Rayat Shikshan Sanstha's

YASHAVANTRAO CHAVAN INSTITUTE OF SCIENCE, SATARA

(An Autonomous College)

A Lead College of Karmaveer Bhaurao Patil University Satara

Reaccredited by NAAC with 'A+' Grade

Choice Based Credit System with Multiple Entry and Multiple Exit Option

(NEP-2020)

Syllabus For

Bachelor of Science

Part - I

MATHEMATICS

Semester I and II

(Syllabus to be implemented from Academic Year 2023-24)

Structure of the Major Course (Level 4.5)

Semester- I

Sr.No.	Course Title	Theory			Practical		
		Course Code	No of hours per week	Credits		No of Lectures per week	Credits
1	Mathematics	BMT-111 BMT-112	4	4	BMP-113	4	2

Semester- II

Sr.No.	Course Title	Theory			Practical		
		Course Code	No of hours per week	Credits		No of Lectures per week	Credits
1	Mathematics	BMT121 BMT-122	4	4	BMP-123	4	2

B: B.Sc., M: Mathematics, T: Theory, P: Practical

Course Titles: B.Sc.-I Semester-I

Theory: 30 hours (for each course)

BMT111: **Calculus**
BMT112: **Differential Equations**

Practical: 60 hours

BMP113: **Practical I**

B.Sc. – I Semester – II

Theory: 30 hours (for each course)

BMT121: **Differential Calculus**
BMT122: **Advanced Differential Equations**

Practical: 60 hours

BMP123: **Practical II**

SEMESTER I
BMT 111: Calculus

Course Objectives: Student should be able to…

1. learn limit and continuity of real valued functions.
2. understand properties of real valued continuous functions defined on closed and bounded interval.
3. study relationship between continuity and differentiability.
4. generalize differentiation of real valued functions.

Credits=2	**SEMESTER-I** **BMT 111: Calculus**	**No. of hours per unit**
UNIT I	**Limits and continuity of Real Valued functions**	**(10)**
	1.1 $\varepsilon - \delta$ definition of limit of function of one variable, Left hand Side and Right-Hand Side limits. 1.2 Properties of limits. (Statements Only) 1.3 Continuous Functions: 1.3.1 Definition: Continuity at a point and Continuous functions on interval 1.3.2 Theorem: If f and g are continuous functions at point$x = a$, then $f + g, f - g, fg$ and $\frac{f}{g}$ are continuous at point $x = a$. (Without Proof) 1.3.3 Theorem: Composite function of two continuous functions is continuous. 1.3.4 Examples on continuity. 1.4 Classification of Discontinuities (First and second kind), Removable Discontinuity, Jump Discontinuity. 1.5 Definition: Bounded sets, Least Upper Bound (Supremum) and Greatest Lower bound (infimum). 1.5.1 Least Upper Bound axiom, Greatest Lower bound axiom and its Consequences.	

UNIT II	**Properties of continuity of Real Valued functions**	**(05)**
	2.1 Theorem: If a function f is continuous in the closed interval [a, b] then it is bounded in [a, b] 2.2 Theorem: If a function f is continuous in the closed interval [a, b], then it attains its bounds at least once in [a, b]. 2.3 Theorem: If a function f is continuous in the closed interval [a, b] and if f(a) and f(b) are of opposite signs then there exists $c \in (a, b)$ such that $f(c) = 0$. 2.4 Theorem: If a function f is continuous in the closed interval [a, b] and if $f(a) \neq f(b)$ then f assumes every value between f(a) and f(b).	
UNIT III	**Differentiation**	**(05)**
	3.1 Definitions: Differentiability at a point, Left Hand derivative, Right Hand Derivative, Differentiability in the interval $[a, b]$. 3.2 Examples on derivative. 3.3 Geometrical interpretation of a derivative. 3.4 Theorem: Continuity is necessary but not a sufficient condition for the existence of a derivative. 3.5 Darboux's Theorem on derivative.	
UNIT IV	**Successive Differentiation**	**(10)**
	4.1 Introduction. 4.2 n^{th} order derivative of some standard functions: $(ax + b)^m$, e^{ax}, a^{mx}, $\frac{1}{ax+b}$, $\log(ax + b)$, $\sin(ax + b)$, $\cos(ax + b)$, $e^{ax}\sin(bx + c)$, $e^{ax}\cos(bx + c)$. 4.3 Examples. 4.3 Leibnitz's Theorem. 4.4 Examples on Leibnitz's Theorem.	

Course Outcomes: Student will be able to…

1. classify discontinuities with the help of examples.
2. apply properties of continuous functions.
3. compare differentiability and continuity of real valued functions.
4. evaluate n^{th} order derivative of real valued functions.

Reference Books:

1. S. Narayan and P. K. Mittal, Differential Calculus, 15th edition, S. Chand Publishing, New Delhi, 2016.
2. S. C. Malik and S. Arora, Mathematical Analysis, 4th edition, New Age International Publishers, 2012.
3. G. B. Thomas and R. L. Finney, Calculus and Analytical Geometry, 14th edition, Pearson Education, 2007.
4. H. Anton, I. Birens and Davis, Calculus, third edition, John Wiley and Sons, Inc. ,2002.

MMT 112: Differential Equations

Course Objectives: Student should able to…

1. study linear differential equations of first order and first degree.
2. learns methods of solution of differential equations of first order but not first degree.
3. obtain auxillary equation of differential equations of type $f(D)y = 0$.
4. find general solution of differential equations of type $f(D)y = X$.

Credits=2	**SEMESTER-I** **BMT 112: Differential Equations**	**No. of hours per unit**
UNIT I	**Differential Equations of first order and first degree**	**(08)**
	1.1 Definition of Differential equation, order and degree of Differential equation. 1.2 Definition: Exact Differential equations. 1.2.1 Theorem: Necessary and sufficient condition for exactness. 1.2.2 Working Rule for solving an exact differential equation. 1.2.3 Integrating Factor (I.F.) by using rules (without proof). 1.2.4 Examples. 1.3 Linear Differential Equation: Definition. 1.3.1 Method of solution. 1.3.2 Examples. 1.4 Bernoulli's Differential Equation: Definition. 1.4.1 Method of solution. 1.4.2 Examples. 1.5 Orthogonal trajectories: Cartesian and polar co-ordinates. 1.5.1 Examples.	
UNIT II	**Differential Equations of first order but not of first degree**	**(06)**
	2.1 Introduction. 2.2 Equations solvable for p : Method and Examples. 2.3 Equations solvable for x : Method and Examples. 2.4 Equations solvable for y : Method and Examples.	

	2.5 Definition: Clairaut's equation. 2.5.1 Method of solution and Examples. 2.6 Equations Reducible to Clairaut's form by substitutions and examples.	
UNIT III	**Homogeneous Linear Differential Equations with constant Coefficients**	**(08)**
	3.1 Introduction 3.1.1 Definition: Complementary function (C.F.) and particular integral (P.I.), operator D. 3.1.2 Property: $(D-a)(D-b)y = (D-b)(D-a)y$ 3.2 General Solution of f(D)y=0. 3.2.1 Solution of f(D)y=0 when A.E. has non-repeated roots. 3.2.2 Solution of f(D)y=0 when A.E. has repeated roots. 3.2.3 Solution of f(D)y=0 when A.E. has non-repeated roots real and complex roots. 3.3 Examples.	
UNIT IV	**Non-Homogeneous Linear Differential Equations with constant Coefficients**	**(08)**
	4.1 Meaning of symbol $\frac{1}{f(D)}$. 4.2 General solution of f(D) y=X. 4.3 Theorem: (A) $\frac{1}{D-a}\ X = e^{ax}\int X\, e^{-ax}dx$ (B) $\frac{1}{D+a}\ X = e^{-ax}\int X\, e^{ax}dx$ 4.4 General Methods to find Particular Integral and Examples. 4.5 Theorem: $\frac{1}{(D-a)^n}e^{ax} = \frac{x^n}{n!}e^{ax}; n \in \mathbb{Z}^+$. 4.6 Short methods to find Particular Integrals when X is in the form $e^{ax}, \sin ax, \cos ax, x^m, e^{ax}V, xV$ (V is function of x). 4.7 Examples.	

