Karmaveer Bhaurao Patil University, Satara

Syllabus for

B. Sc. I Mathematics

Under

Faculty of Science and Technology

(As per NEP 2020)

With effect from Academic Year 2024-2025

Syllabus for Bachelor of Science (B. Sc.) Part – I Mathematics

PREAMBLE:

The B.Sc. Mathematics program aims to deepen students understanding of advanced mathematical concepts and their applications. Building upon the foundational knowledge acquired in the earlier years, this stage focuses on rigorous analytical thinking, abstract reasoning, and problem-solving skills. The curriculum introduces students to higher-level topics such as real and complex analysis, abstract algebra, metric spaces, linear algebra, and Fourier series. It also emphasizes the development of logical reasoning, mathematical proof techniques, and the ability to model real-world phenomena mathematically. This course prepares students for postgraduate studies, competitive examinations, and careers requiring strong analytical and quantitative skills.

GENERAL OBJECTIVES OF THE COURSE:

1. To develop a strong foundation in core areas of mathematics.
2. To enhance analytical and problem-solving skills.
3. To introduce modern mathematical tools and technologies.
4. To prepare students for higher studies and research.
5. To promote interdisciplinary learning and applications.
6. To develop communication and presentation skills in mathematics.
7. To nurture ethical and professional responsibility.
8. To prepare students for employment and entrepreneurial roles.

PROGRAMME OUTCOMES

After completing the B.Sc. program, graduates will:

1. Possess a strong foundation of knowledge in their chosen field of study.
2. Develop a scientific mindset, becoming open-minded, critical, and curious, which will support their entry into research and innovation.
3. Be skilled in practical work, experiments, and the use of laboratory materials.
4. Be eligible to pursue higher studies in their field, both in India and abroad.
5. Qualify to appear for examinations for jobs in government organizations.
6. Meet the minimum eligibility requirements for various science-related job opportunities.
7. Be prepared to establish their own entrepreneurial ventures.
8. Enhance critical thinking, develop a scientific attitude, solve problems, improve practical skills, boost communication abilities, and strengthen social interactions.

PROGRAMME SPECIFIC OUTCOMES

After completing the B.Sc. Mathematics program, students will:

1. Be able to demonstrate comprehensive knowledge in core areas such as algebra, calculus, differential equations, real and complex analysis, topology, and linear algebra.

2. Apply mathematical methods to solve real-world problems in areas such as physics, engineering, computer science, economics, and statistics.

3. Exhibit strong analytical, logical, and critical thinking skills for problem-solving and theoretical investigations.

4. Utilize software and programming languages (such as MATLAB, Python, or R) to model and solve mathematical problems.

5. Be well-prepared for higher education (M.Sc., M.Phil., Ph.D.) or research roles in mathematical sciences and interdisciplinary fields.

6. Communicate complex mathematical ideas clearly and precisely in written and oral forms.

7. Integrate mathematical knowledge with other disciplines and work effectively in team-based or interdisciplinary settings.

8. Demonstrate ethical responsibility and professionalism in the use of mathematics in academic, industrial, or societal contexts.

9. Be equipped for careers in teaching, data science, actuarial science, operations research, banking, analytics, and other math-intensive domains.

10. Acquire the ability to engage in independent learning, formulate mathematical models, conduct basic research, and interpret results critically to address theoretical and applied problems.

1. TITLE: **Mathematics**

2. YEAR OF IMPLEMENTATION: **2024-2025**

3. DURATION: **01 year**

4. PATTERN: **Semester Examination**

5. MEDIUM OF INSTRUCTION: **English**

6. STRUCTURE OF COURSE:

As per NEP-2020 (2.0)

Sem (Level)	Courses			OE	AEC/ VEC/ IKS	Total Credits
	Course I	Course II	Course III			
Sem I (4.5)	DSC – I (2) DSC – II (2) DSC P – I (2)	DSC – I (2) DSC – II (2) DSC P – I (2)	DSC – I (2) DSC – II (2) DSC P – I (2)	OE – I (2)	IKS 1 (2) (Generic)	22
Sem II (4.5)	DSC – III (2) DSC – IV (2) DSC P – II (2)	DSC – III (2) DSC – IV (2) DSC P – II (2)	DSC – III (2) DSC – IV (2) DSC P – II (2)	OE – II (2)	VEC 1 (2)	22
Credits	12	12	12	04	04	44

