(Bachelor of Science) (Mathematics)
(B.Sc.) (Mathematics) Semester (IV)

Course Code	US04MAMTH01	Title of the Course	PARTIAL DIFFERENTIAL EQUATIONS
Total Credits of the Course	4	Hours per Week	4

Course Objectives:	1. To teach PARTIAL DIFFERENTIAL EQUATIONS. 2. To teach Applications of various results of partial differential equations

Course Content		
Unit	Description	Weightage* (%)
1.	Surfaces and Curves in Three Dimensions, Methods of Solving $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$, Orthogonal Trajectories of a System of Curves on Surface, Pfaffian Forms and Equations, Solution of Pfaffian Differential Equations in Three Variables.	25%
2.	Partial Differential Equations, Origin of First Order Partial Differential Equations, Linear Equations of the First Order, Integral Surfaces Through a Given Curve, Surfaces Orthogonal to a Given System of Surfaces.	25%
3.	Non-linear Partial Differential Equations of First Order, Compatible Systems of First Order Equations , Charpit's Method , Special Types of First Order Equations, Solutions Satisfying Given Conditions.	25%
4.	Applications of First Order Equations, The Origin of Second Order Equations, Linear Partial Differential Equations With Constant Coefficients, Equations With Variable Coefficients, Solution of Equation by Separation of Variable.	25%

Teaching-Learning Methodology	Classroom teaching, Presentation by students, Use of ICT whenever required.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%

2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Understand Different methods of Solving $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$
2.	Understand Origin of First Order Partial Differential Equations.
3.	Understand Non-linear Partial Differential Equations of First Order.
4.	Understand Applications of First Order Equations.

Suggested References:

I.Sneddon, Elements of Partial Differential Equations, McGraw Hill Book Company, International Student Edition. Chapter 1 (1.1,1.3,1.4,1.5(excluding Thm.6),1.6),Chapter 2 (2.1,2.2 , 2.4 (Thm.3 without proof),2.5,2.6,2.7,2.9,2.10,2.11 , 2.12 , 2.13 , 2.14),Chapter 3 (3.1,3.4,3.5,3.9)

Sr. No.	References
1.	T. Amaranath ,An Elementary Course in Partial Differential Equations , Narosa Publishing House , New Delhi
2.	Nita Shah ,Ordinary and Partial Differential Equations-Theory and Applications , PHI Learing Pvt. Ltd. , New Delhi.
3.	Zafar Ahsan , Differential Equations and Their Applications ,Prentice - Hall of India Pvt. Ltd., New Delhi
4.	M.D.Raisinghania, Ordinary and Partial differential equations, S.Chand & Company Ltd., New Delhi.

On-line resources to be used if available as reference material
On-line Resources

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(Bachelor of Science) (Mathematics)
(B.Sc.) (Mathematics) Semester (4)

Course Code	US04MAMTH02	Title of the Course	Numerical Analysis
Total Credits of the Course	4	Hours per Week	4 hours

Course Objectives:	1. To introduce students Numerical Analysis and where it can be useful. 2. To teach students various Numerical Methods for solving equations. 3. To teach students how to use Numerical Methods for solving certain problems in Calculus.

Course Content		
Unit	Description	Weightage* (%)
1.	Errors and Their Computations, A General Error Formula, Errors in a series approximation, Solution of Algebraic and Transcendental Equations: Bisection Method, Iteration Method, Aitken's Δ^2 process, Method of False Position, Newton – Raphson Method.	25%
2.	Interpolation: Finite Differences, Forward, Backward and Central Differences, Symbolic Relations of Operators, Detection of Errors by Use of Difference Tables, Differences of Polynomials, Newton's Forward and Backward Formulae, Gauss Forward and Backward Formulae, Stirling's, Bessel's and Everett's Formulae.	25%
3.	Interpolation with Unequally spaced Points, Lagrange's Interpolation formula (Without proof), Divided Difference and Their Properties, Newton's General Interpolation formula, Interpolation by Iteration, Inverse Interpolation, Method of Successive Approximations, Numerical Differentiation: Newton's Forward and Backward Method, Gauss's Method, Maximum and Minimum Values of Tabulated value.	25%
4	Numerical Integration: Trapezoidal Rule, Simpson's $\left(\frac{1}{3}\right)^{rd}$ and $\left(\frac{3}{8}\right)^{th}$ Rules, Numerical Solution of Ordinary Differential Equation by Taylor's series, Picard's Method, Euler's Method, Modified Euler's Method, Range-Kutta Method.	25%