Course Outcomes: Student will be able to…

1) classify differential equations of first order and first degree.

2) solve differential equations of first order but not first degree by various methods.

3) examine differential equation of type f(D)y=0 to obtain the solution.

4) construct complete solution of linear differential equation with constant coefficient.

Reference Books:

1. M. D. Raisinghania, Ordinary and partial differential equations, 18th revised edition, S. Chand and Company Pvt. Ltd., New Delhi, 2016.
2. Z. Ahasan, Differential Equations and Their Applications, 2nd edition, PHI, 2004.
3. R. K. Ghosh and K. C. Maity, An Introduction to Differential Equations, 7th edition, Book and Allied (P) Ltd., 2000.

BMP 113: Practical I (Based on BMT 111 and BMT 112)

Course Objectives: Student should be able to…

1. study the relationship between continuity and differentiation.
2. learn differential equations of special types.
3. understand applications of differential equations of first order.
4. study linear differential equations with constant coefficient.

Credits=2	**SEMESTER-I** **BMP 113: Practical I** **(BMT 111 and BMT 112)**	**No. of contact hours (60)**
1	Computation of limit of a function.	4
2	Testing Continuity of function.	4
3	Computation of n^{th} order derivative.	4
4	Problems on Leibnitz's theorem.	4
5	Problems on Exact differential equations.	4
6	Problems on Linear Differential Equations.	4
7	Problems on Bernoulli's Differential Equations.	4
8	Computation of Orthogonal trajectories: Cartesian co-ordinates.	4
9	Computation of Orthogonal trajectories: polar co-ordinates.	4
10	Computation on Equations solvable for p.	4
11	Computation on Equations solvable for x.	4
12	Computation on Equations solvable for y.	4
13	Computation on Clairaut's Form and Equations Reducible to Clairaut's Form.	4
14	Problems on Linear Differential Equations with constant Coefficients of type f(D)y=0.	4
15	Problems on Linear Differential Equations with constant Coefficients of type f(D)y=X.	4

Course Outcomes: Student will be able to…

1. evaluate examples on continuity and differentiability of functions.
2. solve linear and Bernoulli's differential equations.
3. apply methods of solving differential equations to obtain orthogonal trajectories.
4. construct solutions of linear differential equations with constant coefficients.

Reference Books:

1. M. D. Raisinghania, Ordinary and partial differential equations, 18th revised edition, S. Chand and Company Pvt. Ltd., New Delhi, 2016.
2. S. Narayan and P. K. Mittal, Differential Calculus, 15th edition, S. Chand Publishing, New Delhi, 2016.
3. S. C. Malik and S. Arora, Mathematical Analysis, 4th edition, New Age International Publishers, 2012.
4. G. B. Thomas and R. L. Finney, Calculus and Analytical Geometry, 14th edition, Pearson Education, 2007.
5. Z. Ahasan, Differential Equations and Their Applications, 2nd edition, PHI, 2004.
6. H. Anton, I. Birens and Davis, Calculus, third edition, John Wiley and Sons, Inc. ,2002.
7. R. K. Ghosh and K. C. Maity, An Introduction to Differential Equations, 7th edition, Book and Allied (P) Ltd., 2000.

SEMESTER II

BMT 121 Differential Calculus

Course Objectives: Student should be able to…

1. discuss mean value theorems and their geometrical interpretation.
2. study series expansion of functions and indeterminate forms.
3. learn partial differentiation of functions of two variables.
4. obtain extreme values of functions using Lagrange's method.

Credits=2	**SEMESTER-II** **BMT 121: Differential Calculus**	**No. of hours per unit**
UNIT I	**Mean Value Theorems**	**(08)**
	1.1 Rolle's Theorem 1.1.1 Geometrical interpretation 1.1.2 Examples on Rolle's theorem 1.2 Lagrange's Mean Value Theorem 1.2.1 Geometrical interpretation 1.2.2 Examples 1.3 Cauchy's Mean Value Theorem 1.3.1 Examples	
UNIT II	**Series Expansion and Indeterminate Forms**	**(06)**
	2.1Taylor's Theorem with Lagrange's and Cauchy's form of remainder (Statement only) 2.2Maclaurin's Theorem with Lagrange's and Cauchy's form of remainder (statement only) 2.3 Maclaurin's Series for $e^x, \sin x, \cos x, \log(1+x), \log(1-x), (1+x)^n, \frac{1}{1+x}, \frac{1}{1-x}$ 2.4 Examples on Taylor's series and Maclaurin's series 2.5 Indeterminate Forms: L'hospital's rule ((statement only). The Forms $\frac{0}{0}, \frac{\infty}{\infty}, 0\times\infty, \infty-\infty, 0^0, \infty^0, 1^\infty$ and Examples	

UNIT III	**Partial Differentiation**	**(08)**
	3.1 Introduction: Functions of two variables, Limit and Continuity of functions of two variables, 3.2 Partial derivative, partial derivative of higher orders, Chain Rule (Statement only) and its Examples 3.3 Homogeneous functions: Definition with illustrations 3.4 Euler's theorem on homogenous functions 3.4.1 If $f(x,\ y)$ and $f(x,\ y)$ is a homogenous function of x, y of degree n, then $x^2\frac{\partial^2 f}{\partial x^2} + y\frac{\partial^2 f}{\partial x\,\partial y} + y^2\frac{\partial^2 f}{\partial y^2} = n(n-1)f$. 3.4.2 If $F(u) = f(x,\ y)$ and $f(x,\ y)$ is a homogenous function of x, y of degree n, then $x\frac{\partial f}{\partial x} + y\frac{\partial f}{\partial y} = n\frac{F(u)}{F'(u)}$ 3.4.3 If $F(u) = f(x,\ y)$ and $f(x,\ y)$ is a homogenous function of x, y of degree n, then $x^2\frac{\partial^2 f}{\partial x^2} + y\frac{\partial^2 f}{\partial x\,\partial y} + y^2\frac{\partial^2 f}{\partial y^2} = n(n-1)f$	
UNIT IV	**Extreme Values**	**(08)**
	4.1 Maxima and Minima for function of two variables: Definition of Maximum, Minimum and Stationary values of function of two variables 4.2 Conditions for maxima and minima (Statement Only) and Examples 4.3 Lagrange's Method of undetermined multipliers of two variables and Examples on it	

Course Outcomes: Student will be able to

1. understand Mean value theorems and their application.
2. solve indeterminate forms and expand functions into series.
3. apply Eulers theorem for partial differentiation of Homogeneous functions.
4. evaluate Maxima and Minima of functions of two variables using Lagrange's method.

