K. K. UNIVERSITY

NALANDA, BIHAR - 803115

SCHOOL OF APPLIED SCIENCES

BACHELOR OF SCIENCE (B.Sc.)

MATHEMATICS

(Three Years Full Programme)

2024-2025

PROGRAMME STRUCTURE & SYLLABUS

Under CBCS and NEP 2020

K.K. UNIVERSITY 803115 NALANDA

Pro Vice Chancellor
KK University
Berauti, Nepura, Bihar Sharif
Nalanda - 803115 (Bihar)

Programme Structure - B.Sc. Mathematics

School of Applied Sciences

(Aligned with CBCS and new Education policy-2020)

S. NO.	Type of Course	Credits
1.	Core courses (CC)	78
2.	Open Elective Courses(OEC)	24
3.	Ability Enhancement Courses(AEC)	06
4.	Skill Enhancement Courses(SEC)	04
	Total credits	**120**

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B.Sc. Mathematics

Program Structure

Total Credit - 120

Year	Semester	Type of course	Course Code	Subject Name	L	T	P	C
1	1	CC	BSMT 1101	Calculus	3	1	0	4
		CC	BSMT 1102	Algebra	3	1	0	4
		CC	BSMT 1103	Number Theory	3	1	0	4
		OEC	BSPH S 1101	Physics I	2	0	0	2
			BSPH S 1101P	Practical Physics I	0	0	2	1
		OEC	BSCH S 1101	Chemistry I	2	0	0	2
			BSCH S 1101P	Practical Chemistry I	0	0	2	1
		OEC	BSCMS1101	Fundamental computer	2	0	2	3
		AEC	HNL 1101	Hindi	2	0	0	2
				Total	**15**	**3**	**2**	**20**
		Choose any two Open Elective Course(OEC)						
	2	CC	BSMT 1201	Real Analysis	3	1	0	4
		CC	BSMT 1202	Differential Equations	3	1	0	4
		CC	BSMT 1203	Probability and statics	3	1	0	4
		OEC	BSPH S 1201	Physics II	2	0	0	2
			BSPH S 1201 P	Practical Physics II	0	0	2	1
		OEC	BSCH S 1201	Chemistry II	2	0	0	2
			BSCH S 1201 P	Practical Chemistry II	0	0	2	1
		OEC	BSP S 2101	Programming in C	2	0	2	3
		AEC	BSCS 1201	Communication skill workshop	1	0	2	2
				Total	**14**	**3**	**3**	**20**
2	3		**Choose any two Open Elective Course(OEC)**					
		CC	BSMT 2101	Theory of Real Functions	3	1	0	4
		CC	BSMT 2102	Partial differential Equations and System of ODE	3	1	0	4
		CC	BSMT 2103	Linear programming	3	1	0	4
		OEC	BSPH S 2101	Physics III	2	0	0	2

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			BSPH S 2101 P	Practical Physics III	0	0	2	1
		OEC	BSCH S 2101	Chemistry III	2	0	0	2
			BSCH S 2101P	Practical Chemistry III	0	0	2	1
		OEC	BSPC 2101	Object Oriented Programming in C++	2	0	2	3
				Total	**13**	**3**	**2**	**18**
		Choose any two Open Elective Course(OEC)						
	4	CC	BSMT 2201	Numerical Methods	3	1	0	4
		CC	BSMT 2202	Riemann Integration and Series of Functions	3	1	0	4
		CC	BSMT 2203	Differential Geometry	3	1	0	4
		OEC	BSPH S 2201	Physics IV	2	0	0	2
			BSPH S 2201P	Practical Physics IV	0	0	2	1
		OEC	BSCH S 2201	Chemistry IV	2	0	0	2
			BSCH S 2201P	Practical Chemistry IV	0	0	2	1
		OEC	BSGT S 2201	Graph Theory	2	1	0	3
		AEC	BSEVS 2201	Environmental Sciences	2	0	0	2
				Total	**15**	**3**	**2**	**20**
		Choose any two Open Elective Course(OEC)						
3	**5**	CC	BSMT 3101	Group Theory I	4	1	0	5
		CC	BSMT 3102	Ring Theory and Linear Algebra I	4	1	0	5
		CC	BSMT 3103	Multivariate Calculus	4	1	0	5
		CC	BSMT 3104	Mechanics	3	1	0	4
		SEC	BSMS 3101	Mathematical Modeling system	1	0	2	2
				Total	**16**	**4**	**1**	**21**
		Choose any two Open Elective Course(OEC)						
	6	CC	BSMT 3201	Group Theory II	4	1	0	5
		CC	BSMT 3202	Ring Theory and Linear Algebra II	4	1	0	5
		CC	BSMT 3203	Metric Space and Complex Analysis	4	1	0	5
		CC	BSMT 3204	Logics and sets	3	1	0	4
		SEC	BSDSP 3201	Data Science using python	1	0	2	2
				Total	**16**	**4**	**1**	**21**
Choose any two Open Elective Course(OEC)								

L: Lecture, **T**: Tutorial, **P**: Practical

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SEMESTER –I

Calculus

Sub. Code - BSMT 1101

Program Outcomes:

PO1: Understand the fundamental concepts of mathematical principles and theories.

PO2: Apply mathematical concepts and techniques to solve real-world problems across various disciplines.

PO3: Analyze the complex mathematical problems to identify patterns, relationships, andunderlying structures.

PO4: Evaluate the mathematical arguments and solutions, assessing their validity andeffectiveness.

PO5: Create innovative mathematical models and solutions to address new and emergingchallenges.

Course Outcomes:

CO1: Understand key mathematical concepts, including hyperbolic functions and calculus techniques.

CO2: Apply integration and volume methods to solve complex problems.

CO3: Analyze functions and curves for properties like concavity and asymptotes.

CO4: Evaluate mathematical techniques in real-world applications.

CO5: Create models for motion, growth, and optimization using calculus.

Course Objective:

The objective of the course is to understand key concepts like hyperbolic functions and calculus techniques, apply integration and volume methods to complex problems, analyze functions for properties such as concavity and asymptotes, evaluate mathematical techniques in real-world contexts, and create models for motion, growth, and optimization using calculus.

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Syllabus Details:

UNIT	CONTENT	NO OF HOURS	NO OF WEEK
I	Hyperbolic functions, higher order derivatives, Leibniz rule and its applications to problems of type e^{ax+b} Sinx, e^{ax+b}, Cosx, $(ax + b)^n$ cos x, concavity and inflection points, asymptotes, curve tracing in Cartesian coordinates, tracing in polar coordinates of standard curves, L' Hospital's rule, applications in business, economics and life sciences.	24	1-4
II	Reduction formulae, derivations and illustrations of reduction formulae of the type $\int \sin nx\ dx, \int \cos nx\ dx, \int \tan nx\ dx, \int \sec nx\ dx, \int (logx)^n\ d$ volumes by slicing, disks and washers methods, volumes by cylindrical shells, parametric equations, parameterizing a curve, are length, are length of parametric curves, area of surface of revolution, Techniques of sketching conics, reflection properties of conics, rotation of axes and second degree equations classification into conics using the discriminate, polar equations of conics.	24	5-8
III	Triple product, introduction to vector functions, operations with vector- valued functions, limits and continuity of vector functions, differentiation and integration of vector functions, tangent and normal components of acceleration, modeling ballistics and planetary motion, Kepler's second law.	18	9-11
IV	**List of practical's (using any software)** (i) Plotting of graphs of function e^{ax+b}, $\log(ax + b$, $1ax+b$, $\sin ax+b$, $\cos ax+b$, $ax+b$ and to illustrate the effect of a and b on the graph.	18	12-14

	(ii) Plotting the graphs of polynomial of degree 4 and 5, the derivative graph, the second derivative graph and comparing them. (iii) Sketching parametric curves (Eg. Trochoid, cycloid, epicycloids, hypocycloid). (iv) Obtaining surface of revolution of curves. (v) Tracing of conics in Cartesian coordinates/ polar coordinates. (vi) Sketching ellipsoid, hyperboloid of one and two sheets, elliptic cone, elliptic, paraboloid, hyperbolic paraboloid using Cartesian coordinates. (vii) Matrix operation (addition, multiplication, inverse, transpose.)		
Revision Week			15

Books And References:

1. G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005.
2. M.J. Strauss, G.L. Bradley and K.J. Smith, Calculus, 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi, 2007.
3. H. Anton, I. Bivens and S. Davis, Calculus, 7th Ed., John Wiley and Sons (Asia) P. Ltd., Singapore, 2002.
4. R. Courant and F. John, Introduction to Calculus and Analysis (Volumes I & II), Springer-Verlag, New York, Inc., 1989.

Website and e-Learning Source:

- http://mathforum.org
- http://ocw.mit.edu/ocwweb/Mathematics
- http://www.opensource.org
- www.algebra.com

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Algebra
Sub. Code – BSMT-1102

Program Outcomes:

PO1: Understand the fundamental concepts of mathematical principles and theories.

PO2: Apply mathematical concepts and techniques to solve real-world problems across various disciplines.

PO3: Analyze the complex mathematical problems to identify patterns, relationships, andunderlying structures.

PO4: Evaluate the mathematical arguments and solutions, assessing their validity andeffectiveness.

PO5: Create innovative mathematical models and solutions to address new and emergingchallenges.

Course Outcomes:

CO1: Understand the polar representation of complex numbers, nth roots of unity, and De Movie's theorem.
CO2: Explain the concepts of equivalence relations, function composition, inevitability, andcardinality of sets.
CO3: Apply the division algorithm, Euclidean algorithm, and congruence relations to solve number theory problems.
CO4: Analyze the systems of linear equations and its solution sets by using matrix methods . **CO5**: Determine eigenvalues, eigenvectors, and apply linear transformations and matrixproperties to problems in linear algebra.

Course Objective:

The objective of the course is to understand key concepts of the polar representation of complex numbers and De Moivre's theorem, explain equivalence relations and cardinality of sets, apply the division and Euclidean algorithms in number theory, analyze systems of linear equations with

matrix methods, and determine eigenvalues and eigenvectors while applying lineartransformations in linear algebra.