Teaching-Learning Methodology	Classroom teaching, Presentation by students, Use of ICT whenever required.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	understand various methods for approximating roots of equations.
2.	interpolate through a given set of data to find an approximating function and value.
3.	find numerical solution of Differential Equations and approximate integrals.

Suggested References:	
Sr. No.	References
1.	S. S. Sastry, Introductory methods of Numerical Analysis, 4th Ed., Prentice hall of india, 2010. Chapter : 1(1.3,1.4,1.5), 2(2.1 to 2.6), 3(3.3.1, 3.3.2, 3.3.3, 3.6, 3.7, 3.9.1, 3.10, 3.11), 5(5.1, 5.2, 5.3, 5.4.1, 5.4.2, 5.4.3, 5.4.6), 7(7.1 to 7.5)
2.	G. Sankar rao, Numerical Analysis
3.	B. S. Grewal, Numerical Analysis, Khanna Publiication.
4.	M. K. Jain, S. R. K. Iyengar and R. K. Jain, Numerical Methods for Scientific and Engineering Computation, 6th Ed., New Age Int. Publisher, India 2007

On-line resources to be used if available as reference material
On-line Resources

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(Bachelor of Science) (Mathematics)
(B.Sc.) (Mathematics)Semester (4)

Course Code	US04MAMTH03	Title of the Course	Problems and Exercises in Partial Differential Equation & Numerical Analysis
Total Credits of the Course	4	Hours per Week	4 hours

Course Objectives:	1. To develop problem solving skills of students through interactive teaching and supervised practice. 2. To teach students various methods of solving and applying results of Partial Differential Equations. 3. To teach students various methods of solving and applying results of Numerical Analysis.

Course Content

PART- I (PARTIAL DIFFERENTIAL EQUATIONS)

Unit	Description	Weightage* (%)
1.	Surfaces and Curves in Three Dimensions, Methods Of solving $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$, Orthogonal Trajectories of a system of curves on Surface	10%
2.	Pfaffian Forms and Equations , Solution of Pfaffian Differential Equations in Three Variables, Partial Differential Equations , Origin of First Order Partial Differential Equations , Linear Equations of the First Order	10%
3.	Integral Surfaces Through a Given Curve, Surfaces Orthogonal to a Given System of Surfaces, Non-linear Partial Differential Equations of First Order, Compatible Systems of First Order Equations	10%
4.	Finding solutions using Charpit's Method. , Special Types of First Order Equations , Solutions Satisfying Given Conditions	10%
5.	Jacobi's Method , Applications of First Order Equations , The Origin of Second Order Equations, Linear Partial Differential Equations With Constant Coefficients	10%

PART- II (NUMERICAL METHODS)		
Unit	Description	Weightage* (%)
1.	Inherent Errors and truncated errors; Errors in a series approximation. Solution of algebraic and transcendental equations: Bisection method, Iteration method, Aitken's Δ^2 process, method of false position, Newton Raphson method	10%
2.	Interpolation: Finite Differences, Forward, Backward and Central Differences, Symbolic Relations of Operators, Detection of Errors by Use of Difference Tables, Differences of a Polynomial.	10%
3.	Newton's Forward and Backward Formulae, Gauss Forward and Backward Formulae. Stirling's, Bessel's, Newton's General and Lagrange's formulae.	10%
4.	Numerical differentiation: Differentiation of Newton's forward and backward, Gauss's Method, Maximum and Minimum Values of a Tabulated Function. Trapezoidal Rule, Simpson's $\left(\frac{1}{3}\right)^{rd}$ and $\left(\frac{3}{8}\right)^{th}$ rules.	10%
5.	Numerical solution of ordinary differential equations: Solution by Taylor's series , Picard's method, Euler's Method , Modified Euler's method , Runge-Kutta method.	10%