7. COURSE TITLE

1) First Semester

Sr. No.	**Course**	**Theory**				**Practical**			
		Course Code	**Title of Course**	**No. of lectures per week**	**Credits**	**Course**	**Course Code & Title**	**No. of Practical Per week**	**Credits**
1.	DSC I	BMT 111	Calculus	2	2	DSC P - I	BMP 113: Practical Based on BMT 111 & BMT 112	1	2
2.	DSC II	BMT 112	Differential Equation	2	2				

2) Second Semester

Sr. No.	**Course**	**Theory**				**Practical**			
		Course Code	**Title of Course**	**No. of lectures per week**	**Credits**	**Course**	**Course Code & Title**	**No. of Practical Per week**	**Credits**
1.	DSC III	BMT 121	Differential Calculus	2	2	DSC P - II	BMP 123: Practical Based on BMT 121 & BMT 122	1	2
2.	DSC IV	BMT 122	Advanced Differential Equation	2	2				

8. EVALUATION STRUCTURE:

Semester I (4.5)

Course	Course Category	Course Code	Internal Evaluation			ESE	Total Marks	Credits
			CCE - I	CCE - II	CCE - III			
Major	T	BMT 111	10	10	10	30	50	02
	T	BMT 112	10	10	10	30	50	02
	P	BMP 113	20			30	50	02

Semester II (5.5)

Course	Course Category	Course Code	Internal Evaluation			ESE	Total Marks	Credits
			CCE - I	CCE - II	CCE - III			
Major	T	BMT 121	10	10	10	30	50	02
	T	BMT 122	10	10	10	30	50	02
	P	BMP 123	20			30	50	02

CONTINOUS AND COMPHERENSIVE EVALUATION (CCE) STRUCTURE:

- Internal evaluation of theory papers shall carry a weightage of 40%.
- For the internal evaluation of theory papers, departments have the flexibility to adopt a variety of assessment methods, including class tests, assignments, book review, tutorials, seminars, case studies, fieldwork, project work, quizzes, and similar tools for CCE I and CCE II.
- CCE III shall consist of multiple-choice questions.
- Each CCE will carry 10 marks for 2-credit theory papers and 20 marks for 4-credit theory
- papers, and the best two scores will be considered for final mark entry.
- Internal evaluation of practical papers shall carry a weightage of 50%.
- For practical examinations, internal evaluation will be based on student performance, attendance, journal records, and viva voce.

9. OTHER FEATURES:

A) LIBRARY:

Reference books, Textbooks, journals, and Periodicals are available in Institute and Departmental Library. (Separate reference lists are attached along with the respective course syllabus)

B) EQUIPMENT:

a) Computer, LCD projector, visualizer, smart board

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(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Mathematics

Programme: B. Sc.	**Semester** - I
Type: DSC	**Marks:** 50
Credits: 2	**From:** A. Y. 2024-25

Name of the Course and Code: BMT 111 Calculus

Course Objectives: By the end of the course, students 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.

Course Outcomes: By the end of the course, students 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 nth order derivative of real valued functions.

Module	Title and Contents	Hrs
Module -1:	**Limits and continuity of Real Valued functions** 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 functionson interval 1.3.2 Theorem: If f and g are continuous functions at point $x = a$, then $f + g$, $f - g$, $f \cdot g$ 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.	10
Module -2:	**Properties of continuity of Real Valued functions** 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 $f(b)$.	05

Module -3:	**Differentiation** 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.	05
Module -4:	**Successive Differentiation** 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.	10

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.