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Syllabus details:

UNIT	CONTENT	NO OF HOURS	NO OF WEEK
I	Polar representation of complex numbers, nth roots of unity, De Moivre's theorem for rational indices and its applications. Equivalence relations, Functions Composition of functions, Invertible functions, One to one correspondence and cardinality of a set.	24	1-4
II	Well-ordering property of positive integers, Divisionalgorithm, Divisibility and Euclidean algorithm, Congruence relation between integers, principles of Mathematical Inducation, statement of Fundamental Theorem of Arthmetic.	18	5-7
III	Systems of linear equations, row reduction and echelon forms, vector equations, the matrix equation Ax = b , solution sets of linear systems, applications of linear systems, linear independence.	24	7-10
III	Introduction to linear transformations, matrix of a linear transformation, inverse of a matrix, characterizations of invertible matrices. Subspaces of R^n and rank of a matrix, Eigen values, Eigen Vectors and Characteristic Equation of a matrix.	24	11-14
Revision Week			15

K.K. UNIVERSITY 803115 NALANDA

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Books And References:

1. Titu Andreescu and Dorin Andrica, Complex Numbers A to Z, Birkhauser, 2006.
2. Edgar G. Goodaire Michael M. Parmenter, Discrete Mathematics with Graph Theory, 3rd Ed., Pearson Education (Singapore) P. Ltd., Indian Reprint, 2005.
3. David C. Lay, Linear Algebra and its applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.

<u>Website and e-Learning Source</u>:

- http://mathforum.org
- http://ocw.mit.edu/ocwweb/Mathematics
- http://www.opensource.org
- www.algebra.com

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Number Theory Sub. code- BSMT- 1103

Program Outcomes:

PO1: Understand the fundamental concepts of mathematical principles and theories.

PO2: Apply mathematical concepts and techniques to solve real-world problems across various disciplines.

PO3: Analyze the complex mathematical problems to identify patterns, relationships, andunderlying structures.

PO4: Evaluate the mathematical arguments and solutions, assessing their validity andeffectiveness.

PO5: Create innovative mathematical models and solutions to address new and emergingchallenges.

Course Outcomes:

CO1: Understand the concept of linear Diophantine equations, the prime counting function, andthe prime number theorem.

CO2: Explain the Goldbach's conjecture, linear congruence, and the Chinese Remaindertheorem.

CO3: Apply the Fermat's Little theorem and Wilson's theorem in modular arithmetic.

CO4: Analyze the number theoretic functions and derive properties using Dirichlet products. **CO5:** Evaluate Euler's theorem, primitive roots, and quadratic reciprocity for solvingcongruence.

Course Objective:

The objective of the course is to understand linear Diophantine equations, the prime counting function, and the prime number theorem, explain Goldbach's conjecture, linear congruences, and the Chinese Remainder Theorem. Apply Fermat's Little Theorem and Wilson's Theorem in modular arithmetic; analyze number-theoretic functions using Dirichlet products and evaluateEuler's theorem, primitive roots, and quadratic reciprocity for solving congruences.

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Syllabus details:

UNIT	CONTENT	NO OF HOURS	NO OF WEEK
I	Linear Diophantine equation, prime counting function, statement of prime number theorem, Goldbach conjecture, linear congruence's, complete set of residues, Chinese Remainder theorem, Fermat's Little theorem, Wilson's theorem.	30	1-5
II	Number theoretic functions, sum and number of divisors, totally multiplicative functions, definition and properties ofthe Dirichlet product, the Mobius Inversion formula, the greatest integer function, Euler's phi-function, Euler's theorem, reduced set of residues, some properties of Euler's phi-function.	24	6-9
III	Order of an integer modulo n, primitive roots for primes, composite numbers having primitive roots, Euler's criterion, the Legendre symbol and its properties, quadratic reciprocity, quadratic congruences with composite moduli. Public key encryption, RSA encryption and decryption, the equation $x^2 + y^2 = z^2$, Fermat's Last theorem.	24	10-14
Revision Week			15

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Books And References:

1. David M. Burton, Elementary Number Theory, 6th Ed., Tata McGraw-Hill, Indian reprint, 2007.
2. Neville Robinns, Beginning Number Theory, 2nd Ed., Narosa Publishing House Pvt. Ltd. Delhi, 2007.

Website and e-Learning Source:

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- http://www.opensource.org
- www.algebra.com

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SEMESTER –II

Real Analysis Sub. Code - BSMT 1201

Program Outcomes:

PO1: Understand the fundamental concepts of mathematical principles and theories.

PO2: Apply mathematical concepts and techniques to solve real-world problems across various disciplines.

PO3: Analyze the complex mathematical problems to identify patterns, relationships, andunderlying structures.

PO4: Evaluate the mathematical arguments and solutions, assessing their validity andeffectiveness.

PO5: Create innovative mathematical models and solutions to address new and emergingchallenges.

Course Outcomes:

CO1: Understand the algebraic and order properties of real numbers, δ-neighborhoods,countable and uncountable sets.

CO2: Analyze bounded and unbounded sets, supremum, infimum, and the completenessproperty of R

CO3: Evaluate sequences, including bounded, convergent sequences, limits, and limit theorems.

CO4: Apply subsequences and the Cauchy criterion for convergence, including the Bolzano-Weierstrass Theorem.

CO5: Assess infinite series, focusing on convergence, divergence, and various tests for convergence, including absolute and conditional convergence.

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Course Objective:

In this course, students will understand the properties of real numbers and countable versus uncountable sets, analyze bounded and unbounded sets along with supremum and infimum, and evaluate sequences, including their limits and limit theorems. They will apply subsequences and the Cauchy criterion for convergence and assess infinite series, focusing on convergence tests and the distinction between absolute and conditional convergence.

Syllabus details:

UNIT	CONTENT	NO OF HOURS	NO OF WEEK
I	Review of algebraic and order properties of R, δ-neighborhood of a point in R, idea of countable sets, uncountable sets and unaccountability of R. Bounded above sets, Bounded below sets, Bounded Sets, Unbounded sets, Supreme and infirm, The Completeness property of R, The Archimedean Property, Density of Rational (and irrational) numbers in R, Intervals. Limit points of a set, Isolated points, Illustrations of Bolzano-Weierstrass theorem for set	30	1-5
II	Sequences, Bounded sequence, Convergent sequence, Limit of a sequence. Limit Theorems, Monotone Sequences, Monotone Convergence Theorem. Subsequences, Divergence Criteria, Monotone Subsequence Theorem (Statement only), Bolzano Weierstrass Theorem for Sequences. Cauchy sequence, Cuachy's Convergence Criterion.	24	6-9
III	Infinite series, Convergence and divergence of infinite series, Cauchy Criterion, Tests for convergence: Comparison test, Limit Comparison test, Ratio Test, Cauchy's nth root test,	24	10-14

	Integral test, Alternating series, Leibniz test, Absolute and Conditional convergence.		
Revision Week			15

Books And References:

1. R.G. Bartel and D. R. Sherbert, Introduction Real Analysis, 3rd Ed., John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2002.
2. Gerald G. Bilodeau, Paul R. Thie, G.E. Keough, An Introduction to Anaysis, 2nd Ed., Jones & Bartlett, 2010.
3. Brian S. Thomson, Andrew. M. Bruckner and Judith B. Bruckner, Elementary Real Analysis, prentice Hall, 2001
4. S.K. Berberian, A First Course in Analysis, Springer Verlag, New York, 1994.

<u>Website and e-Learning Source</u>:

- http://mathforum.org
- http://ocw.mit.edu/ocwweb/Mathematics
- http://www.opensource.org
- www.algebra.com

Differential Equations Sub. Code – BSMT-1202

Program Outcomes:

PO1: Understand the fundamental concepts of mathematical principles and theories.

PO2: Apply mathematical concepts and techniques to solve real-world problems across various disciplines.

PO3: Analyze the complex mathematical problems to identify patterns, relationships, andunderlying structures.

PO4: Evaluate the mathematical arguments and solutions, assessing their validity andeffectiveness.

PO5: Create innovative mathematical models and solutions to address new and emergingchallenges.

Course Outcomes:

CO1: Identify different types of solutions for differential equations.

CO2: Understand the principles behind integrating factors and Wronskian.

CO3: Apply the models to real-world scenarios like pollution, drug assimilation, and population growth.

CO4: Analyze the equilibrium points and the predator-prey dynamics model.

CO5: Evaluate the effectiveness of various solution methods for higher-order equations.

CO6: Create mathematical models for complex systems like population growth.

Course Objective:

In this course, students will understand differential equations and their various solutions. They will analyze exact, separable, linear, and Bernoulli equations, including integrating factors. Apply compartmental models and population growth models, as well as case studies like exponential decay and drug assimilation. They will evaluate second-order homogeneous equations and methods for higher-order linear equations, including Euler's equation.