Teaching-Learning Methodology	Classroom teaching, Presentation by students, Use of ICT whenever required.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	---
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	---
3.	**University Examination: Practical Examination of each PART will be conducted separately, each of 50% weightage.**	100%

NOTE :

1. There would be a batch of problem solving session will be of eight hours per week and they will be conducted in batches of students of size 20 to 25 per batch.
2. The candidate shall have to produce at the time practical Examination the record of their prescribed Laboratory work, certified by the Head of the Department.

Course Outcomes: Having completed this course, the learner will be able to	
1.	identify and categorize Partial Differential Equations.
2.	solve Partial Differential Equations.
3.	apply knowledge of Partial Differential Equations to solve certain problems.
4.	Numerically approximate root of an equation.
5.	Interpolate a given set of data to find an interpolating function.
6.	Interpolate a given set of data to find and interpolating function.
7.	Numerically approximate Derivatives and Integrals

Suggested References:	
Sr. No.	References
1.	I. Sneddon, Elements of Partial Differential Equations, McGraw Hill Book Company, International Student Edition .
2.	Shanti Narayan, Integral Calculus, Fourteenth Edition, S. Chand & Company Ltd., New Delhi, 1996
3.	M.D. Raisinghania, Ordinary and Partial differential equations, S. Chand & Company Ltd., New Delhi.
4.	Nita Shah, Ordinary and Partial Differential Equations - Theory and Applications , PHI Learning Pvt. Ltd. , New Delhi
6.	Zafar Ahsan, Differential Equations and Their Applications, Prentice - Hall of India Pvt. Ltd., New Delhi.
7.	S.S. Sastry, Introductory methods of Numerical analysis,4th Ed., Prentice hall of India,2010.
8.	G. Sankar Rao, Numerical analysis.
9.	M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 6th Ed., New Age International Publisher, India 2007.

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(Bachelor of Science) (Mathematics)
(B.Sc.) (Mathematics) Semester (3)

Course Code	US04MIMTH01	Title of the Course	Graph Theory
Total Credits of the Course	2	Hours per Week	2 hours
Note: This course is same as US03IDMTH01. The students opting for this course shall not be offered US03IDMTH01.			

Course Objectives:	1. To teach students Introductory Graph Theory. 2. To teach students various types of operations on graphs. 3. To teach students fundamental properties of various types of graphs.

Course Content		
Unit	Description	Weightage* (%)
1.	Graph, Applications of graph, Finite and infinite graph, Incidence and Degree, Isolated vertex, Pendant vertex and null graph, Isomorphism, Sub graphs, Walks, Paths and circuits.	25%
2.	Connected and disconnected Graphs, Components, Euler graphs, Operation on graph, More on Euler graphs, Arbitrary Traceable graph Hamiltonian paths and circuits.	25%

Teaching-Learning Methodology	Classroom teaching, Presentation by students, Use of ICT whenever required.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	25%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	25%
3.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	understand basic concepts of Graph Theory.
2.	identify types of graphs and use various operations on graphs to solve problems.
3.	take up an Elementary to Intermediate course in Graph Theory

Suggested References:	
Sr. No.	References
1.	Narsingh Deo, Graph theory with application to engineering and Computer science, Fourth printing, prentice Hall of India, 1987. Chapter 1 (except 1.6), Chapter 2 (except 2.3,2.10), Chapter 3 (except 3.5,3.10), Chapter 4 (except4.6,4.7,4.8)
2.	J. Clark and A. D. Holton, A first look at Graph Theory, First Indian Reprint. Allied Publishers,1995.
3.	D. B. West, Introduction to graph theory, Prentice Hall of India, New Delhi, 1999.