Reference Books:

1. S. Narayan and P. K. Mittal, Differential Calculus, 15th edition, S. Chand Publishing, New Delhi, 2016.
2. S. C. Malik and S. Arora, Mathematical Analysis, 4th edition, New Age International Publishers, 2012.

3. G. B. Thomas and R. L. Finney, Calculus and Analytical Geometry, 14th edition, Pearson Education, 2007.
4. H. Anton, I. Birens and Davis, Calculus, third edition, John Wiley and Sons, Inc. ,2002.

BMT 122 Advanced Differential Equations

Course Objectives: Student should be able to…

1.study homogeneous linear differential equations.
2.learn different methods for solving second order differential equations.
3.discuss ordinary simultaneous differential equation and its geometrical interpretation.
4.obtain necessary and sufficient condition of integrability of total differential equations.

Credits=2	**SEMESTER-II** **BMT 122: Advanced Differential Equations**	**No. of hours per unit**
UNIT I	**Homogeneous Linear Differential Equations**	**(06)**
	1.1 General Form of Homogeneous Linear Differential Equation 1.2 Method of Solution and Examples 1.3 Equations Reducible to Homogeneous Linear Form 1.4 Examples	
UNIT II	**Second Order Linear Differential Equations**	**(10)**
	2.1 General Form 2.2 Complete solution when one integral is known: Method and Examples 2.3 Transformation of the equation by changing the dependent variable and Examples (Removal of First Order Derivative) 2.4 Transformation of the equation by changing the independent variable and Examples 2.5 Method of Variation of Parameters and Examples	
UNIT III	**Ordinary Simultaneous Differential Equations**	**(06)**
	3.1 Simultaneous Linear Differential Equation of the form $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$ 3.2 Method of solving Simultaneous Linear Differential Equation 3.3 Geometrical Interpretation 3.4 Examples	

UNIT IV	Total Differential Equations	(08)
	4.1 Total differential Equation $Pdx + Qdy + Rdz = 0$ 4.2 Necessary Condition for Integrability of Total Differential Equation 4.3 Method of solving Total Differential Equations: a) Method of Inspection b) One variable regarding as constant 4.4 Geometrical Interpretation 4.5 Geometrical Relation Between Total Differential Equation and Simultaneous Linear Differential Equation 4.6 Examples	

Course Outcomes: Student will be able to…

1.examine homogeneous linear differential equation and its solution.

2. solve second order differential equations using various methods.

3. analyze ordinary simultaneous differential equations to obtain solution.

4. evaluate total differential equations by treating one variable constant.

Reference Books:

1. M. D. Raisinghania, Ordinary and partial differential equations, 18th revised edition, S. Chand and Company Pvt. Ltd., New Delhi, 2016.
2. Z. Ahasan, Differential Equations and Their Applications, 2nd edition, PHI, 2004.
3. R. K. Ghosh and K. C. Maity, An Introduction to Differential Equations, 7th edition, Book and Allied (P) Ltd., 2000.

BMP 123: Practical II (Based on BMT 121 and BMT 122)

Course Objectives: Student should be able to…

1. study applications of Mean Value theorems.
2. learn methods for finding extreme values of functions of two variables.
3. understand methods for solution of Linear differential equations.
4. gain knowledge of total differential equations and their solution.

Credits=2	**SEMESTER-II** **BMP 123: Practical II** **(Based on BMT 121 and BMT 122)**	**No. of contact hours (60)**
1	Computation on Lagrange's Mean Value Theorem	4
2	Computation on Cauchy's Mean Value Theorem	4
3	Computation on Taylors series and Maclaurin's series.	4
4	Computation on Indeterminate forms.	4
5	Computation on Partial derivatives.	4
6	Application of Eulers theorem on Homogeneous functions.	4
7	Computation of Extreme values.	4
8	Computation on Lagrange's undetermined multiplier method.	4
9	Computation on Homogeneous Linear Differential Equations.	4
10	Computation on Equations Reducible to Homogeneous Linear Differential Equations.	4
11	Problems on Second Order Linear Differential Equations (One solution is known).	4
12	Problems on Second Order Linear Differential Equations (By Changing Dependent Variable).	4
13	Problems on Second Order Linear Differential Equations (By Changing Independent Variable).	4
14	Computation on Simultaneous differential equations.	4
15	Computation on Total Differential Equations.	4

Course Outcomes: Student will be able to…

1. examine indeterminate forms and then find solution.
2. apply Lagrange's method of undetermined multipliers to find extreme values.
3. solve linear differential equations with various methods.
4. construct solutions of total differential equations by treating one variable constant.

Reference Books:

1. M. D. Raisinghania, Ordinary and partial differential equations, 18th revised edition, S. Chand and Company Pvt. Ltd., New Delhi, 2016.
2. S. Narayan and P. K. Mittal, Differential Calculus, 15th edition, S. Chand Publishing, New Delhi, 2016.
3. S. C. Malik and S. Arora, Mathematical Analysis, 4th edition, New Age International Publishers, 2012.
4. G. B. Thomas and R. L. Finney, Calculus and Analytical Geometry, 14th edition, Pearson Education, 2007.
5. Z. Ahasan, Differential Equations and Their Applications, 2nd edition, PHI, 2004.
6. H. Anton, I. Birens and Davis, Calculus, third edition, John Wiley and Sons, Inc., 2002.
7. R. K. Ghosh and K. C. Maity, An Introduction to Differential Equations, 7th edition, Book and Allied (P) Ltd., 2000.

B.Sc. Part – I: Semester – I

BMT 114: Analytical Geometry

Course Objectives: Students should be able to…

1. understand different coordinate systems such as Cartesian coordinates (x, y), polar coordinates (r, θ) or three-dimensional coordinates (x, y, z).
2. learn how to derive and manipulate equation equations of lines, plane and sphere and understanding their properties and graphical representations.
3. study analytical techniques to real-life scenarios.
4. gain knowledge of describe geometric figures using precise mathematical representation.

Credits=2	**SEMESTER-I** **BMT 114: Analytical Geometry**	**No. of hours per unit**
Unit-I:	**Analytical Geometry of Two Dimension**	**(06)**
	Change of axes, Translation and Rotation, Conic section: General equation of second degree in x and y, Centre of conic, Nature of conic and Reduction to standard form.	
Unit-II:	**Planes in 3-Dimension:**	**(06)**
	Revision, System of planes, Two sides of a plane, Length of the perpendicular from a point to a plane, Bisector of angles between two planes, Joint equation of two planes and angle between planes.	
Unit-III:	**Lines in 3-Dimension:**	**(09)**
	Revision, The condition that a given line may lie in a given plane, The condition that two given lines are coplanar, The shortest distance between two lines, The length of perpendicular from a given point to a given line.	
Unit-IV:	**Sphere:**	**(09)**
	Definition, Equation of the sphere in various forms, Plane section of a sphere, Intersection of two spheres, Equation of circle, Sphere through a given circle, Intersection of a sphere and a line.	

Course Outcomes: Students will be able to…

1. use basic transformations such as translations, rotations, reflection and their effects on geometric effects.
2. apply analytical geometry concepts to real-world problems such as finding intersection of lines for engineering applications.
3. analyze the concepts as lines, circles, planes and sphere.
4. evaluate distances, intersections and optimization problems.