Syllabus details:

UNIT	CONTENT	NO OF HOURS	NO OF WEEK
I	Differential equations and mathematical models. General, Particular, explicit, implicit and singular solutions of a differential equation. Exact differential equations and integrating factors, separable equations and equations reducible to this form, linear equation and Bernoulli equations, special integrating factors and transformations.	24	1-4
II	Introduction to compartmental model, exponential decay model, lake pollution model (case study of Lake Burley Griffin), drug assimilation into the blood (case of a single cold pill, case of a course of cold pills), exponential growth of population, limited growth of population, limited growth with harvesting.	24	5-8
III	General solution of homogeneous equation of second order, principle of super position for homogeneous equation, Wronskian: its properties and applications.Linearhomogeneous and non-homogeneous equations of higher order with constant coefficients, Euler's equation, method of undertermined coefficients, methods of variation of parameters. Equilibrium points, Interpretation of the phase plane, predatory-prey model and its analysis, epidemic model of influenza and its analysis, battle model and its analysis.	24	9-12
	List of Practical (using any software) 1. Plotting of second order solution family of differential equation. 2. Plotting of third order solution family of differential	12	13-14

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IV	equation. 3. Growth model (exponential case only). 4. Decay model (exponential case only). 5. Lake pollution model (with constant/seasonal flow and pollution concentration). 6. Case of single cold pill and a course of cold pills. 7. Limited growth of population (with and without harvesting). 8. Predatory-prey model (basic volterra model, with density dependence, effect of DDT, two prey one predator.) 9. Epidemic model of influenza (basic epidemic model, contagious for life, disease with carriers). 10. Battle model (basic battle model, jungle warfare, long range weapons). 11. Plotting of recursive sequences. 12. Study the convergence of sequences through plotting. 13. Verify Bolzano-Weierstrass theorem through plotting of sequences and hence identify convergent subsequences from the plot. 14. Study the convergence/divergence of infinite series by plotting their sequences of partial sum. 15. Cauchy's root test by plotting n^{th} roots. 16. Ratio test by plotting the ratio of n^{th} and $(n+1)^{th}$ term.		
	Revision Week		15

Books And References:

1. Belinda Barnes and Glenn R. Fulford, Mathematical modeling with case studies, A Differential Equation Approach using Maple and Matlab, 2^{nd} Ed., Taylor and Fracis group, London and New York , 2009.
2. C.H. Edwards and D.E. Penny, Differential Equations and Boundary value problems Computing and Modeling, Pearson Education India, 2005.
3. S.L. Ross, Differential Equations, 3^{rd} Ed., John Wiley and Sons, India, 2004.
4. Martha L Abell, James P Braselton, Differential Equations with MATHEMATICA, 3^{rd} Ed., Elsevier Academic Press, 2004.

5.

Website and e-Learning Source:

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- http://www.opensource.org
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Probability and Statics Sub. Code – BSMT-1203

Program Outcomes:

PO1: Understand the fundamental concepts of mathematical principles and theories.

PO2: Apply mathematical concepts and techniques to solve real-world problems across various disciplines.

PO3: Analyze the complex mathematical problems to identify patterns, relationships, andunderlying structures.

PO4: Evaluate the mathematical arguments and solutions, assessing their validity andeffectiveness.

PO5: Create innovative mathematical models and solutions to address new and emergingchallenges.

Course Outcomes:

CO1: Understand key concepts such as sample space, probability axioms, and random variables.

CO2: Apply knowledge to calculate probabilities for various distributions.

CO3: Analyze joint cumulative distribution functions for marginal and conditional distributions. CO4: Synthesize expectations and moments, developing joint moment generating functions(JMGFs).

CO5: Evaluate the correlation coefficients in probability distributions and regression.

Course Objective:

The objective of this course is to understand key concepts of probability, including sample space, probability axioms, and random variables. Student will apply these concepts to calculate probabilities for various distributions. They will analyze joint cumulative distribution functions for marginal and conditional distributions. Synthesize expectations and moments to develop joint

K.K. UNIVERSITY 803115 NALANDA

Pro Vice Chancellor
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Nalanda - 803115 (Bihar)

moment generating functions (JMGFs). Finally, students will evaluate correlation coefficients in probability distributions and regression analysis.

Syllabus details:

UNIT	CONTENT	NO OF HOURS	NO OF WEEK
I	Sample space, probability axioms, real random variables (discrete and continuous), Cumulative distribution function, probability mass density functions mathematical expectation, moments, moment generating function, characteristic function.	24	1-4
II	Discrete distributions, uniform, binomial, Poisson, geometric, negative binomial, continuous distributions, uniform, normal, exponential, Joint cumulative distribution function and its properties, Joint probability density functions.	24	5-8
III	Marginal and conditional distributions, expectation of function of two random variables, conditional expectations, independent random variables, vicariate normal distribution, correlation coefficient, joint moment generating function (jmgf) and calculation of covariance (from jmgf), linear regression for two variables.	24	9-13
	Revision Week		14-15

Books And References:

1. Robert V. Hogg, Joseph W. McKean and Allen T. Craig, Introduction to Mathematical Statics, person Education, Asia, 2007.

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2. Irwin Miller and Marylees Miller, John E.Freund, Mathematical Statistics with Applications, 7^{th} Ed., Person Education, Asia, 2006.
3. Sheldon Ross, introduction to probability Models. 9^{th} Ed., Academic press, Indian Reprint, 2007.
4. Alexander M. Mood, Franklin A. Graybill and Duane C. Boes, Introduction to the Theory of Statistics, 3^{rd} Ed., Tata McGraw-Hill, Reprint 2007.

5.

Website and e-Learning Source:

- http://mathforum.org
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- http://www.opensource.org
- www.algebra.com

SEMESTER –III

Theory of Real Functions

Sub. Code – BSMT-2101

Program Outcomes:

PO1: Understand the fundamental concepts of mathematical principles and theories.

PO2: Apply mathematical concepts and techniques to solve real-world problems across various disciplines.

PO3: Analyze the complex mathematical problems to identify patterns, relationships, andunderlying structures.

PO4: Evaluate the mathematical arguments and solutions, assessing their validity andeffectiveness.

PO5: Create innovative mathematical models and solutions to address new and emergingchallenges.

Course Outcomes:

CO1: Understand fundamental concepts related to limits, continuity, and differentiability of functions.

CO2: Apply limit theorems and continuity criteria to functions.

CO3: Analyze properties of continuous and differentiable functions.

CO4: Synthesize the concepts for Taylor and Maclaurin series expansions.

CO5: Evaluate applications of the Mean Value Theorem and Taylor's theorem.

CO6: Create models using Taylor and Maclaurin series for function approximation.

Course Objective:

In this course, students will understand fundamental concepts related to limits, continuity, and differentiability of functions. They will apply limit theorems and continuity criteria to various functions. Students will analyze properties of continuous and differentiable functions. They will synthesize concepts for Taylor and Maclaurin series expansions. Students will evaluate applications of the Mean Value Theorem and Taylor's theorem. Finally, they will create models using Taylor and Maclaurin series for function approximation.

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Nalanda - 803115 (Bihar)

Syllabus details:

UNIT	CONTENT	NO OF HOURS	NO OF WEEK
I	Limits of functions $(\in -\delta\ approach)$, sequential criterion for limits, divergence criteria. Limit theorems, one sided limits. Infinite limits and limits at infinity. Continuous functions, sequential criterion for continuity and discontinuity. Algebra of continuous functions. Continuous functions on an interval, intermediate value theorem, location of roots theorem, preservation of intervals theorem. Uniform continuity, non-uniform continuity criteria, uniform continuity theorem.	30	1-5
II	Differentiability of a function at a point and in an interval, Caratheodory's theorem, algebra of differentiable functions. Relative extrema, interior extremum theorem. Rolle's theorem, Mean value theorem, intermediate value property of derivatives, Darboux's theorem. Applications of mean value theorem to inequalities and approximation of polynomials, Taylor's theorem to inequalities.	24	6-9
III	Cauchy's mean value theorem. Taylor's theorem with Lagrange's form of remainder, Taylor's theorem with Cauchy's form of remainder, application of Taylor's theorem to convex functions, relative extrema. Taylor's series and Maclaurin's series expansions of exponential and trigonometric functions, In (1+x), 1/ax + x and $(1+x)^n$.	24	10-14
	Revision Week		15

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Books And References:

1. R. Bartle and D.R. Sherbert, Introduction to Real Analysis, John Wiley and Sons, 2003.
2. K.A. Ross, Elementary Analysis: The Theory of Calculus, Springer, 2004.
3. A. Mattuck, Introduction to Analysis, prentice Hall, 1999.
4. S.R. Ghorpade and B.V. Limaye, A Course in Calculus and Real Analysis, Springer, 2006.

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PDE and Systems of ODE

Sub. Code – BSMT-2102

Program Outcomes:

PO1: Understand the fundamental concepts of mathematical principles and theories.

PO2: Apply mathematical concepts and techniques to solve real-world problems across various disciplines.

PO3: Analyze the complex mathematical problems to identify patterns, relationships, andunderlying structures.

PO4: Evaluate the mathematical arguments and solutions, assessing their validity andeffectiveness.

PO5: Create innovative mathematical models and solutions to address new and emergingchallenges.

Course Outcomes:

CO1: Understand basic concepts and classifications of partial differential equations.

CO2: Apply the method of characteristics and separation of variables to first-order equations. **CO3:** Analyze the derivation of heat, wave, and Laplace equations, and classify second-orderlinear equations.

CO4: Evaluate the Cauchy-Kowaleewskaya theorem and its applications in initial boundaryvalue problems.

CO5: Create solutions for systems of linear differential equations using numerical methods like Euler and Runge-Kutta.

Course Objective:

The course objectives for partial differential equations (PDEs) aim to develop students' cognitive skills. Students will understand PDE concepts**,** apply methods like characteristics and separation of variables, analyze key equations such as heat and wave equations, evaluate the Cauchy-

Kowaleewskaya theorem, and create solutions for linear systems using numerical methods like Euler's and Runge-Kutta.

Syllabus details:

UNIT	CONTENT	NO OF HOURS	NO OF WEEK
I	Partial Differential Equations – basic concepts and Definitions, Mathematical Problems. First- Order Equations: Classification, Construction and Geometrical Interpretation. Method of Characteristics for obtaining General Solution of Quasi Linear Equations. Conical Forms of First-order Linear Equations. Method of Sepration of Variables for solving first order partial differential equations.	24	1-5
II	Derivation of heat equation, Wave equation and Laplace equation. Classification of second order linear equations as hyperbolic, parabolic or elliptic. Reduction of second order Linear Equations to canonical forms. The Cauchy problem, the Cauchy-Kowaleewskaya theorem, Cauchy problem of an infinite string. Initial Boundary Value problems, Semi-Infinite String with a fixed end, Semi-infinite String with a Free end, Equations with non-homogeneous boundary conditions, Non-Homogeneous Wave Equation. Method of separation of variables, Solving the Vibrating String Problem, Solving the Heat Conduction problem.	24	6-9
III	Systems of linear differential equations, types of linear systems, differential operators, an operator method for linear systems with constant coefficients, Basic Theory of linear systems in normal form, homogeneous linear systems with constant coefficients: Two Equations in two unknown	24	10-14

	functions, The method of successive approximations, the Euler method, the modified Euler method, The Runge-Kutta method. **List of practical's (using any software)** (i) Solution of Cauchy problem for first order PDE. (ii) Finding the characteristics for the first order PDE. (iii) Plot the integral surfaces of a given first order PDE with initial data. (iv) Solution of wave equation		
	Revision Week		15

Books And References:

1. Tyn Myint-U and Lokenath Debnath, Linear partial Differential Equations for Scientists and Engineers, 4th edition, Springer, Indian reprint, 2006.
2. S.L. Ross, Differential equations, 3rd Ed., John Wiley and Sons, India, 2004.
3. Martha L Abell, James P Braselton, Differential equations with MATHEMATICA, 3rd Ed., Elsevier Academic Press, 2004.
4.