On-line resources to be used if available as reference material
On-line Resources

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(Bachelor of Science) (Mathematics)
(B.Sc.) (Mathematics) Semester (3)

Course Code	US04MIMTH02	Title of the Course	Problems and Exercises in Graph Theory
Total Credits of the Course	2	Hours per Week	4 hours
Note: This course is same as US03IDMTH02. The students opting for this course shall not be offered US03IDMTH02.			

Course Objectives:	1. To develop problem solving skills of students through interactive teaching and supervised practice. 2. To teach students various methods of solving and applying results of Graph Theory. 3. To teach students various types of subgraphs and their methods.

List of Practicals		
Sr. No.	Description	Weightage* (%)
1.	Finite and infinite graph, Incidence and Degree, Isolated vertex, pendant vertex and null graph,	20%
2.	Subgraphs – vertex disjoint and edge disjoint, subgraphs induced by some vertices, Walks, Paths and circuits, Four cube problem.	20%
3.	Connected and disconnected Graphs, Components, distance, diameter, eccentricity, center of a connected graph.	20%
4	Construction of new graphs by different operations on graphs, union, intersection and ring sum.	20%
5.	Euler graphs, Konisberg's seven bridge problem, traceble graphs, Hamiltonian graph and traveling salesman problem.	20%

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	---
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	---
3.	**University Practical Examination**	100%

Course Outcomes: Having completed this course, the learner will be able to	
1.	identify and categorize Graph Theory.
2.	solve problems of Graph Theory.
3.	apply knowledge of Graph Theory to solve certain problems in real life.

Suggested References:	
Sr. No.	References
1.	Narsingh Deo, Graph theory with application to engineering and Computer science, Fourth printing, prentice Hall of India, 1987. Chapter 1 (except 1.6), Chapter 2 (except 2.3,2.10), Chapter 3 (except 3.5,3.10), Chapter 4 (except4.6,4.7,4.8)
2.	J. Clark and A. D. Holton, A first look at Graph Theory, First Indian Reprint. Allied Publishers,1995.
8.	B. S. Grewal, Higher Engineering Mathematics, Thirty-fifth edition, Khanna Publ.

On-line resources to be used if available as reference material

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(Bachelor of Science) (Mathematics)
(B.Sc.) (Mathematics)Semester (3)

Course Code	US04MIMTH03	Title of the Course	Number Theory
Total Credits of the Course	2	Hours per Week	2 hours
Note: This course is same as US03IDMTH03. The students opting for this course shall not be offered US03IDMTH03.			

Course Objectives:	1. To teach students Introductory Number Theory. 2. To teach students types of fundamental operations and functions in Number Theory. 3.To teach students various properties of Prime Numbers.

Course Content		
Unit	Description	Weightage* (%)
1.	Divisibility: definition and properties, Common Divisors, Greatest Common Divisor (GCD): definition and examples, Properties of GCD, Division Algorithm, Euclidean Algorithm, LCM: definition and examples, Properties of LCM, Relation between GCD and LCM.	25%
2.	Prime Numbers, Properties of Primes, Fundamental Theorem of Arithmetic, Linear Congruences: definition and properties, Statement and interpretation of the Chinese Remainder Theorem, Definition of Euler's function, Statement and interpretation of Euler's theorem, Statement and interpretation of Fermat's theorem.	25%

Teaching-Learning Methodology	Classroom teaching, Presentation by students, Use of ICT whenever required.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	25%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	25%
3.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	understand basic concepts of Number Theory.
2.	use various operations and functions in Number Theory to solve problems.
3.	take up an Elementary to Intermediate course in Number Theory

Suggested References:	
Sr. No.	References
1.	D. Burton , elementary Number Theory, 6th Ed , Tata McGraw-Hill Edition, Indian reprint.
2.	I. Niven And H. Zuckermar , An Introduction to the theory of Numbers, Wiley-Eastern Publication.
3.	S. Barnard and J. N. Child , Higher Algebra, Mc Millan and Co. Ltd.
4.	Neville Robinns, Beginning Number Theory, 2nd Ed.,Narosa Publishing House Pvt.Ltd. Delhi,2007

On-line resources to be used if available as reference material
On-line Resources

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(Bachelor of Science) (Mathematics)
(B.Sc.) (Mathematics)Semester (3)

Course Code	US04MIMTH04	Title of the Course	Problems and Exercises in Number Theory
Total Credits of the Course	2	Hours per Week	4 hours
Note: This course is same as US03IDMTH04. The students opting for this course shall not be offered US03IDMTH04.			