Evaluation Pattern:

Total Marks: 50

Internal Continuous Evaluation (20 Marks):	**End Semester Examination (30 Marks):**
• CCE - I: 10 Marks: Assignment/Class Tests, • CCE - II: 10 Marks: Case study/ Seminar/ Field Work • CCE – III: 10 Marks: Multiple Choice questions (The Best of two will be considered for the final mark entry)	• Q.1) Solve the following questions. [5X2=10] • Q.2) Attempt any two questions. [2X10=20] • Q.3) Attempt any four questions [4X5=20] Note: Conversion of 50 marks of ESE evaluation to30 marks.

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Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Mathematics

Programme: B. Sc.	**Semester** - I
Type: DSC	**Marks:** 50
Credits: 2	**From:** A. Y. 2024-25

Name of the Course and Code: BMT 112 Differential Equation

Course Objectives: By the end of the course, students should be 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 auxiliary equation of differential equations of type $f(D)y = 0$.
4) find general solution of differential equations of type $f(D)y = X$.

Course Outcomes: By the end of the course, students 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.

Module	Title and Contents	Hrs
Module -1:	**Differential Equations of first order and first degree** 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.	08
Module -2:	**Differential Equations of first order but not of first degree** 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.	06

Module -3:	**Homogeneous Linear Differential Equations with constant Coefficients** 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	08
Module -4:	**Non-Homogeneous Linear Differential Equations with constant Coefficients** 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 $e^{ax}, sin\ ax, cos\ ax, xm, e^{ax}V, xV$ (V is function of x). 4.7 Examples.	08

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.
4. R. K. Gupta, Differential Equations, 49th edition, Krishna Education Publication, 2014

Evaluation Pattern:

Total Marks: 50

Internal Continuous Evaluation (20 Marks):	**End Semester Examination (30 Marks):**
• CCE - I: 10 Marks: Assignment/Class Tests, • CCE - II: 10 Marks: Case study/ Seminar/ Field Work • CCE – III: 10 Marks: Multiple Choice questions (The Best of two will be considered for the final mark entry)	• Q.1) Solve the following questions. [5X2=10] • Q.2) Attempt any two questions. [2X10=20] • Q.3) Attempt any four questions [4X5=20] Note: Conversion of 50 marks of ESE evaluation to30 marks.

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Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Mathematics

Programme: B. Sc.	**Semester** - I
Type: DSC Practical	**Marks:** 50
Credits: 2	**From:** A. Y. 2024-25

Name of the Course and Code: BMP 113 Practical Based on BMT 111 & BMT 112

Practical Batch: 20 Students / Batch

Course Objectives: By the end of the course, students 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.

Course Outcomes: By the end of the course, students 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 solution of linear differential equation with constant coefficients.

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

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.
8. R. K. Gupta, Differential Equations, 49th edition, Krishna Education Publication, 2014

Evaluation Pattern: 60:40	
Total Marks: 50	
End Semester Examination:	
Internal Evaluation (20 Marks): • Journal: 10 Marks • Viva: 05 Marks • Student Performance: 05 Marks	**End Semester Examination (30 Marks):** • Q.1) Answer the following questions. (Any Two) [2 X 10 = 20] • Q.2) Answer the following questions. (Any Two) [2 X 05 = 10]

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Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Mathematics

Programme: B. Sc.	**Semester** - II
Type: DSC	**Marks:** 50
Credits: 2	**From:** A. Y. 2024-25

Name of the Course and Code: BMT 121 Differential Calculus

Course Objectives: By the end of the course, students 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.

Course Outcomes: By the end of the course, students 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.