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Linear Programming Sub. Code – BSMT-2103

Program Outcomes:

PO1: Understand the fundamental concepts of mathematical principles and theories.

PO2: Apply mathematical concepts and techniques to solve real-world problems across various disciplines.

PO3: Analyze the complex mathematical problems to identify patterns, relationships, andunderlying structures.

PO4: Evaluate the mathematical arguments and solutions, assessing their validity andeffectiveness.

PO5: Create innovative mathematical models and solutions to address new and emergingchallenges.

Course Outcomes:

CO1: Understand the fundamentals of linear programming problems and the theory behind the simplex method.

CO2: Apply the simplex algorithm and compare the two-phase and Big-M methods.

CO3: Analyze duality concepts and formulate dual problems with economic interpretations.

CO4: Evaluate transportation problem-solving methods, including northwest-corner, least cost,and Vogel approximation.

CO5: Create solutions for assignment problems using the Hungarian method.

Course Objective:

The objective of this course is to understand linear programming fundamentals and the simplex method, apply the simplex algorithm and compare the two-phase and Big-M methods**.** To analyze duality concepts and formulate dual problems, evaluate transportation problem-solving methods; and create solutions for assignment problems using the Hungarian method.

Syllabus details:

UNIT	CONTENT	NO OF HOURS	NO OF WEEK
I	Introduction to linear Programming problem, Theory of simplex method, optimality and unboundedness, the simplex algorithm, simplex method in tableau format, introduction to artificial variables, two-phase method, Big-M method and their comparison.	24	1-5
II	Duality, formulation of the dual problem, primal-dual relationships, economic interpretation of the dual.	24	6-9
III	Transportation problem and its mathematical formulation, northwest-corner method least cost method and Vogel approximation method for determination of staring basic solution, algorithm for solving transportation problem, assignment problem and its mathematical formulation, Hungarian method for solving assignment problem.	24	10-14
Revision Week			15

Books And References:

1. Mokhtar S. Bazaraa, John J. Jarvis and hanif D. Sherali, Linear programming andNetwork Flows, 2nd Ed., John Wiley and Sons, India, 2004.
2. F. S. Hillier and G.J. Lieberman, Introduction to Operations Research, 9th Ed., Tata McGraw Hill, Singapore, 2009.
3. Hamdy A. Taha, Operations Research, An Introduction, 8th Ed., prentice-Hall India, 2006.
4. G. Hadley, Linear programming, Narosa Publishing House, Delhi, 2002.

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SEMESTER –IV

Numerical Methods Sub. Code – BSMT-2201

Program Outcomes:

PO1: Understand the fundamental concepts of mathematical principles and theories.

PO2: Apply mathematical concepts and techniques to solve real-world problems across various disciplines.

PO3: Analyze the complex mathematical problems to identify patterns, relationships, andunderlying structures.

PO4: Evaluate the mathematical arguments and solutions, assessing their validity andeffectiveness.

PO5: Create innovative mathematical models and solutions to address new and emergingchallenges.

Course Outcomes:

CO1: Understand the concepts of numerical methods and error analysis.

CO2: Apply appropriate algorithms to solve mathematical equations and systems.

CO3: Analyze the accuracy and convergence of numerical techniques.

CO4: Implement interpolation and integration methods to approximate solutions.

CO5: Evaluate numerical solutions to differential equations for efficiency and reliability.

Course Objective:

The objective of this course is to understand numerical methods and error analysis.Apply algorithms to solve equations and systems. Analyze the accuracy and convergence and implement it in interpolation and integration methods. Evaluate solutions to differential equations for efficiency and reliability.

Syllabus details:

UNIT	CONTENT	NO OF	NO OF

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		HOURS	WEEK
I	Algorithms, Convergence, Errors: Relative, Absolute, Round off, Truncation. Transcendental and Polynomial equations: Bisection method, Newton's method, Secant method. Rate of convergence of these methods.	30	1-5
II	System of linear algebraic equations: Gaussian Elimination and Gauss Jordan methods. Gauss Jacobi method, Gauss Seidel method and their convergence analysis. Interpolation: Lagrange and Newton's methods, Error bounds. Finite difference operators. Gregory forward and backward difference interpolation.	24	6-9
III	Numerical Integration: Trapezoidal rule, Simpson's rule, Simpsons $3/8^{th}$ rule, Boole's Rule. Midpoint rule, Composite Trapezoidal rule, Composite Simpson's rule. Ordinary Differential Equations: Euler's method. Runge-Kutta methods of orders two and four. **List of Practical's (using any software)** (i) Calculate the sum 1/1 + ½ + 1/3 + ¼ + ………………….. +1/N. (ii) To find the absolute value of an integer. (iii) Enter 100 integers into an array and sort them in an ascending order. (iv) Bisection Method. (v) Newton Raphson Method. (vi) Secant Method. (vii) Regulai Falsi Method. (viii) LU decomposition method. (ix) Gauss-Jacobi Method.	24	10-14

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	(x) SOR method or Gauss-Siedel Method. (xi) Lagrange Interpolatio or Newton Interpolation. (xii) Simpson's rule.		
	Revision Week		15

Books And References:

1. Brian Bradie, A Friendly Introduction to Numerical Analysis, Person Education, India, 2007.
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical methods for Scientific and Engineering Computation, 6^{th} Ed., New age International Publisher, India, 2007.
3. C.F. Geral and P.O. Wheatley, Applied Numerical Analysis, person Education, India, 2008.
4. Uri M. Ascher and Chen Greif, A First Course in Numerical Methods, 7^{th} Ed., PHI Learning private Limited, 2013.
5. John H. Mathews and Kurtis D.Fink, Numerical Methods using Matlab, 4^{th} Ed., PHI Learning private Limited, 2012.

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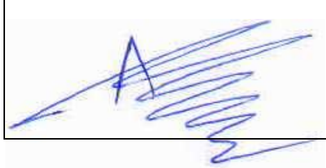

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Riemann Integration and Series of FunctionsSub. Code –

BSMT-2202

Program Outcomes:

PO1: Understand the fundamental concepts of mathematical principles and theories.

PO2: Apply mathematical concepts and techniques to solve real-world problems across various disciplines.

PO3: Analyze the complex mathematical problems to identify patterns, relationships, andunderlying structures.

PO4: Evaluate the mathematical arguments and solutions, assessing their validity andeffectiveness.

PO5: Create innovative mathematical models and solutions to address new and emergingchallenges.

Course Outcomes:

CO1: Understand the principles of Riemann integration and conditions for integrability.

CO2: Apply Riemann sums to evaluate integrals and analyze properties of integrable functions.

CO3: Examine improper integrals and study the convergence of special functions.

CO4: Evaluate the convergence of sequences and series of functions using various theorems.

CO5: Investigate power series, their convergence, and related theorems in analysis.

Course Objective:

The course objectives for Riemann integration enable students to understand upper and lower sums and integrability, apply properties of the Riemann integral and key theorems, analyze improper integrals and convergence, evaluate continuity and differentiability of limit functions; and create solutions involving limit superior, power series, and differentiation and integration techniques, including Abel's and Weierstrass Approximation Theorems.

Syllabus details:

UNIT	CONTENT	NO OF HOURS	NO OF WEEK
I	Riemann integration; inequalities of upper and lower sums; Riemann conditions of integrability. Riemann sum and definition of Riemann integral through Riemann sums; equivalence of two definitions; Riemann inerrability of monotone and continuous functions, Properties of the Riemann integral; definition and inerrability of piecewise continuous and monotone functions. Intermediate Value theorem for Integrals; Fundamental theorems of Calculus.	24	1-5
II	Improper integrals; convergence of Beta and Gamma functions.Point wise and uniform convergence of sequence of functions. Theorems on continuity, derivability and inerrability of the limit function of a sequence of functions. Series of functions; Theorems on the continuity and derivability of the sum function of a series of functions; Cauchy criterion for uniform convergence and Weierstrass M- Test.	24	6-9
III	Limit superior and Limit inferior. Power series, radius of convergence, Cauchy Hadamard Theorem, Differentiation and integration of power series; Abel's Theorem; Weierstrass Approximation Theorem.	24	10-14
Revision Week			15

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Books And References:

1. K.A. Ross, Elementary Analysis, The Theory of Calculus, Undergraduate Text in Mathematics, Springer (SIE), Indian reprint, 2004.
2. R.G. Bartle D.R. Sherbert, introduction to Real Analysis, 3rd Ed., John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2002.
3. Charles G. Denlinger, Elements of Real Analysis, Jones & Bartlett (Student Edition), 2011

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Differential Geometry Sub.

Code – BSMT-2203

Program Outcomes:

PO1: Understand the fundamental concepts of mathematical principles and theories.

PO2: Apply mathematical concepts and techniques to solve real-world problems across various disciplines.

PO3: Analyze the complex mathematical problems to identify patterns, relationships, andunderlying structures.

PO4: Evaluate the mathematical arguments and solutions, assessing their validity andeffectiveness.

PO5: Create innovative mathematical models and solutions to address new and emergingchallenges.

Course Outcomes:

CO1: Understand the geometry of space curves, curvature, and torsion.

CO2: Apply the fundamental forms and curvatures in surface theory.

CO3: Analyze developable surfaces and minimal surfaces in differential geometry.

CO4: Evaluate geodesics and related theorems in surface geometry.

CO5: Explore tensor operations and their applications in geometry and physics.

