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

Course Code	US03CMTH51	Title of the Course	ORDINARY DIFFERENTIAL EQUATIONS
Total Credits of the Course	4	Hours per Week	4

Course Objectives:	1. To teach Ordinary Differential Equations in more depth. 2. To teach Applications of Ordinary Differential Equations. 3. To teach Laplace Transforms and their properties.

Course Content		
Unit	Description	Weightage* (%)
1.	Differential Equations, Exact Differential Equations, Integrating Factors, Differential Equations of the First Order and of Higher Degree, Differential Equation Solvable for p, for y and for x, Clairaut's Equation	25%
2.	Linear Differential Equations with Constant Coefficients, Complimentary Function and Particular Integral, Operators, Products of Operators, Determination of Complimentary function, Inverse Operators, Determination of Particular Integral and Working rules for f(D)y = X where $X = e^{mx}, \sin mx, \cos mx, x^m, e^{ax}V, xV$ (V is a function of x only). Homogeneous Linear Differential Equations.	25%
3.	Laplace Transform, Properties of Laplace Transform, Laplace Transform of Derivatives, Laplace Transform of Integrals, Inverse Laplace Transforms, Properties of Inverse Laplace Transforms, Solution of ODE with Constant Coefficients, Solution of ODE with Variable Coefficients.	25%
4.	Application of Differential Equations: Newton's law of cooling, Rate of growth or decay, Chemical solution, Motion of particle falling under gravity, Electric circuits, Orthogonal Trajectories.	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.	To teach Ordinary Differential Equations in more depth.
2.	To teach Applications of Ordinary Differential Equations.
3.	To teach Laplace Transforms and their properties.

Suggested References:

Sr. No.	Reference
1.	Shanti Narayan, Integral Calculus, Fourteenth Edition, S.Chand & Company Ltd., New Delhi, 1996 Chapter : 11 (11.8,11.9 Only), 12 , 13 , 14
2.	Nita Shah, Ordinary and Partial Differential Equations - Theory and Applications, PHI Learning Pvt. Ltd., New Delhi. Chapter: 16 (Except 16.10 ,16.11)
3.	Zafar Ahsan, Differential Equations and Their Applications, 2nd Ed., Prentice - Hall of India Pvt. Ltd., New Delhi
4.	B.S.Grewal, Higher Engineering Mathematics, Thirty-fifth edition, Khanna Publ
5.	D J Karia, N Y Patel, B P Patel, M L Patel, Introduction to calculus and differential equations, Roopal prakashan.

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 (III)

Course Code	US03CMTH52	Title of the Course	MULTIVARIATE CALCULUS
Total Credits of the Course	4	Hours per Week	4

Course Objectives:	1. To teach Multivariate Calculus. 2. To teach Applications of various results of Multivariate Calculus.

Course Content		
Unit	Description	Weightage* (%)
1.	Beta and Gamma Functions and Their Properties, Relation Between Beta and Gamma functions and Examples, Vector Calculus: Gradient of scalar field, Directional derivatives, Tangent Plane and Normal Vector to a Surface, Divergence and Curl of a Vector Field.	25%
2.	Line integral, Evaluation of Line Integrals, Double Integral, Change of Variables in Double Integral, Application of Double integral, Change of Order of Integration in Cartesian Form	25%
3.	Line Integral Independent of Path, Green's Theorem and its Application with Examples, Area of Plane Region, Vector Form of Green's Theorem, Surfaces, Tangent Plane and Normal Line to the Surface, First Fundamental Form, Area of a Surface, Surface Integrals, Moment of Inertia of Surface	25%
4.	Triple Integrals, Divergence Theorem of Gauss and its Applications With Examples, First and Second Form of Green's Theorem, Application of Triple Integral (Total Mass, Moment of Inertia, Volume), Stoke'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)	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 Beta and Gamma functions and their properties.
2.	Understand elementary Vector Calculus.
3.	Understand line, double and triple integrals.
4.	Apply the results understood above to physics and mechanics.

Suggested References:	
Sr. No.	References
1.	E.Kreyszing , Advanced Engineering Mathematics , Fifth edition , New Age International (P) Ltd., New Delhi , 1997. Chapter : 9
2.	Shanti Narayan, A course of Mathematical Analysis, S.Chand & Company Ltd. Appendix I (A.4, A.5, A.6)
3.	B.S.Grewal, Higher Engineering Mathematics, Thirty-fifth edition,Khanna Publ
4.	Dr.Dinesh Karia, M.L.Patel, N.Y.Patel, B.P.Patel, A Textbook of Calculus with an Introduction to Differential Equations.

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 (III)

Course Code	US03CMTH53	Title of the Course	PROBLEMS AND EXERCISES IN ORDINARY DIFFERENTIAL EQUATIONS & MULTI-VARIATE CALCULUS.
Total Credits of the Course	4	Hours per Week	4

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 Ordinary Differential Equations. 3. To teach students various methods of solving and applying results of Multivariate Calculus.