Module	Title and Contents	Hrs
Module -1:	**Mean Value Theorems** 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	08
Module -2:	**Series Expansion and Indeterminate Forms** 2.1 Taylor's Theorem with Lagrange's and Cauchy's form of remainder (Statement only) 2.2 Maclaurin'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'Hôpital's rule (statement only). 2.5.1 The Forms $\frac{0}{0}$, $\frac{\infty}{\infty}$, $0\times\infty$, $\infty-\infty$, 0^0, ∞^0, 1^∞ 2.5.2 Examples	06

Module -3:	**Partial Differentiation** 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 $z = f(x,y)$ and $f(x,y)$ is homogenous function of x, y of degree n, then $x\frac{\partial z}{\partial x} + y\frac{\partial z}{\partial y} = nz$ 3.4.2 If $F(u) = f(x,y)$ and $f(x,y)$ is homogenous function of x, y of degree n, then $x^2\frac{\partial^2 f}{\partial x^2} + 2xy\frac{\partial^2 f}{\partial x^2} + y^2\frac{\partial^2 f}{\partial y^2} = g(u)[g'(u) - 1]$ where $g(u) = n\frac{f(u)}{f'(u)}$ 3.4.3 If $F(u) = f(x,y)$ and $f(x,y)$ is homogenous function of x, y of degree n, then $x^2\frac{\partial^2 f}{\partial x^2} + 2xy\frac{\partial^2 f}{\partial x^2} + y^2\frac{\partial^2 f}{\partial y^2} = n(n-1)f$	08
Module -4:	**Extreme Values** 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	08

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.

Evaluation Pattern:

Total Marks: 50

Internal Continuous Evaluation (20 Marks):	**End Semester Examination (30 Marks):**
• CCE - I: 10 Marks: Assignment/Class Tests, • CCE - II: 10 Marks: Case study/ Seminar/ Field Work • CCE – III: 10 Marks: Multiple Choice questions (The Best of two will be considered for the final mark entry)	• Q.1) Solve the following questions. [5X2=10] • Q.2) Attempt any two questions. [2X10=20] • Q.3) Attempt any four questions [4X5=20] Note: Conversion of 50 marks of ESE evaluation to 30 marks.

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Faculty of Science and Technology

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Board of Studies in Mathematics

Programme: B. Sc.	**Semester** - II
Type: DSC	**Marks:** 50
Credits: 2	**From:** A. Y. 2024-25

Name of the Course and Code: BMT 122 Advanced Differential Equation

Course Objectives: By the end of the course, students 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.

Course Outcomes: By the end of the course, students 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.

Module	Title and Contents	Hrs
Module -1:	**Homogeneous Linear Differential Equations** 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	06
Module -2:	**Second Order Linear Differential Equations** 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	10
Module -3:	**Ordinary Simultaneous Differential Equations** 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 Examples 3.4 Examples	06
Module -4:	**Total Differential Equations** 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	08

	4.6 Examples	

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.
4. R. K. Gupta, Differential Equations, 49th edition, Krishna Education Publication, 2014

Evaluation Pattern:

Total Marks: 50

Internal Continuous Evaluation (20 Marks):	**End Semester Examination (30 Marks):**
• CCE - I: 10 Marks: Assignment/Class Tests, • CCE - II: 10 Marks: Case study/ Seminar/ Field Work • CCE – III: 10 Marks: Multiple Choice questions (The Best of two will be considered for the final mark entry)	• Q.1) Solve the following questions. [5X2=10] • Q.2) Attempt any two questions. [2X10=20] • Q.3) Attempt any four questions [4X5=20] Note: Conversion of 50 marks of ESE evaluation to 30 marks.

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Board of Studies in Mathematics

Programme: B. Sc.	**Semester** - II
Type: DSC Practical	**Marks:** 50
Credits: 2	**From:** A. Y. 2024-25

Name of the Course and Code: BMP 123 Practical Based on BMT 121 & BMT 122

Practical Batch: 20 Students / Batch

Course Objectives: By the end of the course, students 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.

Course Outcomes: By the end of the course, students 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.

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

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.
8. R. K. Gupta, Differential Equations, 49th edition, Krishna Education Publication, 2014

Evaluation Pattern: 60:40	
Total Marks: 50	
End Semester Examination:	
Internal Evaluation (20 Marks): • Journal: 10 Marks • Viva: 05 Marks • Student Performance: 05 Marks	**End Semester Examination (30 Marks):** • Q.1) Answer the following questions. (Any Two) [2 X 10 = 20] • Q.2) Answer the following questions. (Any Two) [2 X 05 = 10]