Course Objective:

The course objectives for differential geometry focus on developing key concepts and skills. Students will understand the geometry of space curves, including curvature and torsion**,** apply fundamental forms and curvatures in surface theory, analyze developable and minimal surfaces; evaluate geodesics and related theorems in surface geometry; and explore tensor operations and their applications in geometry and physics.

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Syllabus details:

UNIT	CONTENT	NO OF HOURS	NO OF WEEK
I	Theory of Space Curves: Space curves, Curvature, torsion and Serret-Frenet formulae. Osculating circles, Osculating circles and spheres, Existence of space curves. Evolutes and involutes of curves. Theory of Surfaces: Parametric curves on surfaces. Direction coefficients. First and second Fundamental forms. Principal and Gaussian curvatures. Line of curvature, Euler's theorem. Rodrigue's formula, Conjugate and Asymptotic lines.	30	1-5
II	Developables : Developable associated with space curves and curveson surfaces, Minimal surfaces.Geodesics: Canonical geodesic equations. Nature of geodesics on a surface of revolution. Clairaut's theorem. Normal property of geodesics. Torsion of a geodesic. Geodesic curvature. Gauss-bonnet theorem. Surfaces of constant curvature. Conformal mapping. Geodesic mapping. Tissot's theorem.	24	6-9
III	Tensors: Summation convention and indicial notation, Coordinate transformation and Jacobin, Contra-variant and Covariant vectors, Tensors of different type, Algebra of tensors and contraction, Metric tensor and 3- index Christopher symbols, Parallel propagation of vectors, Covariant and intrinsic derivatives, Curvature tensor its properties, Curl, Divergence and Laplacian operators in tensor form, Physical components.	24	10-14
Revision Week			15

Books And References:

1. T.J. Willmore, An Introduction to Differential Geometry, Dover Publications, 2012.
2. B. O'neill, Elementary Differential Geometry, 2nd Ed., Academic Press, 2006.
3. C.E. Weatherburn, Differential Geometry of Three Dimensions, Cambridge University Press 2003.
4. D.J. Struik, Lectures on Classical Differential Geometry, Dover Publications, 1988.
5. S. Lang, Fundamentals of Differential Geometry, Springer, 1999.
6. B.Spain, Tensor Calculus: A Concise Course, Dover Publications, 2003.

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SEMESTER –V

Group Theory –I Sub. Code – BSMT-3101

Program Outcomes:

PO1: Understand the fundamental concepts of mathematical principles and theories.

PO2: Apply mathematical concepts and techniques to solve real-world problems across various disciplines.

PO3: Analyze the complex mathematical problems to identify patterns, relationships, andunderlying structures.

PO4: Evaluate the mathematical arguments and solutions, assessing their validity andeffectiveness.

PO5: Create innovative mathematical models and solutions to address new and emergingchallenges.

Course Outcomes:

CO1: Understand the key concepts such as groups, subgroups, and dihedral groups.

CO2: Explain the significance of symmetries in groups and illustrate relationships among different types.

CO3: Apply the principles like Lagrange's theorem to solve group theory problems.

CO4: Analyze and compare the properties of cyclic and abelian groups.

CO5: Construct and prove advanced theorems, including the isomorphism theorems, to evaluate group structures.

Course Objective:

The course objectives for group theory enable students to understand key concepts such as groups, subgroups, and dihedral groups. They will also explain the significance of symmetries within groups and illustrate the relationships among different types. Additionally, students will

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apply principles like Lagrange's theorem to solve group theory problems and analyze the properties of cyclic and abelian groups. Finally, they will construct and prove advanced theorems, including the isomorphism theorems, to evaluate group structures effectively.

Syllabus Details:

UNIT	CONTENT	NO OF HOURS	NO OF WEEK
I	Symmetries of a square, Dihedral groups, definition and examples of groups including permutation groups and quaternion groups (illustration through matrices), elementary properties of groups. Subgroups and examples of subgroups, centralizer, center of a group, product of two subgroups.	24	1-5
II	Cyclic, Properties of cyclic groups, classification of subgroups of cyclic groups, Cycle Notation for permutations, properties of permutations, even and odd permutations, alternating, group, properties of cosets, Lagrange's theorem and consequences including Fermat's Little theorem.	24	6-9
III	External direct product of a finite number of groups, normal subgroups, factor groups, Cauchy's theorem for finite abelian groups. Group homeomorphisms, properties of homeomorphisms, Cayley's theorem, properties of isomorphism's, First, Second and Third isomorphism theorems.	24	10-14
Revision Week			15

Books And References:

1. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
2. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
3. Joseph A. Gallian, Contemporary Abtract Algebra, 4th Ed., Narosa Publishing House, New Delhi, 1999
4. I.N. Herstein, Topics in Algebra, Wiley Eastern Limited, India, 1975.
5. Joseph J. Rotman, An Introduction to the Theory of Groups, 4th Ed., Springer Verlag, 195.

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Ring Theory and Linear Algebra –I

Sub. Code – BSMT-3102

Program Outcomes:

PO1: Understand the fundamental concepts of mathematical principles and theories.

PO2: Apply mathematical concepts and techniques to solve real-world problems across various disciplines.

PO3: Analyze the complex mathematical problems to identify patterns, relationships, andunderlying structures.

PO4: Evaluate the mathematical arguments and solutions, assessing their validity andeffectiveness.

PO5: Create innovative mathematical models and solutions to address new and emergingchallenges.

Course Outcomes:

CO1: Define fundamental concepts like rings, fields, ideals, vector spaces, and linear transformations.

CO2: Explain properties of rings and ideals, and relationships among vector spaces and subspaces.

CO3: Apply principles to solve problems related to linear combinations, dimensions, and ring structures.

CO4: Analyze characteristics of linear transformations, including null space, range, rank, and nullity.

CO5: Construct and prove isomorphism theorems in both ring theory and linear algebra, and utilize change of coordinate matrices for linear transformations.

Course Objective:

The course objectives for ring theory and linear algebra focus on defining key concepts such asrings, fields, ideals, vector spaces, and linear transformations. Students will explain the

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properties of rings and ideals, as well as the relationships among vector spaces. They will apply principles to solve problems related to linear combinations and dimensions, analyze the characteristics of linear transformations, including null space and rank, and construct isomorphism theorems in both ring theory and linear algebra while utilizing change of coordinatematrices.

Syllabus Details:

UNIT	CONTENT	NO OF HOURS	NO OF WEEK
I	Definition and examples of rings, properties of rings, subrings, integral domains and fields, characteristic of a ring. Ideal, ideal generated by a subset of a ring, factor rings, operations on ideals, prime and maximal ideals	30	1-5
II	Ring homeomorphisms, properties of ring homeomorphisms, Isomorphism theorems I, II and III, field of quotients. Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces.	24	6-9
III	Linear transformations, null space, range, rank and nullity ofa linear transformation, matrix representation of a linear transformation, algebra of linear transformations. Isomorphism's, Isomorphism theorems, inevitability and isomorphism's, change of coordinate matrix.	24	10-14
Revision Week			15

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Books And References:

1. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
2. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
3. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra, 4th Ed., prentice-Hall of India Pvt. Ltd., new Delhi, 2004.
4. Joseph A. Gallian, Contemporary Abstract algebra, 4th Ed., Narosa Publishing House, New Delhi, 1999.
5. S. Lnag, Introduction to Linear Algebra, 2nd Ed., Springer, 2005.
6. Gilbert Strang, Linear Algebra and its Applications, Thomson, 2007.
7. S. Kumaresan, Linear Algebra-A Geometric Approach, Prentice hall of India, 1999.
8. Kenneth Hoffman, Ray Alden Kunze, Linear Algebra, 2nd Ed., Prentice-Hall of India Pvt. Ltd., 1971.
9. D.A.R. Wallace, Groups, Rings and Fields, Springer Verlag London Ltd., 1998.

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Multivariate Calculus Sub.

Code – BSMT-3103

Program Outcomes:

PO1: Understand the fundamental concepts of mathematical principles and theories.

PO2: Apply mathematical concepts and techniques to solve real-world problems across various disciplines.

PO3: Analyze the complex mathematical problems to identify patterns, relationships, andunderlying structures.

PO4: Evaluate the mathematical arguments and solutions, assessing their validity andeffectiveness.

PO5: Create innovative mathematical models and solutions to address new and emergingchallenges.

Course Outcomes:

CO1: Define key concepts such as functions of several variables, partial differentiation, and vector fields.

CO2: Explain limits and continuity of functions of two variables, including conditions for total differentiability.

CO3: Apply the chain rule, directional derivatives, and Lagrange multipliers in constrained optimization problems.

CO4: Analyze double and triple integrals over various regions, including changes of variables in polar, cylindrical, and spherical coordinates.

CO5: Evaluate line integrals and demonstrate understanding of Green's theorem, Stokes' theorem, and the Divergence theorem in relation to line and surface integrals.

Course Objective:

The course objectives for multivariable calculus encompass defining functions of several variables, partial differentiation, and vector fields. Students will explain limits and continuity for functions of two variables and apply the chain rule, directional derivatives, and Lagrange multipliers in constrained optimization. They will analyze double and triple integrals with

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variable changes and evaluate line integrals while understanding Green's theorem, Stokes'theorem, and the Divergence theorem.

Syllabus Details:

UNIT	CONTENT	NO OF HOURS	NO OF WEEK
I	Functions of several variables, limit and continuity of functions of two variables Partial differentiation, total differentiability and differentiability, sufficient condition for differentiation, total differentiability and differentiability, sufficient condition for differentiability. Chain rule for one and two independent parameters, directional derivatives, the gradient, maximal and normal property of the gradient, tangent planes, Extrema of functions of two variables, method of Lagrange multipliers, constrained optimization problems, Definition of vector field, divergence and curl	30	1-5
II	Double integration over rectangular region, double integration over non-rectangulaar region, Double integrals in polar co-ordinates, Triple integrals, Triple integral over a parallelepiped and solid regions. Volume by triple integrals, cylindrical and sphereical co-ordinates.	24	6-9
III	Change of variables in double integrals and triple integrals. Line integrals, Applications of line integrals: Mass and Work. Fundamental theorem for line integrals, conservative vector fields, independence of path. Green's theorem, surface integrals integrals over parametrically defined surfaces. Stoke's theorem, The Divergence theorem.	24	10-14
	Revision Week		15

Books And References:

1. G.B Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005.
2. M.J. Strauss, G.L. Bradley and K.J. Smith, Calculus, 3rd Ed., Dorling Kidersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2007.
3. E. Marsden, A.J. Tromba and a. Weinstein, basic Multivariable Calculus, Springer (SIE), Indian reprint, 2005.
4. James Stewart, Multivariable Calculus, Concepts and Contexts, 2nd Ed., Brooks/Cole, Thomson Learning, USA, 2001.