Reference Books:

1. S. Gaikwad, K. Takale et. Al., Analytical Geometry, Nirali Prakashan, 2019.
2. S. K. Stein, A. Barcellos, and S. J. Szabo, Analytic Geometry, Boston: Pearson, 2018.
3. R. M. Khan, Analytical Geometry of Two and Three Dimensions, 5th revised edition, New Central Book Agency, 2010.
4. P. N. Chatterji, Solid Geometry, 20th edition, Rajhans Agencies, Meerut, 2009.
5. S. Narayan and P. K. Mittal, Analytical Solid Geometry, 17th edition, S. Chand Publishing, New Delhi, 2007.
6. G. B. Thomas and R. L. Finney, Calculus and Analytic Geometry, Boston: Addison-Wesley, 1996.
7. J. G. Chakravorty and P. R. Ghosh, Advanced Analytical Geometry, 14th edition, U. N. Dhur and Sons. Pvt. Ltd., 1987.

B.Sc. Part – I: Semester – I

BMT115: Introduction to Linear Algebra

Course Objectives: Students should be able to…

1. understand the basic concept and notation associated with matrices.
2. apply matrix techniques to solve problems in various fields.
3. apply matrix algebra to solve system of homogeneous and non-homogeneous linear equations.
4. enhance critical thinking and problem solving by working on exercises and applications.

Credits=2	**SEMESTER-I** **BMT 115: Introduction to Linear Algebra**	**No. of hours per unit**
Unit-I:	**Matrices and Rank of Matrix**	**(07)**
	Revision, Hermitian and Skew Hermitian matrices, Properties of Hermitian and Skew Hermitian matrices, Sub-matrices of Matrix, Minors of Matrix, Rank of matrix (Definition), Echelon form of a matrix and Reduced row echelon form, Elementary transformation of a matrices, Elementary matrices, Invariance of rank under elementary transformation.	
Unit-II:	**System of Linear Homogeneous and Non-Homogeneous Equations**	**(08)**
	Condition for consistency, Nature of the general solution, Gauss Elimination and Gauss Jordan method (using row echelon form and reduced row echelon form), examples.	
Unit-III:	**Eigenvalues and Eigenvectors of Matrix**	**(08)**
	Characteristic polynomial of matrix, Characteristic equation of matrix, Eigenvalue or characteristic root of matrix, Eigenvector or characteristic vector of matrix, Cayley-Hamilton Theorem (Statement only) and its application.	
Unit-IV:	**Quadratic Forms**	**(07)**
	Quadratic forms, Reduction of real quadratic form, Canonical or Normal form of a real quadratic form, Signature and Index of a real quadratic form.	

Course Outcomes: Students will be able to…

1. understand the fundamental concepts, properties and notations associated with matrices.
2. apply matrix transformation to solve geometric problems and interpret the geometric meaning of various matrix operations.
3. evaluate solution of system of linear homogeneous and non-homogeneous equations.

4. create mathematical ideas and solutions related to matrices clearly and concisely.

Reference Books:

1. D. C. Lay, S. R. Lay and J. J. McDonald, Linear Algebra and Its Applications, 6th edition, Pearson, 2021.
2. K. Hoffman and R. Kunze, Linear Algebra, Pearson, 2018.
3. S. Lipschutz and M. Lipson, Linear Algebra, 3rd edition, McGraw Hill Education, 2017.
4. G. Strang, Introduction to Linear Algebra, 5th edition, Wellesley-Cambridge Press, 2016.
5. S. H. Friedberg, A. J. Insel and L. E. Spence, Linear Algebra, 4th edition, Pearson Education India, 2015.
6. A. R. Vasishtha and A. K. Vasishtha, Matrices, Krishna Prakashan, 2014.
7. S. Narayan and P. K. Mittal, A Textbook of Matrices, S Chand and Company, 2010.
8. S. Kumaresan, Linear Algebra, PHI Learning Pvt. Ltd., 2000.

B.Sc. Part – I: Semester – I

BMP116: Practical I (Based on BMT 114 and BMT 115) (Credits: 02)

Course Objective: Students should be able to…

1. understand how matrices and determinant are used as mathematical tool.
2. find power of matrix and inverse of matrix.
3. use analytical geometry in higher level mathematics.
4. determine the properties of geometric shapes such as plane, line and sphere etc.

Sr. No.	Name of Practical	No. of Contact Hours
1.	Hermitian and Skew Hermitian matrices.	4
2.	Rank of matrix.	4
3.	Solution of system of m linear homogeneous equations in n unknowns.	4
4.	Solution of system of m linear non-homogeneous equations in n unknowns.	4
5.	Eigenvalues and Eigenvectors of matrix.	4
6.	Inverse of matrix using Cayley-Hamilton Theorem.	4
7.	Canonical form of real quadratic form.	4
8.	Signature and Index of a real quadratic form.	4
9.	Examples on change of axis, translation and rotation.	4
10.	Conic section.	4
11.	Examples on length of perpendicular from a point to a plane.	4
12.	Examples on joint equation of two planes and angle between two planes.	4
13.	Shortest distance between two lines.	4
14.	Intersection of two spheres.	4
15.	Equation of sphere in various forms	4

Course Outcomes: Students will be able to…

1. understand the concept of eigenvalues and eigenvectors and their significance in matrix analysis.
2. apply matrix concepts and techniques in solving real-world problem in various fields.
3. apply transformations such as translation and rotation.
4. analyze complex geometric problem, break down them in smaller component and use analytical techniques to find solution.

Reference Books:

1. D. C. Lay, S. R. Lay and J. J. McDonald, Linear Algebra and Its Applications, 6th edition, Pearson, 2021.
2. S. Gaikwad, K. Takale et. Al., Analytical Geometry, Nirali Prakashan, 2019.
3. S. K. Stein, A. Barcellos, and S. J. Szabo, Analytic Geometry, Boston: Pearson, 2018.
4. K. Hoffman and R. Kunze, Linear Algebra, Pearson, 2018.
5. S. Lipschutz and M. Lipson, Linear Algebra, 3rd edition, McGraw Hill Education, 2017.

6. G. Strang, Introduction to Linear Algebra, 5th edition, Wellesley-Cambridge Press, 2016.
7. S. H. Friedberg, A. J. Insel and L. E. Spence, Linear Algebra, 4th edition, Pearson Education India, 2015.
8. A. R. Vasishtha and A. K. Vasishtha, Matrices, Krishna Prakashan, 2014.
9. S. Narayan and P. K. Mittal, A Textbook of Matrices, S Chand and Company, 2010.
10. R. M. Khan, Analytical Geometry of Two and Three Dimensions, 5th revised edition, New Central Book Agency, 2010.
11. P. N. Chatterji, Solid Geometry, 20th edition, Rajhans Agencies, Meerut, 2009.
12. S. Narayan and P. K. Mittal, Analytical Solid Geometry, 17th edition, S. Chand Publishing, New Delhi, 2007.
13. S. Kumaresan, Linear Algebra, PHI Learning Pvt. Ltd., 2000.
14. G. B. Thomas and R. L. Finney, Calculus and Analytic Geometry, Boston: Addison-Wesley, 1996.
15. J. G. Chakravorty and P. R. Ghosh, Advanced Analytical Geometry, 14th edition, U. N. Dhur and Sons. Pvt. Ltd., 1987.

B.Sc. Part – I: Semester – II

BMT124: Discrete Mathematics (Credits: 02)

Course Objectives: Students should be able to…

1. learn classical notations of logic.
2. know different number systems and their conversion.
3. study the concept of graph and trees to tackle real situations.
4. understand the different algorithms.