Course Objectives:	1. To develop problem solving skills of students through interactive teaching and supervised practice. 2. To teach students various methods of solving and applying results of Number Theory.

List of Practicals		
Sr. No.	Description	Weightage* (%)
1.	Examples based on the following topics. 1. Divisibility and Division Algorithm. 2. Properties of divisors and GCD. 3. Finding GCD by Euclidean Algorithm.	20%
2.	Examples based on the following topics. 1. Finding LCM and problems related to properties of LCM. 2. Relation between GCD and LCM.	20%
3.	Examples based on the following topics. 1. Primes and divisibility. 2. Properties of primes. 3. Fundamental theorem of arithmetic.	20%
4	Examples based on the following topics. 1. Solving Linear Congruences. 2. Chinese Remainder Theorem.	20%
5.	Examples based on the following topics. 1. Properties of Euler's function. 2. Numericals on Euler's theorem and Fermat's theorem.	20%

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	---
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	---
3.	**University Practical Examination**	100%

Course Outcomes: Having completed this course, the learner will be able to	
1.	identify and categorize Number Theory.
2.	solve problems of Number Theory.
3.	apply knowledge of Number Theory to solve certain problems in real life.

Suggested References:	
Sr. No.	References
1.	D. Burton , elementary Number Theory, 6th Ed , Tata McGraw-Hill Edition, Indian reprint.
2.	I. Niven And H. Zuckermar , An Introduction to the theory of Numbers, Wiley- Eastern Publication.
3.	S. Barnard and J. N. Child , Higher Algebra, Mc Millan and Co. Ltd.
4.	Neville Robinns, Beginning Number Theory, 2nd Ed.,Narosa Publishing House Pvt.Ltd. Delhi,2007

On-line resources to be used if available as reference material

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(Bachelor of Science) (Mathematics)
(B.Sc.) (Mathematics)Semester (3)

Course Code	US04MIMTH05	Title of the Course	Mechanics
Total Credits of the Course	2	Hours per Week	2 hours
Note: This course is same as US03IDMTH05. The students opting for this course shall not be offered US03IDMTH05.			

Course Objectives:	1. To introduce students to mechanics. 2. To teach students fundamental laws and results in mechanics. 3. To teach students how to study how to apply laws and results of mechanics in specific situations in science and real life..

Course Content		
Unit	Description	Weightage* (%)
1.	Ingredients of mechanics, Position vector, Velocity vector, Acceleration vector, Gradient vector, Fundamental laws of Newtonian mechanics, Theory of dimensions.	25%
2.	Plane statics, Equilibrium of a particle, Equilibrium of systems of particles, Moment of force about a line, Necessary and sufficient condition for equilibrium.	25%

Teaching-Learning Methodology	Classroom teaching, Presentation by students, Use of ICT whenever required.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	25%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	25%
3.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	understand basic concepts of Mechanics.
2.	apply results of mechanics in specific situations.
3.	take up an Elementary to Intermediate course in Mechanics.

Suggested References:	
Sr. No.	References
1.	J. L. Synge and B. A. Griffith, Principles of Mechanics. Chapter 1, Chapter 2(2.2,2.3,2.4), Chapter 3(3.1 , 3.4), Chapter 4(4.1,4.2)
2.	P. N. Chatterjee, Statics and Dynamics

On-line resources to be used if available as reference material
On-line Resources

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(Bachelor of Science) (Mathematics)
(B.Sc.) (Mathematics)Semester (3)

Course Code	US04MIMTH06	Title of the Course	Problems and Exercises in Mechanics
Total Credits of the Course	2	Hours per Week	4 hours
Note: This course is same as US03IDMTH06. The students opting for this course shall not be offered US03IDMTH06.			