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Mechanics

Sub. Code – BSMT-3104

Program Outcomes:

PO1: Understand the fundamental concepts of mathematical principles and theories.

PO2: Apply mathematical concepts and techniques to solve real-world problems across various disciplines.

PO3: Analyze the complex mathematical problems to identify patterns, relationships, andunderlying structures.

PO4: Evaluate the mathematical arguments and solutions, assessing their validity andeffectiveness.

PO5: Create innovative mathematical models and solutions to address new and emergingchallenges.

Course Outcomes:

CO1: Define key concepts such as moment of a force, couples, and free body diagrams.

CO2: Explain the laws of Coulomb friction and apply them to various surface contact problems.

CO3: Apply the principles of equilibrium and analyze resultant force systems, including two-point equivalent loading.

CO4: Evaluate moments of area and centroids using theorems such as Pappus-Guldinus and transfer theorems.

CO5: Demonstrate understanding of conservative force fields and work-energy principles.

Course Objective:

The course objectives for mechanics involve defining key concepts like the moment of a force, couples, and free body diagrams; explaining the laws of Coulomb friction and applying them to surface contact problems; applying equilibrium principles to analyze resultant force systems, including two-point equivalent loading; evaluating moments of area and centroids using theorems such as Pappus-Guldinus; and demonstrating an understanding of conservative force fields and work-energy principles.

Syllabus Details:

UNIT	CONTENT	NO OF HOURS	NO OF WEEK
I	Moment of a force about a point an axis, couple and couple, Moment of a couple about a line, resultant of a force system, distributed force system, free body diagram, free bodyinvolving interior sections, general equations of equilibrium, two point equivalent loading, problems arising from structures, static indeterminacy.	24	1-5
II	Laws of Coulomb friction, application to simple and complex surface contact friction problems, transmission of power through belts, screw jack, wedge, first moment of an area and the centroid, other canters, Theorem of pappus-Guldinus, second moments and the product of area of a plane area, transfer theorems, relation between second moments and products of area, polar moment of area, principal axes.	24	6-9
III	Conservative force field, conservation force field, conservation for mechanical energy, work energy equation, kinetic energy and work kinetic energy expression based on center of mass, moment of momentum equation for a single particle and a system of particles, translation and rotation of rigid bodies, references, relationship between velocities of a particle for different references, acceleration of particle for different reference.	24	10-14
Revision Week			15

Books And References:

1. I.H. Shames and G.Krishna Mohan Rao, Engineering Mechanics: Statics and Dynamics, (4^{th} Ed.), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2009.
2. R.C. Hibbeler and Ashok Gupta, Engineering Mechanics: Statics and Dynamics. 11^{th} Ed., Doring Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi.

Website and e-Learning Source:

- http://mathforum.org
- http://ocw.mit.edu/ocwweb/Mathematics
- http://www.opensource.org
- www.algebra.com

SEMESTER –VI

Group Theory –II Sub.

Code – BSMT-3201

Program Outcomes:

PO1: Understand the fundamental concepts of mathematical principles and theories.

PO2: Apply mathematical concepts and techniques to solve real-world problems across various disciplines.

PO3: Analyze the complex mathematical problems to identify patterns, relationships, andunderlying structures.

PO4: Evaluate the mathematical arguments and solutions, assessing their validity andeffectiveness.

PO5: Create innovative mathematical models and solutions to address new and emergingchallenges.

Course Outcomes:

CO1: Define key concepts such as automorphism, inner automorphism, and characteristicsubgroups.

CO2: Explain the properties of automorphism groups for finite and infinite cyclic groups.

CO3: Apply the properties of external direct products and permutation representations to analyze group actions.

CO4: Analyze groups acting on themselves by conjugation, using the class equation to draw conclusions about conjugacy in symmetric groups.

CO5: Evaluate the Sylow's theorems, including consequences like Cauchy's theorem and the simplicity of alternating groups for $n \geq 5$.

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Course Objective:

The course objectives for group theory encompass defining automorphism, inner automorphism, and characteristic subgroups; explaining the properties of automorphism groups for finite and infinite cyclic groups; and applying external direct products and permutation representations to analyze group actions. Students will also analyze groups acting on themselves by conjugation using the class equation to understand conjugacy relations. Finally, they will evaluate Sylow's theorems, including the implications of Cauchy's theorem and the simplicity of alternatinggroups for n≥5.

Syllabus Details:

UNIT	CONTENT	NO OF HOURS	NO OF WEEK
I	Automorphism, inner automorphism, automorphism, groups, automorphism groups of finite and infinite cyclic groups, applications of factor groups to automorphism groups, Characteristic subgroups, Commentator subgroup and its properties.	30	1-5
II	Properties of external direct products, permutation representation associated with a given group action, Applications of group actions: Generalized Cayley's theorem, Index theorem.	24	6-9
III	Group actions, stabilizers and kernels, permutation representation associated with a given group action, Applications of group actions: Generalized Cayley's theorem, Index theorem. Groups acting on themselves by conjugation, class equation	24	10-14

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	and consequences, conjugacy in s_n, P-groups, Sylow's theorems and consequences, Cauchy's theorem, Simplicity of A_n for $n \geq 5$, non-simplicity tests.		
	Revision Week		15

Books And References:

1. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
2. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
3. Joseph A. Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa Publishing House, 1999.
4. David S. Dummit and Richard M. Foote, Abstract Algebra, 3rd Ed., John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2004.
5. J.R. Durbin, Modern Algebra, John Wiley & Sons, New York Inc., 2000.
6. D.A.R. Wallace, Groups, Rings and Fields, Springer Verlag London Ltd., 1998.

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- http://www.opensource.org
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Ring Theory and Linear Algebra –II

Sub. Code – BSMT-3202

Program Outcomes:

PO1: Understand the fundamental concepts of mathematical principles and theories.

PO2: Apply mathematical concepts and techniques to solve real-world problems across various disciplines.

PO3: Analyze the complex mathematical problems to identify patterns, relationships, andunderlying structures.

PO4: Evaluate the mathematical arguments and solutions, assessing their validity andeffectiveness.

PO5: Create innovative mathematical models and solutions to address new and emergingchallenges.

Course Outcomes:

CO1: Understand fundamental concepts of polynomial rings, divisibility, and factorization in algebraic structures.

CO2: Apply algorithms and tests to solve polynomial factorization and linear algebra problems involving eigenvalues and minimal polynomials.

CO3: Analyze the structure of dual spaces, eigen spaces, and invariant subspaces in relation tolinear operators.

CO4: Evaluate techniques like the Gram-Schmidt process and least squares approximation forsolving linear systems.

CO5: Use the Spectral Theorem to decompose operators and apply orthogonal projections in linear transformations.

Course Objective:

The course objectives include understanding polynomial rings, divisibility, and factorization; applying algorithms for polynomial factorization and linear algebra involving eigenvalues;

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Nalanda - 803115 (Bihar)

analyzing dual spaces, eigenspaces, and invariant subspaces; evaluating techniques like Gram-Schmidt and least squares for linear systems; and using the Spectral Theorem for operator decomposition and orthogonal projections.

Syllabus Details:

UNIT	CONTENT	NO OF HOURS	NO OF WEEK
I	Polynomial rings over commutative rings, division algorithm and consequences, principal ideal domains, factorization of polynomials, reducibility tests, irreducibility tests, Eisenstein criterion, unique factorization in z(x). Divisibility in integral domains, irreducible, primes, unique factorization domains, Euclidean domains.	30	1-5
II	Dual spaces, dual basis, double dual, transpose of a linear transformation and its matrix in the dual basis, annihilators, Eigen spaces of a linear operator, diagonalizability, invariant subspaces and Cayley-Hamilton theorem, the minmal polynomial for a linear operator.	24	6-9
III	Inner product spaces and noms, Gram-Schmidt orthogonalisation process, orthogonal complements, Bessel's inequality, the adjoint of a linear operator, Least Squares Approximation, minimal solutions to systems of linear equations, Normal and self-adjoint operators, orthogonal projections and Spectral theorem.	24	10-14
Revision Week			15

Books And References:

1. John B. Fraleigh, A First course in Abstract Algebra, 7th Ed., Pearson, 2002.
2. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.

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3. Joseph A. Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa Publishing House, 1999.
4. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra, 4th Ed., prentice-Hall of India Pvt. Ltd., New Delhi, 2004.
5. S. Lang, Introduction to Linear Algebra, 2nd Ed., Springer, 2005.
6. Gilbert Strang, Linear Algebra- A Geometric Approach, Prentice Hall of India, 1999.
7. Kenneth Hoffman, Ray Alden Kunze, Linear Algebra, 2nd Ed., Prentice-Hall of India Pvt. Ltd., 1971.
8. S.H. Friedberg, A.L. Insel and L.E. Spence, Linear Algebra, Prentice Hall of India Pvt. Ltd., 2004.

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Metric Space and Complex Analysis

Sub. Code – BSMT-3203

Program Outcomes:

PO1: Understand the fundamental concepts of mathematical principles and theories.

PO2: Apply mathematical concepts and techniques to solve real-world problems across various disciplines.

PO3: Analyze the complex mathematical problems to identify patterns, relationships, andunderlying structures.

PO4: Evaluate the mathematical arguments and solutions, assessing their validity andeffectiveness.

PO5: Create innovative mathematical models and solutions to address new and emergingchallenges.

Course Outcomes:

CO1: Understand key concepts of metric spaces, sequences, and completeness. **CO2:**Apply contraction mappings and Banach's Fixed Point Theorem in metric spaces.**CO3:**Analyze connectedness, limits, and continuity in metric and complex spaces.