Credits=2	**SEMESTER-I** **BMT 124: Discrete Mathematics**	**No. of hours per unit**
Unit-I:	**Valid and Invalid Arguments**	**(06)**
	Revision, Mathematical logic, Modus Ponens and Modus Tollens, Additional valid argument forms, Rules of inferences, Contradictions, and valid arguments.	
Unit-II:	**Number Systems**	**(06)**
	Number systems, Addition and subtraction of binary, decimal, quintal, octal, hexadecimal number systems and their conversions.	
Unit-III:	**Graphs**	**(09)**
	Definition, Basic properties, Examples, Special Graphs, Directed and undirected graphs, Concept of degree, Matrix representation of graphs, Walk, Trail, Path and Circuits.	
Unit-IV:	**Trees**	**(09)**
	Definition and examples of trees, Rooted trees, Binary trees and their properties, Spanning trees, Minimal spanning trees, Kruskal's Algorithm.	

Course Outcomes: Students will be able to…

1. understand the fundamental concepts in Discrete mathematics, including sets, logic, proof techniques etc.
2. apply mathematical reasoning and formal logic to construct valid arguments, analyze prepositions and solve problems.
3. analyze the efficiency of algorithms using concept from Discrete mathematics.
4. evaluate complex problems by applying appropriate mathematical techniques and arrive at logical solutions.

Reference Books:

1. S. Lipschutz and M. Lipson, Discrete Mathematics, Schaum's Outlines Series, Tata McGraw Hill, 2017.

2. C. L. Liu and D. P. Mohapatra, Elements of Discrete Mathematics, 4th edition, McGraw Hill Education, 2017.
3. N. L. Biggs, Discrete Mathematics, 2nd edition, Oxford University Press, 2013.
4. R. Johnsonbaugh, Discrete Mathematics, 8th edition, Pearson, 2013.
5. R. M. Somasundaram, Discrete Mathematical Structures, PHI Learning Pvt. Ltd., 2003.
6. K. H. Rosen, Discrete Mathematics and its Application, McGraw Hill, 2002.
7. Susanna S., Discrete Mathematics with Applications, PWS Publishing Company, 1995.

B.Sc. Part – I: Semester – II

BMT125: Vector Calculus

Course Objectives: Students should be able to…

1. understand the fundamental concept of vectors and vector operations.
2. apply vector calculus techniques to solve problems in various fields.
3. develop proficiency in computing line integral, volume integrals and surface integrals by using vector calculus methods, including Green's Theorem, Stokes' theorem and Divergence Theorem.
4. gain deep understanding of geometric interpretation of vector calculus and their applications in real-world scenarios.

Credits=2	**SEMESTER-I** **BMT 125: Vector Calculus**	**No. of hours per unit**
Unit-I:	**Introduction to Vectors and Vector Functions**	**(07)**
	Revision: Vector presentation and notation, Vector operation, Dot product and cross product. **Vector function:** Definition, Properties of vector functions, Parametric equations and curves in space, Differentiation and Integration of Vector functions.	
Unit-II:	**Gradient and Directional Derivatives**	**(08)**
	Definition, Properties of gradients, Directional derivative and gradient vector, Application of gradients in finding tangent planes and normal lines.	
Unit-III:	**Divergence and Curl**	**(06)**
	Divergence: Definition, Interpretation of divergence, Properties of divergence. **Curl:** Definition, Interpretation of curl, Properties of curl.	
Unit-IV:	**Vector Integral Calculus**	**(09)**
	Surface integral: Definition, Application of Surface integral. Green's Theorem (Statement only) and its application, Stokes' Theorem (Statement only) and its application, Gauss divergence Theorem (Statement only) and its application.	

Course Outcomes: Students will be able to…

1. understand vector function and their properties including parametric equations, derivatives and integrals of vector functions.
2. understand the concept of gradient, divergence and curl of vector fields, including their geometric interpretation and applications.
3. apply Green's Theorem, Stokes' Theorem and Divergence Theorem.
4. evaluate line integrals, surface integrals and flux integrals.

Reference Books:

1. A. R. Vasishtha, Vector Calculus, Krishna Prakashan Media, 2020.

2. M. R. Spiegel, S. Lipschutz and D. Spellman, Vector Analysis, 2nd edition, McGraw Hill Education, 2017.
3. R. Gupta, Vector Calculus, Laxmi Publications, 2016.
4. S. J. Colley, Vector Calculus, 4th edition, Pearson, 2011.
5. J. E. Marsden and A. Tromba, Vector Calculus, 6th edition, W. H. Freeman and Co. Ltd., 2011.
6. M. L. Khanna, Vector Calculus, Jaiprakash Nath and Co. Meerut, 1997.
7. S. Narayan and P. K. Mittal, A Textbook of Vector Calculus, 4th edition, S. Chand, 1987.

B.Sc. Part – I: Semester – II

BMP126: Practical II (Based on BMT 124 and BMT 125) (Credits: 02)

Course Objective: Students should be able to…

1. study the graph theory which deals with structures composed of vertices (nodes) and edges.
2. learn logic gates, minimization techniques and their applications in digital circuit and computer architecture.
3. study differentiation of vector functions.
4. explore the integration of vector fields including line integrals, surface integrals and volume integrals.

Sr. No.	Name of Practical	No. of Contact Hours
1.	Logical equivalence.	4
2.	Valid and Invalid arguments.	4
3.	Rules of inferences.	4
4.	Number systems and their conversion.	4
5.	Degree of vertices and graph.	4
6.	Matrix representation of graph.	4
7.	Minimal Spanning trees.	4
8.	Kruskal's Algorithm.	4
9.	Vector function.	4
10.	Gradients and directional derivative.	4
11.	Examples on finding tangent planes and normal lines.	4
12.	Properties of divergence and curl.	4
13.	Application of Green's Theorem.	4
14.	Application of Stokes' Theorem.	4
15.	Application of Divergence Theorem.	4

Course Outcomes: Students will be able to…

1. understand how discrete mathematics is used in various areas of computer science.
2. apply Fundamental Theorem of Calculus for line integrals and surface integrals
3. analyze graphs and trees including topics graph connectivity, path, cycle and spanning tree.
4. evaluate the problems using Green's Theorem, Stokes' Theorem and Divergence Theorem.

Reference Books:

1. A. R. Vasishtha, Vector Calculus, Krishna Prakashan Media, 2020.
2. M. R. Spiegel, S. Lipschutz and D. Spellman, Vector Analysis, 2nd edition, McGraw Hill Education, 2017.

3. S. Lipschutz and M. Lipson, Discrete Mathematics, Schaum's Outlines Series, Tata McGraw Hill, 2017.
4. C. L. Liu and D. P. Mohapatra, Elements of Discrete Mathematics, 4th edition, McGraw Hill Education, 2017.
5. R. Gupta, Vector Calculus, Laxmi Publications, 2016.
6. N. L. Biggs, Discrete Mathematics, 2nd edition, Oxford University Press, 2013.
7. R. Johnsonbaugh, Discrete Mathematics, 8th edition, Pearson, 2013.
8. S. J. Colley, Vector Calculus, 4th edition, Pearson, 2011.
9. J. E. Marsden and A. Tromba, Vector Calculus, 6th edition, W. H. Freeman and Co. Ltd., 2011.
10. R. M. Somasundaram, Discrete Mathematical Structures, PHI Learning Pvt. Ltd., 2003.
11. K. H. Rosen, Discrete Mathematics and its Application, McGraw Hill, 2002.
12. M. L. Khanna, Vector Calculus, Jaiprakash Nath and Co. Meerut, 1997.
13. Susanna S., Discrete Mathematics with Applications, PWS Publishing Company, 1995.
14. S. Narayan and P. K. Mittal, A Textbook of Vector Calculus, 4th edition, S. Chand, 1987.