Course Content

PART- I (ORDINARY DIFFERENTIAL EQUATIONS)

Unit	Description	Weightage* (%)
1.	Differential Equations, Exact Differential Equations; Integrating Factors, Differential Equations of the First Order and of Higher Degree	10%
2.	Differential Equation Solvable for p, for x and for y; Clairaut's Equation, Linear Differential Equations with Constant Coefficients, Complimentary Function and Particular Integral, Determination of Particular Integral and Working rules for f(D)y = X where $X = e^{mx}, \sin mx, \cos mx, x^m$	10%
3.	Determination of Particular Integral and Working rules for f(D)y = X, where $X = e^{ax}V, xV$ (where V is a function of x only). Homogeneous Linear Differential Equations	10%
4.	Laplace Transform, Properties of Laplace Transform, Laplace Transform of Derivatives, Laplace Transform of Integrals, Inverse Laplace Transforms, Properties of Inverse Laplace Transforms, Solution of ODE with Constant Coefficients, Solution of ODE with Variable Coefficients	10%
5.	Application of Differential Equations, Orthogonal Trajectories in Cartesian Co-ordinates	10%

PART- II (MULTI-VARIATE CALCULUS)		
Unit	Description	Weightage* (%)
1.	Improper integrals, Beta Functions, Gamma Functions, Relation Between Beta and Gamma functions	10%
2.	Vector Calculus: Gradient, Divergence and Curl, Directional derivatives, Tangent Plane and Normal Vector to a Surface	10%
3.	Line integral, Double Integral, Change of Variables in Double Integral, Application of Double integral, Change of Order of Integration in Cartesian Form.	10%
4.	Area of a Surface, Surface Integrals, Moment of Inertia of Surface, Verify Green's Theorem, Triple Integrals	10%
5.	Application of Divergence Theorem of Gauss, Application of Triple Integral (Total Mass, Moment of Inertia, Volume)	10%

Teaching-Learning Methodology	Classroom teaching, Presentation by students, Use of ICT whenever required.
NOTE:	1. Use of the standard text books may be permitted at the time of Practical Examination. 2. Use of non- programmable Scientific Calculator is Allowed. 3. There would be a batch of problem solving session of eight hours per week and they will be conducted in batches of students of size 20 to 25 per batch. 4. 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.

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%

Course Outcomes: Having completed this course, the learner will be able to	
1.	identify and categorize an Ordinary Differential Equation.
2.	solve Ordinary Differential Equations.
3.	apply knowledge of Ordinary Differential Equation to solve certain problems in Science 4. solve Laplace transformation problems.
4.	solve problems of Beta and Gamma Functions; and Line, Double and Triple Integrals.
5.	solve problems in Vector Calculus.
6.	apply results of Multivariate Calculus to solve certain problems in Science.

Suggested References:	
Sr. No.	References
1.	S.S. Sastry, Introductory methods of Numerical analysis, Prentice Hall Of India, 2010
2.	Brain Bradie, A Friendly Introduction to Numerical analysis, Pearson Education,India,2007.
3.	G. Sankar Rao , Numerical analysis.
4.	B.S. Grawal, Numerical analysis.
5.	Bajpai, calus and farly, Numerical Analysis for scientists and Engineers, John Wiely.
6.	E. Kreyszing , Advanced Engineering Mathematics , Fifth edition , New Age International (P) Ltd., New Delhi , 1997.
7.	Shanti Narayan , A course of Mathematical Analysis ,S. Chand & Company Ltd.
8.	B.S.Grewal, Higher Engineering Mathematics, Thirty-fifth edition, Khanna Publ.

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

Course Code	US03SMTH51	Title of the Course	NUMBER THEORY - 1
Total Credits of the Course	2	Hours per Week	2

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, Fundamental theorem of divisibility, Square number, Common divisors, Greatest common divisor (G.C.D.): definition and examples, Properties of G.C.D.	25%
2.	Least common multiple (L.C.M.): definition and examples, Properties of L.C.M, Relation between GCD and LCM, Prime numbers, Fundamental property of prime number, Factorization in prime numbers , Unique factorization theorem.	25%
3.	Total number of positive divisor of positive integer , Sum and product of positive divisors of positive integer, Definition of Congruences ,Definition of Euler's function, Perfect numbers : definition and examples , Mersenne numbers: definition and examples , Fermat numbers : definition and examples.	25%
4.	Gauss function : definition and examples ,Properties of Gauss function, Mobius function : definition and examples , Properties of Mobius function ,Fibonacci numbers : definition and examples ,Properties of Fibonacci numbers.	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)	---
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	100% (50 Marks)

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 (III)

Course Code	US03SMTH52	Title of the Course	GRAPH THEORY - 1
Total Credits of the Course	2	Hours per Week	2

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%
3.	Trees and their properties, Pendant vertices in a tree, Distance and centers in a tree, Counting trees , Spanning Trees, Fundamental circuits, Finding all spanning trees of a graph.	25%
4.	Cut-sets in a graph and their properties, Fundamental circuits and cut sets, Con- nectivity and separab.	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)	---
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	100% (50 Marks)

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 (III)

Course Code	US03SMTH53	Title of the Course	MECHANICS - 1
Total Credits of the Course	2	Hours per Week	2

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%
3.	Couples, Work and potential energy, Principle of virtual work, Application in plane statics, Mass center and center of gravity, Gravitational potential.	25%
4.	Flexible cables, Cable in contact with smooth and rough curve, Plane Kinematics, Kinematics of a particle, Motion of a rigid body parallel to a plane.	25%
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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	100% (50 Marks)

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.Chaterjee, Statics and Dynamics

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

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