Course Objectives:	1. To develop problem solving skills of students through interactive teaching and supervised practice. 2. To teach students various methods of solving and applying results of Mechanics.

List of Practicals		
Sr. No.	Description	Weightage* (%)
1.	Problems on: Position vector, Velocity vector, Acceleration vector, Gradient vector. Interpretation of gradient.	20%
2.	Fundamental laws of Newtonian mechanics, Dimensions of physical quantities. Equilibrium of a particle.	20%
3.	Notion of force, equations of motion. Solution of equations of motion in simple situations.	20%
4	Equilibrium of systems of particles, Moment of force about a line.	20%
5.	Necessary and sufficient condition for equilibrium, Examples on equilibrium system. Application in plane statics.	20%

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	---
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	---
3.	**University Practical Examination**	100%

Course Outcomes: Having completed this course, the learner will be able to	
1.	identify and categorize Mechanics.
2.	solve problems of Mechanics.
3.	apply knowledge of Mechanics to solve certain problems in real life.

Suggested References:	
Sr. No.	References
1.	J. L. Synge and B. A. Griffith, Principles of Mechanics. Chapter 1, Chapter 2(2.2,2.3,2.4), Chapter 3(3.1, 3.4), Chapter 4(4.1,4.2)
2.	P. N. Chatterjee, Statics and Dynamics

On-line resources to be used if available as reference material

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(Bachelor of Science) (Mathematics)
(B.Sc.) (Mathematics) Semester (3)

Course Code	US04MIMTH07	Title of the Course	Advanced Calculus
Total Credits of the Course	2	Hours per Week	2 hours
Note: This course is same as US03IDMTH07. The students opting for this course shall not be offered US03IDMTH07.			

Course Objectives:	• Understand the concept of double & triple integrations and its applications. • Understand the fundamental theorem of vector calculus, including, Green's theorem, Stokes' theorem, and the divergence theorem. • Develop critical thinking skills to solve problems in Physics and Engineering.

Course Content		
Unit	Description	Weightage* (%)
1.	Double Integrals and its applications, Double integrals in polar coordinates, Change of Variables in Double Integrals, Change of Order of Integration, plane area using double integrals, Triple Integrals and its applications.	25%
2.	Vector Calculus: Gradient of scalar fields, Directional derivatives, Tangent Plane and Normal Vector to the Surface, Divergence and Curl of a Vector Field, Line integrals, Evaluation of Line Integrals, Line Integral Independent of Path, Green's Theorem (without proof) and its Application with Examples, Surface area, Surface Integrals, Divergence Theorem of Gauss (without proof) and its Applications with Examples, Stoke's Theorem (without proof) and its Applications with Example.	25%

Teaching-Learning Methodology	Classroom teaching, Presentation by students, Use of ICT whenever required.

Course Outcomes: Upon completion of the course, the student will be able to….	
1.	understand double and triple integrals.
2.	find area and volume.

3.	understand line integral, surface integrals.
4.	apply the result in Physics.

Suggested References:

Sr. No.	References
1.	E. Kreyszing, Advanced Engineering Mathematics, Fifth edition, New Age International (P) LTD, New Delhi, 1997.
2.	R. K. Jain, S.R.K. Iyenger, Advanced Engineering Mathematics, Fifth Edition, Narosa publishing House, New Delhi, 2017.
3.	B.S. Grewal, Higher Engineering Mathematics, 42th Edition, Khanna Publishers, Nai Sarak, Delhi, 2012.
4.	Shanti Narayan, A course of Mathematics Analysis, 29th edition, S. Chand & company Ltd, New Delhi, 2005.

On-line resources to be used if available as reference material

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(Bachelor of Science) (Mathematics)
(B.Sc.) (Mathematics) Semester (3)

Course Code	US04MIMTH08	Title of the Course	Problems and Exercises in Advanced Calculus
Total Credits of the Course	2	Hours per Week	4 hours
Note: This course is same as US03IDMTH08. The students opting for this course shall not be offered US03IDMTH08.			