Rayat Shikshan Sanstha's

Yashavantrao Chavan Institute of Science, Satara (Autonomous)

Department of Mathematics

Open Elective (OE) Course Name: Financial Mathematics

Semester – I

BMT 117: Time Value of Money

Course Objectives: Students should be able to…

1. understand that interest represents the cost of borrowing or the return on investment.
2. study the discounted value of a future payment or investment based on the interest rate and time period involved.
3. gain the knowledge of differences between simple interest and compound interest calculations and recognize the advantages of compounding in generating higher returns or higher costs over time.
4. learn to calculate the future value and present value of annuities, including both ordinary annuities and annuities due.

Credits **(Total Credits 2)**	**SEMESTER – I** **BMT117: Time Value of Money**	**No. of hours per unit**
Unit – I	**Simple Interest**	**(08)**
	Total interest, Rate of interest, Term of maturity, Current Value, Future value, Simple Discount, Ordinary Interest and Exact Interest, Focal date and Equation of Value, Equivalent time, Partial Payments, Dollar Weighted method.	
Unit – II	**Bank Discount**	**(08)**
	Discount formula, Discount term and Discount rate, Difference between Simple discount and Bank discount, Comparison between Discount rate and Interest rate, Discounting Promissory note, Discounting treasury bill.	
Unit – III	**Compound Interest**	**(08)**
	Compounding formula, Current value, Discount factor, Rate of Compound interest, Compounding term, the rule of 72 and other rules, Effective interest rate, Types of compounding, Continuous compounding, Equations of value for compound interest, Equated time for compound interest.	

Unit – IV	**Annuities**	**(06)**
	Definition and basic concepts of annuities, Types of Annuities, Future value of an ordinary annuity, Current value of an ordinary annuity, Payment, term and Interest of an ordinary payment, Annuity due: Future and Current Values, Payment and term of an annuity due, Deferred annuity, Future and current values of deferred annuity, Perpetuities.	

Course Outcomes: Students will be able to…

1. apply the concept of simple interest to real world scenarios, such as calculating interests on loans, investments or savings accounts.
2. interpret bank discount calculations to assess the attractiveness of different financial instruments or investment opportunities.
3. evaluate the validity of compound interest calculations and identify any errors or inconsistencies.
4. design situations where annuity calculations can be used to analyze and compare different financial options or retirement strategies.

Reference Books:

1) Hull, J. C. Options, Futures and Other Derivatives, Pearson Education, New York, 9th ed., 2017.
2) Kosowski, R. L., S. N. Neftci and M. Rutkowski, Principles of Financial Engineering, Academic Press, London,3rd ed., 2015.
3) Ross, S. M., An Introduction to Mathematical Finance: Options and Other Topics, Cambridge University Press, 2013.
4) Alhabeeb M. J., Mathematical Finance, John Wiley and Sons, Inc., Publication, 2012.
5) Baxter, Martin and A. Rennie, Financial Calculus: An Introduction to Derivative Pricing, Cambridge University Press, 2nd ed., 2003.

BMT118: Debt and Leasing

Course Objectives: Students should be able to…

1. understand the fundamental concepts, principles and practices related to borrowing and lending money.
2 learn about the fundamental concepts and terminology related to mortgages such as interest rates, loan terms, down payments and amortization.
3 gain knowledge of how mortgage repayments are structured over time through amortization.
4 study the meaning of leasing and how it functions as a contractual arrangement between a lessor and lessee.

Credits **(Total Credits 2)**	**SEMESTER – I** **BMT118: Debt and Leasing**	**No. of hours per unit**
Unit – I	**Credit and Loans**	**(08)**
	Types of Debt, Dynamics of Interest- Principal Proportions, Premature Payoff, Assessing Interest and Structuring Payments, Cost of Credit, Finance charge and Average Daily Balance, Credit limit vs. Debt limit.	
Unit – II	**Mortgage**	**(08)**
	Analysis of Amortization, Effects of Interest rate, Term and Down Payment on Monthly Payment, Graduated Payment Mortgage, Mortgage Points and the Effective Rate.	
Unit – III	**Mortgage Loan**	**(08)**
	Mortgage Loan, Repayment Penalty on Mortgage Loan, refining a Mortgage Loan, Wraparound and Balloon Payment Loans, Sinking Funds, Comparison between Amortization and Sinking Fund Methods.	
Unit – IV	**Leasing**	**(06)**
	The Lessee: The cost of buying on credit, The cost of leasing, The Lessor.	

Course Outcomes: Students should be able to…

1. apply credit management strategies to improve creditworthiness such as reducing debt and making timely payments.
2. evaluate mortgage offers from different lenders considering factors like interest rates, fees and terms.
3. assess the advantages and disadvantages of various mortgage debt strategies.
4. develop a leasing strategy for a business considering factors such as cash flow, tax implications and equipment obsolescence.

Reference Books:

1) Hull, J. C. Options, Futures and Other Derivatives, Pearson Education, New York, 9th ed., 2017.
2) Kosowski, R. L., S. N. Neftci and M. Rutkowski, Principles of Financial Engineering, Academic Press, London,3rd ed., 2015.
3) Ross, S. M., An Introduction to Mathematical Finance: Options and Other Topics, Cambridge University Press, 2013.
4) Alhabeeb M. J., Mathematical Finance, John Wiley and Sons, Inc., Publication, 2012.
5) Baxter, Martin and A. Rennie, Financial Calculus: An Introduction to Derivative Pricing, Cambridge University Press, 2nd ed., 2003.

BMP119: Lab 1 (Based on BMT 117 and BMT 118)

Course Objectives: Students should be able to…

1. learn to calculate the present value, future value and interest rates.
2. understand time value of money principles account for risk and uncertainty.
3. explore debt management strategies to optimize capital structure.
4. study the risk associated with debt and leasing and explore risk mitigation strategies.

Credits **(Total Credits 2)**	**SEMESTER – I** **BMP119: Lab 1** **(Based on BMT 117 and BMT 118)** **List of Practicals (30)**	**No. of hours per Practical**
	Part A	
1	Computation of Present value.	2
2	Computation of Future value.	2
3	Computation of Annuity.	2
4	Preparation of amortization schedule with monthly payments.	2
5	Evaluation of net present value of a project.	2
6	Computation of internal rate of return for an investment.	2
7	Computation of a value of bond.	2
8	Computation of present value of perpetuity.	2
9	Computation of Sinking fund.	2
10	Evaluation of profitability of a project.	2
11	Computation of monthly contribution for annual return by retirement.	2
12	Computation of monthly saving required to accumulate amount for child's college education.	2
13	Calculation of Annuity due where payments are made at the beginning of each period instead of the end.	2
14	Computation of the capitalization rate for a real estate investment by dividing the net operating income by the property value.	2
15	Computation of the playback period of an investment by determining the time it takes to recover the initial investment through cash flows.	2

	Part B	
1	Computation of the debt-to-equity ratio of a company	2
2	Analysing the debt service coverage ratio	2
3	Creation of an amortisation schedule for a loan	2
4	Preparation of a debt restructuring proposal	2
5	Developing strategies for effective debt collection	2
6	Performing a lease versus buy analysis for a company	2
7	Recording the journal entries for a capital lease transaction	2
8	Evaluation of the impact of operating leases on a company's financial statements	2
9	Monitoring a company's compliance with debt covenants	2
10	Analysis of the issuance of debt instruments	2
11	Creation of a debt repayment plan	2
12	Evaluation of feasibility and impact of a debt equity	2
13	Recognizing lease expenses in accordance with accounting standards	2
14	Analysis of the potential recovery value of a defaulted debt	2
15	Evaluation of different debt financing options	2

Course Outcomes: Students will be able to…

1. apply time value of money formulas and principles to solve practical problems.
2. analyze and interpret the results of cash flow analysis, net present value and internal rate of return calculations.
3. evaluate the advantages disadvantages of leasing as compared to purchasing assets outright.
4. design a comprehensive debt management plan for a company.

