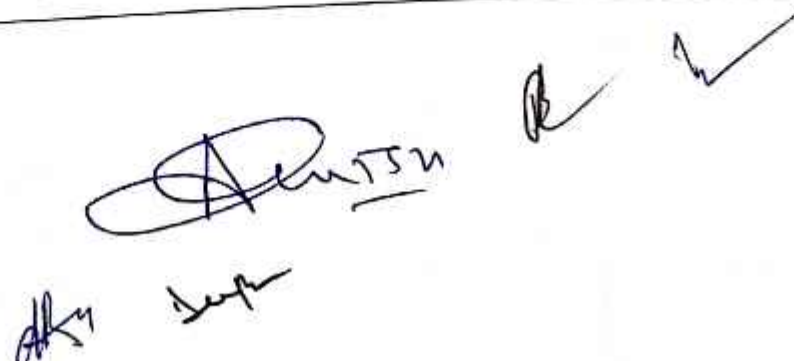
Suggested Continuous Evaluation Methods: Max. Marks: 25

SN	Assessment Type	Max. Marks
		10
1	Class Tests	5
2	Online Quizzes/ Objective Tests	5
3	Presentation	5
4	Assignment (Introduction to Indian ancient Mathematics and Mathematicians)	

Course prerequisites: To study this course, a student must have subject Mathematics in class 12th

Suggested equivalent online courses:

Further Suggestions:



B.A./B.Sc. II (SEMESTER-IV) PAPER-I Differential Equations & Mechanics

Programme: Diploma Class: B.A./B.Sc.	Year: Second	Semester: Fourth
Subject: Mathematics		
Course Code: B030401T	Course Title: Differential Equations & Mechanics	
<p>Course outcomes:</p> <p>CO1: The objective of this course is to familiarize the students with various methods of solving differential equations, partial differential equations of first order and second order and to have qualitative applications.</p> <p>CO2: A student doing this course is able to solve differential equations and is able to model problems in nature using ordinary differential equations. After completing this course, a student will be able to take more courses on wave equation, heat equation, diffusion equation, gas dynamics, non linear evolution equation etc. These entire courses are important in engineering and industrial applications for solving boundary value problem.</p> <p>CO3: The object of the paper is to give students knowledge of basic mechanics such as simple harmonic motion, motion under other laws and forces.</p> <p>CO4: The student, after completing the course can go for higher problems in mechanic such as hydrodynamics, this will be helpful in getting employment in industry.</p>		
Credits: 6	Core Compulsory / Elective	
Max. Marks: 25+75	Min. Passing Marks:	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 6-0-0		
<p>Part- A</p> <p>Differential Equations</p>		
Unit	Topics	No. of Lectures
I	Second order linear differential equations with variable coefficients: Use of a known solution to find another, normal form, method of undetermined coefficient, variation of parameters, Series solutions of differential equations, Power series method.	12
II	Bessel, Legendre and Hypergeometric functions and their properties, recurrence and generating relations.	11
III	Origin of first order partial differential equations. Partial differential equations of the first order and degree one, Lagrange's solution, Partial differential equation of first order and degree greater than one. Charpit's method of solution, Surfaces Orthogonal to the given system of surfaces.	11
IV	Origin of second order PDE, Solution of partial differential equations of the second and higher order with constant coefficients, Classification of linear partial differential equations of second order, Solution of second order partial differential equations with variable coefficients, Monge's method of solution.	11



Part- B
Mechanics

Unit	Topics	No. of Lectures
V	Frame of reference, work energy principle, Forces in three dimensions, Poinso's central axis, Wrenches, Null lines and planes.	12
VI	Virtual work, Stable and Unstable equilibrium, Catenary, Catenary of uniform strength.	11
VII	Velocities and accelerations along radial and transverse directions, and along tangential and normal directions, Simple Harmonic motion, Motion under other law of forces. Elastic strings, Motion in resisting medium, Constrained motion, Motion on smooth and rough plane curves.	11
VIII	Motion of particles of varying mass, Rocket motion, Central orbit, Kepler's laws of motion, Motion of particle in three dimensions, Rotating frame of reference, Rotating Earth, Acceleration in terms of different coordinates systems.	11

Suggested Readings(Part-A Differential Equations):

1. G.F. Simmons, Differential Equations with Application and Historical Notes, Tata –McGrawHill
2. B. Rai, D.P. Choudhary & H. J. Freedman, A Course of Ordinary Differential Equations, Narosa
3. Ian N. Snedden, Elements of Partial Differential Equations, Dover Publication
4. L.E. Elsgolts, Differential Equation and Calculus of variations, University Press of the Pacific.
5. Suggested digital platform:NPTEL/SWAYAM/MOOCs
6. Course Books published in Hindi may be prescribed by the Universities.

Suggested Readings(Part-B Mechanics):

1. R.C. Hibbeler, Engineering Mechanics-Statics, Prentics Hall Publishers
2. R.C. Hibbeler, Engineering Mechanics-Dynamics, Prentics Hall Publishers
3. A. Nelson, Engineering Mechanics Statics and Dynamics, Tata McGraw Hill
4. J.L. Synge & B.A. Griffith, Principles of Mechanics, Tata McGraw Hill
5. Suggested digital platform:NPTEL/SWAYAM/MOOCs
6. Course Books published in Hindi may be prescribed by the Universities.

this course can be opted as an elective by the students of following subjects: Engg. and Tech. (UG), Economics(UG/PG), B.Sc.(C.S.)

Suggested Continuous Evaluation Methods: Max. Marks: 25

Assessment Type	Max. Marks
Class Tests	10
Online Quizzes/ Objective Tests	5
Presentation	5
Assignment	5

Course prerequisites: To study this course, a student must have Certificate Course in Applied Mathematics

Suggested equivalent online courses:

Further Suggestions:



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