Course Objectives:	• To develop problem solving skills of students through interactive teaching and supervised practice • To teach students various methods of solving and applying results of advanced Calculus. • Develop skills required to solve problems in Physics and Engineering.

Sr. No.	List of Practicals
1.	Fundamentals of domain and range of functions of two variables
2.	Graphical representation of functions of two variables
3.	Double integrals using Cartesian and polar co-ordinates system.
4.	Change of order of integration of double integrals.
5.	Application of double integrals to evaluate area.
6.	Application of triple integrals
7.	Gradient of a scalar function, directional derivatives, Tangent plane & Normal line.
8.	Curl and divergence of a vector fields and its application.
9.	Line integrals
10.	Example based on Green's, Gauss's and Stoke's theorem

Teaching-Learning Methodology	Classroom teaching, Presentation by students, Use of ICT whenever required.

Course Outcomes: Upon completion of the course, the student will be able to….	
1.	Obtain area and volume.
2.	Solve problems in vector calculus
3.	Apply results of advanced calculus to solve certain problems in science.

Suggested References:

Sr. No.	References
1.	E. Kreyszing, Advanced Engineering Mathematics, Fifth edition, New Age International (P) LTD, New Delhi, 1997.
2.	R. K. Jain, S.R.K. Iyenger, Advanced Engineering Mathematics, Fifth Edition, Narosa publishing House, New Delhi, 2017.
3.	B.S. Grewal, Higher Engineering Mathematics, 42th Edition, Khanna Publishers, Nai Sarak, Delhi, 2012.

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SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC (CGPA 3.11)
Syllabus with effect from the Academic Year 2024-2025

(Bachelor of Science)
B. Sc. Semester – IV (Mathematics)

Course Code	US04SEMTH01	Title of the Course	Numerical Methods (Practical)
Total Credits of the Course	2	Hours per Week	4 hours

Course Objectives:	• To understand and implement numerical methods for finding the roots of equations. • To learn interpolation and extrapolation techniques for estimating values at points within and outside a data range. • To introduce methods for approximating definite integrals of complex functions using numerical techniques.

Sr. No.	Description
1.	Method of successive bisection.
2.	Method of false position
3.	Method of Newton Raphson
4.	Interpolation and Extrapolation with equal intervals: The Gregory-Newton formula for forward and backward interpolation.
5.	Interpolation for unequal intervals using Lagrange's interpolation and Newton's divided differences formula.
6.	Numerical Integration: Trapezoid Rule, Simpson's $\left(\frac{1}{3}\right)^{rd}$ and $\left(\frac{3}{8}\right)^{th}$ Rule.

Teaching-Learning Methodology	Classroom teaching, Presentation by students, Use of ICT whenever required.

Exam Pattern		
Sr. No	Details of the Evaluation	Weightage
1	Internal Written / Practical Examination (As per CBCS R.6.8.3)	----
2	Internal Continuous Assessment in the form of Practical, Viva-voce, Practical Journal, Attendance (As per CBCS R.6.8.3)	----
3	University Examination	100 %

Course Outcomes: Upon completion of the course, the student will be able to….

1.	find roots of linear and non-linear system (algebraic and transcendental) equations.
2.	apply interpolation and extrapolation methods for both equal and unequal in real-world problems such as estimating missing values in data sets.
3.	apply, analyze, and implement various numerical integration methods to solve real-world problems with high accuracy and efficiency.

Suggested References:

Sr. No.	References
1.	S. S. Sastry, Introductory Methods of Numerical Analysis, Prentice Hall of India Pvt. Ltd, fifth edition, 2012.
2.	B. S. Grewal, Higher Engineering Mathematics, Khanna Publiication, 45th edition, 2024.
3.	G. Sankar Rao, Numerical Analysis, 5th Edition, New Age International Pubishers, 2018.
4.	E. Kreyszig, Advanced Engineering Mathematics, Wiley, 10th edition, 2017.

On-line resources to be used if available as reference material

On-line Resources: https://nptel.ac.in/courses/111107105 - Unit-4-7.

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