Reference Books:

1) Hull, J. C. Options, Futures and Other Derivatives, Pearson Education, New York, 9th ed., 2017.
2) Kosowski, R. L., S. N. Neftci and M. Rutkowski, Principles of Financial Engineering, Academic Press, London,3rd ed., 2015.
3) Ross, S. M., An Introduction to Mathematical Finance: Options and Other Topics, Cambridge University Press, 2013.
4) Alhabeeb M. J., Mathematical Finance, John Wiley and Sons, Inc., Publication, 2012.
5) Baxter, Martin and A. Rennie, Financial Calculus: An Introduction to Derivative Pricing, Cambridge University Press, 2nd ed., 2003.

Semester – II

BMT127: Depreciation and Leverage

Course Objectives: Students should be able to…

1. gain insight into the overall capital budgeting process within an organisation.
2. learn depreciation and depletion and their relation to the decrease in value of tangible assets.
3. understand break even analysis and its significance in business decision making.
4. study different types of leverage and understand how they affect risk and return.

Credits **(Total Credits 2)**	**SEMESTER – II** **BMT127: Depreciation and Leverage**	**No. of hours per unit/credits**
Unit – I	**Capital Budgeting**	**(08)**
	Net Present Value, Internal rate of return, Profitability index, Capitalization and Capitalized cost, other capital budgeting methods.	
Unit – II	**Depreciation and Depletion**	**(08)**
	The Straight-line method, The fixed proportion method, The sum of digits method, The Amortization method, The sinking fund method, Composite rate and composite life, Depletion.	
Unit – III	**Break-Even analysis**	**(08)**
	Deriving BEQ and BER, BEQ and BER variables, Cash Break-Even technique, The Break-Even point and the Target profit, Algebraic approach to the Break- Even point, The Break Even-Point when borrowing, Dual Break-Even Point, Applications of Break-Even point, BEQ and BER sensitivity to their variables, Limitations of Break-Even Analysis.	
Unit – IV	**Leverage**	**(06)**
	Operating Leverage, Fixed cost and Business risk, Financial Leverage, Total or Combined Leverage.	

Course Outcomes: Students will be able to…

1. apply capital budgeting techniques to evaluate investment projects in different scenarios.
2. analyze and interpret the effects of depreciation and depletion on asset values and profitability.
3. assess the strengths and limitations of break-even analysis as a decision-making tool.
4. develop strategies to optimize leverage levels for a company’s capital structure.

Reference Books:

1) Hull, J. C. Options, Futures and Other Derivatives, Pearson Education, New York, 9th ed., 2017.
2) Kosowski, R. L., S. N. Neftci and M. Rutkowski, Principles of Financial Engineering, Academic Press, London,3rd ed., 2015.
3) Ross, S. M., An Introduction to Mathematical Finance: Options and Other Topics, Cambridge University Press, 2013.
4) Alhabeeb M. J., Mathematical Finance, John Wiley and Sons, Inc., Publication, 2012.
5) Baxter, Martin and A. Rennie, Financial Calculus: An Introduction to Derivative Pricing, Cambridge University Press, 2nd ed., 2003.

BMT128: Investment

Course Objectives: Students should be able to…

1. learn how stocks are issued, bought and sold as well as the role of stock exchange in facilitating these transactions.
2. understand the risk associated with bond and mutual funds and manage these risks to protect investment.
3. study about call and put options and how they derive their value from underlying assets.
4. make more informed financial decisions and manage risk effectively.

Credits **(Total Credits 2)**	**SEMESTER – I** **BMT128: Investment**	**No. of hours per unit**
Unit – I	**Stocks**	**(08)**
	Buying and Selling stocks, Common stock valuation, Cost of new issues of common stock, Stock value with two stage dividend growth, Cost of stock through CAPM, Other methods for common stock valuation, Valuation of preferred stock, Cost of preferred stock.	
Unit – II	**Bounds and Mutual Funds**	**(08)**
	Bond valuation, Premium and discount prices, Premium Amortization, Discount accumulation, Bound purchase price between interest days, Estimating yield rates, Duration, Fund evaluation, Loads, Performance measures, The effect of systematic risk, Dollar cost averaging.	
Unit – III	**Options**	**(08)**
	Dynamics of making profit with options, Intrinsic value of Calls and Puts, Time value of Calls and Puts, the delta ratio, Determinants of option value, Option valuation, Combined intrinsic values of options.	
Unit – IV	**Cost of Capital and Ratio Analysis**	**(06)**
	Before and After-tax cost of capital, Weighted average cost of capital, Ratio Analysis, The DuPont Model.	

Course Outcomes: Students will be able to…

1. utilize stock market research tools to analyze and evaluate individual stocks.
2. analyze yield curves to understand the relationship between yields and maturities.
3. assess the impact of implied volatility and market conditions on options premiums.
4. design a comprehensive cost of capital that incorporates various sources of capital and their respective costs.

Reference Books:

1) Hull, J. C. Options, Futures and Other Derivatives, Pearson Education, New York, 9th ed., 2017.
2) Kosowski, R. L., S. N. Neftci and M. Rutkowski, Principles of Financial Engineering, Academic Press, London,3rd ed., 2015.
3) Ross, S. M., An Introduction to Mathematical Finance: Options and Other Topics, Cambridge University Press, 2013.
4) Alhabeeb M. J., Mathematical Finance, John Wiley and Sons, Inc., Publication, 2012.
5) Baxter, Martin and A. Rennie, Financial Calculus: An Introduction to Derivative Pricing, Cambridge University Press, 2nd ed., 2003.

BMP129: Lab II (Based on BMT 127 and BMT 128)

Course Objectives: Students should be able to…

1. understand the concept of depreciation and its importance in financial reporting.
2. learn the concept of leverage and its significance in financial decision making.
3. identify the different types of investment instruments such as stocks, bonds, mutual funds.
4. perform financial analysis and valuation of stocks and bonds to identify investment opportunities.