CO4: Evaluate differentiability of complex functions using the Cauchy-Riemann equations and theorems like Cauchy-Goursat.

CO5: Solve problems using Taylor and Laurent series, and apply the fundamental theorem ofalgebra.

Course Objective:

The objective of the course is to understand metric spaces and contraction mappings, *apply* setand relation concepts, analyze differentiability using Cauchy-Riemann equations, *evaluate*

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contour integrals, and synthesize key theorems like Liouville's and the Fundamental Theorem of Algebra, alongside series convergence.

Syllabus Details:

UNIT	CONTENT	NO OF HOURS	NO OF WEEK
I	Metric spaces: definition and examples. Sequences in metric spaces, Cauchy sequences. Complete Metric Spaces. Open and closed balls, neighbourhood, open set, interior of a set. Limit point of a set,closed set, diameter of a set, Cantraction mappings, banach Fixed point Theorem. Connectedness, connected subsets of R.	30	1-5
II	Continuous mappings, sequential criterion and other characterizations of continuity. Uniform continuity. Homeomorphism, Contraction mappings, Banach Fized point Theorem. Connectedness, connected subsets of R. Limits, Limits involving the point at infinity, continuity. Properties of complex numbers, regions in the complex plane, functions of complex variable, mappings. Derivatieves, differentiation formulas, Cauchy-Riemann equations, sufficient conditions for differentiability.	24	6-9
III	Analytic functions, examples of analytic functions, exponential function, Logarithmic function, trigonometric function, derivatives of functions, definite integrals of functions. Contours, Contour integrals and its examples, upper bounds for moduli of contour integrals. Cauchy- Goursat theorem, Cauchy integral formula. Liouville's theorem and the fundamental theorem ofalgebra. Convergence of sequences and series, Taylor series and its examples. Laurent series and its examples, absolute and uniform convergence of power series.	24	10-14

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Revision Week	15

Books And References:

1. Satish Shirali and Harikishan L. Vasudeva, Metric Spaces, Springer Verlag, London, 2006.
2. S.Kumaresan, Topology of Metric Spaces, 2nd Ed., Narosa Publishing House, 2011.
3. G.F. Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill, 2004.
4. James Ward Brown and Ruel V. Churchill, Complex Variables and Applications, 8th Ed., McGraw- Hill International Edition, 2009.
5. Joseph Bak and Donald J. Newman, Complex Analysis, 2nd Ed., Undergraduate Text in Mathematics, Springer- Verlag new York, Inc., New York, 1997.

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- http://mathforum.org
- http://ocw.mit.edu/ocwweb/Mathematics
- http://www.opensource.org
- www.algebra.com

Logics and sets Sub. Code – BSMT-3204

Program Outcomes:

PO1: Understand the fundamental concepts of mathematical principles and theories.

PO2: Apply mathematical concepts and techniques to solve real-world problems across various disciplines.

PO3: Analyze the complex mathematical problems to identify patterns, relationships, andunderlying structures.

PO4: Evaluate the mathematical arguments and solutions, assessing their validity andeffectiveness.

PO5: Create innovative mathematical models and solutions to address new and emergingchallenges.

Course Outcomes:

CO1: Understand the fundamentals of propositional logic and truth tables. **CO2:**
Apply set theory operations and laws to various mathematical problems.**CO3:**
Analyze relations, including equivalence and partial orders.

CO4: Evaluate set identities and logical equivalences in mathematical contexts.

CO5: Use quantifiers and predicates to form and interpret logical expressions.

Course Objective:

This course aims to build a solid foundation in propositional logic, set theory, and relations. Students will understand propositional logic and truth tables, apply set theory operations to solveproblems and analyze relations like equivalence and partial orders. They will evaluate set identities and logical equivalences and use quantifiers and predicates to form and interpret logical expressions .

Syllabus Details:

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UNIT	CONTENT	NO OF HOURS	NO OF WEEK
I	Introduction, Propositions, truth table, negation, conjunction and disjunction. Implications, biconditional Propositions, converse, contra positive and inverse propositions and precedence of logical operators. Propositional equivalence: Logical equivalences. Predicates and quantifiers: Introduction, Quantifiers, Binding variables and negations.	24	1-5
II	Sets, subsets, Set operations and the laws of set theory and Venn diagrams. Examples of finite and infinite sets. Finite sets and counting principle. Empty set, properties of empty set. Standard set operations. Classes of sets. Power set of set.	24	6-9
III	Difference and Symmetric difference of two sets. Set identities, Generalized union and intersection. Relation: product set, Composition of relations, Types of relations, Partitions, Equivalence Relations with example of congruence modulo relation, Partial ordering relations, nary relations.	24	10-14
Revision Week			15

Books And References:

1. R.P. Grimaldi, Discrete Mathematics and Combinatorial Mathematics, Pearson Education, 1998.
2. P.R. Halmos, Naïve Set Theory, Springer, 1974.
3. E. Kamke, Theory of sets, Dover Publishers, 1950.

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<u>**Syllabus for subsidiary PapersSemester I**</u>

<u>**CHEMISTRY – IBSCH-S- 1101**</u>

UNITS	CONTENTS	NO. Hrs.	NO week
I	**Physical Chemistry** **Gaseous State** (a) Kinetic Theory of gases, Derivation of kinetic gas equation, deduction of gas laws, calculation of gas constants and kinetic theory. (b) Types of solids, crystal forces, law of constancy of angels, seven crystal systems, law of rational indices, Bragg's Law,Lattice energy, Born-Haber cycle	9	1-3
	Thermochemistry (a) Heat in chemical reactions, Reaction enthalpy, standard enthalpy changes, (b) Hess Law, Kirchoff law (c) Bond energy and determination	6	4-5
	Ionic Equilibrium (a) Ionic product of water, pH, pK_a, pK_b, pK_w (b) Buffer solution, Idea of buffer solution in everday life. (c) Solubility product and its application in salt analysis. (d) Specific conductance, Molar conductance, Equivalent conductance.	9	6-8
II	**Inorganic Chemistry** **Atomic Structure and Bonding** (a) Features of H-spectra and Bohr's theory. (b) Shapes of orbitals and their labellings, idea of quantum number (c) Pauli's Exclusion Principles, Hund's rule, Aufbau principle (d) Electronic configuration of elements (e) Idea of iconic and covalent bonds, Ionisation potential, Electronegativity, **Chemistry of the following elements** Li, Sn, Fluorine, Chlorine, Iodine	9	9-11

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III	**Organic Chemistry** **Structure and mechanism** (a) Hybridisation, bond angle, bond length, idea of bonds, (b) Inductive effect, electromeric effect, mesomeric effect (c) Bond fission and products	**9**	**12-14**
Revision			**15**

PRACTICAL CHEMISTRY – IBSCH-S- 1101P

PRACTICAL	
1.	Inorganic chemistry Volumetric Analysis (a) Acidimetry and alkalimetry (b) Use of potassium permanganate and potassium dichromate (c) Iodometry
2.	Note book and Viva voce

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PHYSICS - IBSPH-S- 1101

UNIT	CONTENTS	No of hours	No of week
I	Relativity – Galilean transformation Inertial frame of reference. Michelson-Morley experiment, Lorentz., Fitzgerald Contraction Einstein's Postulates, Lorentz, Transformation and its Consequences, Addition of velocities. Relativistic Doppler effect on propagation of light waves, variation of mass with velocity. Mass energy relation.	15	1-5
II	Mechanics and properties of Matter- Inertial and non-inertial frames of reference; Coriolis and centrifugal forces and their simple application. Motion in Central field. Kepler's law. Generalized coordinates. Constraints (Homonymic and non homonymic) Lagrangian equation of motion and its simple applications. Elasticity & Elastic constants, Relation between elastic constant bending of beams and Cantilevers, Torsion of cylinder and rigidity modulus by flat spiral spring.	15	6-10
III	Effect of temperature and pressure on elasticity. Surface tension and surface energy. Ripples and gravity waves; surface tension by the method of ripples; Effect of temperature and pressure on surface tension. Perfect fluids, equation of Continuity Euler's equation for a perfect fluid Benoulli's equation. Viscosity of fluids, critical velocity. Poiseuille's formula with correction. Flow of a compressible fluid through a narrow tube; viscosity of gases: Rankine's method. Effect of temperature and pressure on viscosity.	12	11-14
Revision			15

Reference Books:

1. Concepts of Modern Physics: Arthur Beiser
2. Introduction to Special Relativity: Robert Resnick.
3. Classical Mechanics: J.C. Upadhyay
4. Mechanics by D.S. Mathur

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HNL – 1101: HINDI –I

PHYSICS - I BSPH-S- 1101

UNIT	CONTENTS	No of hours	No of week
I	• Hindi Bhasha ke Vibhinna Roop – Rashtra bhasha, Rjabhasha, Janbhasha. • Tippan, Aalekhan, Sankshepa, Sarkari patra ke prakar, paribhashik shabdawali. • Anuvaad ki paribhasha, prakar, Upyogita aur mahatva, Achhe Anuvaad ke Gun, Anuvaad prayog (Hindi se English me Anuvaad).	10	1-5
II	• Sabhashan Kala ka Artha, Sambhashan ke Vibhinn Roop – Vaartalap, Vyakhyan, Vaad-Vivaad, Ekaalap, Avaachik Abhivyakti, Jan Sambodhan, Sambhashan Kala ke Upaadan- Bhasha Gyan, Antaraal Dhwani (Volume), Lahaja (Accent).	10	6-10
III	• Sambhashan Kala ke Vibhinn Roop – Udgoshana, Sanchalan, Aankho Dekha Haal, Vachan Kala, Vaad-Vivaad Pratiyogita, Samuh samvaad.	8	11-14
Revision			15

Book :

1. Karyalayeeya Hindi – Dr. Kailashnath Pandey – Prabhat Prakashan, New Delhi.
2. Prayojanmulak Hindi – Prayukti aur Anuvaad – Madhav Sonatakke
3. Anuvaad Vigyan – Bholanath Tiwari
4. Bhashan aur Sambhashan ki Divya shakti – Shri Ram Sharma Aacharya – Yug Nirman Yojana Press, Mathura.
5. Bhashan Kala – Dr. Mahesh Sharma – GyanGanga Delhi.