Credits **(Total Credits 2)**	**SEMESTER – II** **BMP129: Lab II** **(Based on BMT 127 and BMT 128)** **List of Practicals (30)**	**No. of hours per Practical**
	Part A	
1	Computation of depreciation expense.	2
2	Preparation of depreciation schedule.	2
3	Comparison of financial impact of using different depreciation methods.	2
4	Analysis of asset replacement.	2
5	Tax effects of depreciation.	2
6	Computation of financial leverage.	2
7	Debt-to-Equity Ratio Analysis.	2
8	Analysis of Leverage and profitability.	2
9	Conduction of Breakeven analysis.	2
10	Computation of weighted average cost of capital.	2
11	Determination of the effect of financial leverage on earnings per share.	2
12	Evaluation of financial risk by leverage ratio.	2
13	Exploration of impact of leverage on the valuation.	2
14	Designing an optimal capital structure.	2
15	Assessment of effect of leverage on dividend policy.	2

	Part B	
1	Construction of investment portfolio.	2
2	Analysis of risk and return characteristics of investment assets.	2
3	Valuation of Stock.	2
4	Computation of present value of future cash flows for a bond.	2
5	Backtesting of investment strategy.	2
6	Analysis of performance of different sectors.	2
7	Analysis of real estate investment.	2
8	Evaluation of different exchange traded funds.	2
9	Designing risk management strategies.	2
10	Evaluation of the performance of an investment portfolio.	2
11	Analysis of Behavioural finance.	2
12	Preparation of a research report on selected investment opportunity.	2
13	Evaluation of alternative investment opportunities.	2
14	Analysis of macroeconomic factors and their potential impact on investment markets.	2
15	Developing a comprehensive investment plan for retirement.	2

Course Outcomes: Students will be able to…

1. apply the appropriate depreciation method to calculate the depreciation expense for a specific asset.
2. assess the risk associated with high levels of leverage.
3. evaluate the costs and fees associated with investment products and services.
4. design an investment plan that aligns with specific financial goals.

Reference Books:

1) Hull, J. C. Options, Futures and Other Derivatives, Pearson Education, New York, 9th ed., 2017.
2) Kosowski, R. L., S. N. Neftci and M. Rutkowski, Principles of Financial Engineering, Academic Press, London,3rd ed., 2015.
3) Ross, S. M., An Introduction to Mathematical Finance: Options and Other Topics, Cambridge University Press, 2013.
4) Alhabeeb M. J., Mathematical Finance, John Wiley and Sons, Inc., Publication, 2012.
5) Baxter, Martin and A. Rennie, Financial Calculus: An Introduction to Derivative Pricing, Cambridge University Press, 2nd ed., 2003.

Indian Knowledge System

Semester – I

IKS101: Vedic Mathematics

Course Objectives: Students should be able to…

1. gain knowledge of history of Indian Mathematics from Vedic era.
2. study ruler-compass constructions in Vedic geometry.
3. understand the importance of decimal number system.
4. learn speed up calculations in arithmetic, algebra and trigonometry.

Credits **(Total Credits 2)**	**SEMESTER – I** **IKS101: Vedic Mathematics**	**No. of hours per unit**
Unit – I	**Background: Culture and Language**	**(06)**
	The Indus valley civilisation, The Vedic Period, The Oral tradition, Grammar.	
Unit – II	**Vedic Geometry**	**(08)**
	The Sulbasutra, The theorem of the diagonal, Rectilinear Figures and their transformations, Circle from square: the direct construction, The inverse formula: Square from circle, generalities, Measures and Numbers, Geometry, Influences.	
Unit – III	**Decimal Numbers**	**(08)**
	Background, Numbers and Based numbers, The Place Value Principal and its Realisations, Other Realisations, The Choice of a Base.	
Unit – IV	**Numbers in the Vedic Literature**	**(08)**
	Origin, Number names in Rigveda, Infinity and zero, Early Arithmetic, Combinatorics.	

Course Outcomes: Students will be able to…

1. describe Vedic period and tradition in Mathematics.
2. sketch geometrical constructions using simple methods.
3. examine place value principal realisations and other realisations.
4. test various Vedic arithmetic methods for speed up calculations.

Reference Books:

1) P. P. Divakaran, The Mathematics of India: Concepts, Methods, Connections, Hindustan Book Agency, 2018.Rep Springer New York, 2018.
2) C. S. Seshadri, Studies in History of Indian Mathematics, Hindustan Book Agency, Delhi, 2010.
3) B. Datta and A. N. Sing, History of Hindu Mathematics, Reprint, Bharatiya Kala Prakashan, Delhi, 2004.
4) Shri. B. K. Tirthaji, V. S. Agarwal, Vedic Mathematics or Sixteen Simple Mathematical formulae from Vedas, Orient Book Distributors,1981.
5) C. N. Srinivasiengar, History of Indian Mathematics, The World Press, Calcutta, 1967.

B.Sc. (Mathematics) (Part-I) (Semester- II)
Skill Enhancement Course
(Introduced from June 2023)
SEC103: Python Programming Language
Credit: 2

Course Objectives: students should be able to…

1) understand logic behind the basic programs.
2) identify different datatypes in python.
3) create interactive programs using loop.
4) learn how to use indexing and slicing to access data in python program.

Credit=1	**SEMESTER-II** **SEC 103: Python Programming Language**	**No. of hours per unit**
UNIT I	**Basics of Python**	**(07)**
	Python, Anaconda, Spyder IDE, Python Identifiers and Keywords data types,simple mathematical operation, Indentation and Comments., First Python program, Expression, Boolean expression, logical operations: comparison operator, membership operator, identity operator, bitwise operator. Order of evaluation. File Handling: open, read, write, append modes of file. Built-in functions, User-defined functions, Arguments, recursive function, Python Anonymous/Lambda Function, Global, Local and Nonlocal variables and return statement Input and Output, First Python program.	
UNIT II	**Control Structure and Python Packages**	**(08)**
	Conditional Statements, if-else, nested if-else, if-elif-else, try-except block. Looping Statements: for loop, while loop, Nested loops. Control Statements: break, continue and pass, Modules, import, import with renaming, from-import statement, math module, cmath module, random module, packages. Strings, list, tuples, dictionary, set and array. Operations on set and array: Set operations, Intersection, union, difference, symmetric difference, searching and sorting.	

Practicals Based on Python Programming Language

Credit=1	SEMESTER-II **Practicals Based on Python Programming Language**	No. of contact hours
1	Creating Simple Programs in Python.	3
2	Program using conditional Statements.	3
3	Program using Looping statements.	3
4	Program using Control statements.	3
5	Examples on user defined functions.	3
6	Examples on Lists data type.	3
7	Examples on Tuple data type.	3
8	Examples on Dictionary data type.	3
9	Examples on Indexing and slicing.	3
10	Examples on operations on set.	3

Course Outcomes: Student will be able to…

1. Create simple programs in Python.
2. Understand importance of python.
3. Perform operations on sets.
4. Read and write files.

Recommended Book:

1. Lutz, M., Python Pocket Reference, Sebastopol: O'Reilly Media, 2020.
2. Y. Kanetkar and A. Kanetkar, Let Us Python, BPB Publication, 2019.
3. VanderPlas, J., Python Data Science Handbook, Sebastopol: O'Reilly Media, 2016.
4. A. Saha, Doing Math with Python, No Starch Press, 2015.
5. Downey, A. B., Think Python: How to Think Like a Computer Scientist, Needham: Green Tea Press, 2015.
6. Sweigart, Al., Automate the Boring Stuff with Python, San Francisco: No Starch Press, 2015.
7. Ramalho, L., Fluent Python: Clear, Concise, and Effective Programming, Sebastopol: O'Reilly Media, 2015.
8. J. Kiusalaas, Numerical Methods in Engineering with Python3, Cambridge University Press,2013.
9. Shaw, Z. A., Learn Python the Hard Way, Boston: Addison-Wesley, 2013.
10. Beazley, D. M., and Brian K. J., Python Essential Reference, Indianapolis: Addison-Wesley, 2009.