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Semester: II

CHEMISTRY– IIBSCH-S- 1201

UNITS	CONTENTS	NO. Hrs.	NO. week
I	**Physical Chemistry** **Gaseous State** (a) Rate of reaction, order and molecularity (b) Expression for specific rate constant of first order reaction. (c) Half-life period and Units	9	1-3
	Colligative Properties (a) Osmosis and its determination (b) Vapour Pressure (c) Raoult's law of lowering vapour pressure (d) Relation between osmotic pressure and lowering of vapour pressure.	12	4-7
II	**Inorganic Chemistry** Principles involved in the volumetric and gravimetric estimation of Cu and Fe Isotopes: Brief idea of detection andseparation, Radiocarbon dating	9	8-10
III	**Organic Chemistry** **Nomenclature** (a) IUPAC Nomenclature of aliphatic and aromatic compounds Chemistry of monohydric alcohol and Grignard reagent Idea of purification of compounds, Chromatography	12	11-14
Revision			**15**

PRACTICAL CHEMISTRY – IIBSCH-S- 1201P

PRACTICAL	
1.	Organic chemistry Detection of nitrogen, sulphur and halogen in organic compounds Detection of following functional group of organic compounds (a) OH (Phenolic) (b) CHO (c) C= O (d) COOH (e) NH_3 and NO_2
2.	Note book and Viva voce

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PHYSICS – IIBSPH-S- 1201

UNIT	CONTENTS	No of hours	No of week
I	Waves and Acoustics- Differential equation of a wave. Equation of progressive waves. Stationary waves. Compression waves in fluids and in extended solids. Free, damped and force oscillation's Fourier analysis Vibration of strings. Intensity and Loudness of sound and their measurements Acoustics of buildings Ultrasonic's.	15	1-5
II	Kinetic Theory of gases:- basics assumptions of kinetic theory, Ideal gas approximations, deduction of perfect gas laws, Maxwell's distribution law (both in terms of velocity and energy), root mean square and most probable speeds Finite size of molecules, Collision probability, distribution of free path from Maxwell's distribution, Degree of freedom, equipartition of energy.	15	6-10
III	Transport phenomena:- Viscosity, thermal conduction and diffusion of gases, Brownian motion: Einstein theory, perrin's work, determination of Avogadro number. Real gas:- Nature of intermolecular interaction: isotherms of real gases, Vander Waals equation of state, critical constant of gas, law of corresponding states, Virial coefficients, Boyle's temperature.	15	11-14
Revision			15

Reference Books:

1. The Physics of Waves and Oscillations: N.K. Bajaj.
2. Heat and Thermodynamics: K.W. Zeemansky.
3. A Treatise on Heat : M.N. Saha and B.N. Srivastava.
4. Kinetic Theory of Gases: Walter Kauzmann

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ENGLISH – IENL-1201

UNIT	CONTENTS	No of hours	No of week
I	**I. Prose:** 1. The Bet — Anton Chekov 2. Socrates and the Schoolmaster — F. L. Brayne 3. An Astrologer's Day — R. K. Narayan 4. The Gift of the Magi — O' Henry 5. With the Photographer — Stephen Leacock	10	1-5
II	**II. Spoken Communication:** 1) Meeting People, Exchanging Greetings and Taking Leave 2) Introducing Yourself 3) Introducing People to Others 4) Answering the Telephone and Asking for Someone 5) Dealing with a Wrong Number 6) Taking and Leaving Messages 7) Making Inquiries on the Phone 8) Calling for Help in an Emergency	10	6-10
III	II. Grammar and Vocabulary: Articles, prepositions, modal auxiliaries, antonyms, synonyms, one-word substitutes. IV. Written Communication: Summarizing	10	11-14
	Revision		15

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Semester: III CHEMISTRY– IIIBSCH-S- 2101

UNITS	CONTENTS	No. Hrs.	No. Hours
I	**Physical Chemistry** **State of Matter** (a) Van der Waals equation, critical constants, collision frequency, mean free path (b) Idea of lattice planes, stoichiometric and non-stoichiometric defects in simple ionic solid	9	1-3
	Thermodynamics (a) Extensive and Intensive system (b) First and second law of thermodynamics (c) Carnot cycle	6	4-5
	Inorganic Chemistry **Atomic structure and bonding** (a) De Broglie waves (b) Schrodinger wave equation (c) Idea of overlap and hybridization (d) Metallic bonding (e) Double salts and complex salts (f) Werner's theory	9	7-9
II	**Introduction to the transition metal complex** Variable oxidation states, magnetism	3	10
III	**Organic Chemistry** **Structure and Mechanism** (a) Different types of isomerism (b) Electrophilic and nucleophilic substitution at saturated carbon	6	11-12
	Natural Products (a) Carbohydrates (b) Elementary idea of Alkaloids and Terpenoids	6	13-14
	Revision		15

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PHYSICS –IIIBSPH-S- 2101

UNIT	CONTENTS	No of hours	No of week
I	Boundary conditions at the surface of separation of two dielectrics. Electric doubles, Dipole moment, Dielectric polarization. Electrical image- problems involving Infinite conducting plane and thin conducting spherical shell only. Magnetic shell, Langevin and Weiss' theory to dia, para and ferromagnetic. Curie's law, production and measurement of strong magnetic field, Magnetic circuit and Electromagnetic.	15	1-5
II	Current Electricity and Modern Physics: Thermodynamic treatment of see back, peltier and Thomson effects and their applications. Moving coil aperiodic and ballistic galvanometer, Growth and decay of currents in electric. Circuits, Oscillatory discharge of a condenser. A.C. and A.C. circuits: use of vectors and complex quantities in. A.C. circuits theory (L.R.C.R. and I.C.R. circuits), De Sauty's bridge, Anderson's bridge and Carey Foster's bridge.	15	6-10
III	Measurement of electronic charge by Millikan's method and specific charge of an electron by Thomson's method. Natural radioactivity. Rutherford & Soddy's theory of activity Elementary ideas about nucleus and its structure. Nuclear fission. Reactors, Aaron's mass spectrograph.	15	11-14
Revision			15

Reference Books:

1. Concepts of Modern Physics: Arthur Beiser
2. Electronic devices: T.L. Floyd
3. Electronic Fundamental and Applications: D. Chatopadhyay and P.C. Rakshit.
4. Elementary Modern Physics: A.P. Arya
5. Solids State Physics: C. Kittel.

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Semester: IV CHEMISTRY –IVBSCH-S- 2201

UNITS	CONTENTS	No of hours	No of week
I	**Physical Chemistry** **Ionic Equilibrium** (a) Oswald's dilution law (b) Salt Hydrolysis (c) Theory of acid- base indicator	12	1-4
	Chemical Kinetics (a) Second order reaction, expression of rate constant (b) Effect of temperature on reaction rate (c) Arrhenius equation	12	5-8
II	**Inorganic Chemistry** (a) Chemistry of Group 4 elements (b) Idea of Major pollutants in environments	12	9-12
	Chemistry of Fe, Cr, Ni compounds	6	13-14
Revision			15

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PHYSICS –IVBSPH-S- 2201

UNIT	CONTENTS	No. ofhours	No of week
I	Photoelectric emission, Einstein's photoelectric equation, Photo-electric, Photo-conductive and photo voltaic cells. Compton effect Bragg's law and determination of x-ray wavelength. Cathode ray oscilloscope and its uses in amplitude,frequency and phase measurements. Solid state rectifier one stage R.C. Amplifier principles of amplitude modulation and demodulation Radio receiver through Block diagram.	15	1-5
II	Optics- Fermat's Principle, Newton's rind. Michelson's interferometer Fresnel's diffraction at straight edge. Fraunhofer's diffraction single slit, double slit, plane transmission gratings, Resolving power of microscope and telescope. Polarisation, production of plane. Circularly and elliptically polarized lights. Nicol's prism. Quarter wave plate. Half-shade polarimeter babinet's compensator. Bohr's theory of hydrogen spectra. Principle action Ruby laser. Maxwell's equations. Equation of plane electromagnetic waves and its solution.	15	6-10
III	Thermal Physics – Maxwell's law of distribution of Velocities and its experimental verification; Degree of freedom & equipartition of energy. Mean free path and its experimental determination, Perfect gas equation and Vander Waals equation of state. Cycle Entropy and its Calculation in simple cases. Thermodynamic relations and their applications to Simple physical problem. Clausius-Clapeyron equation. Joule- Thomson effect, Liquefaction of gases with special reference to Helium, super fluidity in liquid helium. Kirchhoff law and black body radiation. Stefan Boltzmann law its deduction and experimental verification.	12	11-14
Revision			15

K.K. UNIVERSITY 803115 NALANDA

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Reference Books:

1. Heat and Thermodynamics: Brij Lal and N. Subramanyam.
2. Heat and Thermodynamics: K.W. Zeemansky.
3. A textbook of Optics : N. Subrahmanyam, Brijalal and M.N. Avadhanulu
4. Optics: Ajoy Ghatak

ENGLISH – IIENL-2201

UNIT	CONTENTS	No. ofhours	No of week
I	**Short Stories** 1. Maupassant - The Necklace 2. O. Henry - The Last Leaf 3. Catherine Mansfield - A Cup of Tea 4. R.K. Narayan - Selvi 5. MR Anand - The Lost Child 6. Jhumpa Lahiri - The Interpreter of Maladies 7. Shashi Deshpande - Hear Me Sanjaya!	10	1-5
II	**II. Pieces of Prose** a. James Bryce - Some hints of Public Speaking b. C.E.M. .Toad - A Dialogue on Civilization c. Hill - Principles of good writing d. Bapsi Sidhwa - Why do I write? e. Jawahar Lal Nehru - The Reawakening of India f. Subhash Chandra Bose - To Delhi, To Delhi g. Dr. Rukhmabai - Purdah - The Need for its Abolition	10	6-10
III	**III. Novel** Lord of the Flies - William Golding	8	11-14
Revision			15