





<b>Class</b>		<b>B.Sc. Mathematics</b>	
<b>Semester/Year</b>		<b>II Year</b>	
<b>Subject &amp; Subject Code</b>		<b>Mathematics- BMATH20Y201</b>	
<b>Paper</b>		<b>Abstract Algebra-I</b>	
<b>Max. Marks</b>		<b>30 (ETE) + 20 (IA) =50</b>	
<b>Credit</b>		<b>Total Credits</b>	
<b>L</b>	<b>T</b>	<b>P</b>	<b>4</b>
2	2	0	

**Course Objectives:**

The main aim of the course is to introduce you to basic concepts from abstract algebra, especially the notion of a group. The course will help prepare you for further study in abstract algebra as well as familiarize you with tools essential in many other areas of mathematics. The other aim of this module is to provide the learner with the skills, knowledge and competencies to carry out their duties and responsibilities in an pure Mathematic environment.

**Course Outcome:**

The Students will be able to:

1. Understand the concepts of direct product of groups, normal subgroups, and factor groups.
2. Describe the structure of finite Abelian group.
3. Use Sylow's theorems to describe the structure of certain finite groups.
4. Explain the notion of an extension of a field.
5. Describe the structure of finite fields.
6. Use Galois theory to analyze the solvability of polynomials.
7. Produce rigorous proofs of propositions/theorems arising in the context of abstract algebra.

**Student Learning Outcomes (SLO):**

Students will:

1. Students will have a working knowledge of important mathematical concepts in abstract algebra such as definition of a group, order of a finite group and order of an element.
2. Students will be knowledgeable of different types of subgroups such as normal subgroups, cyclic subgroups and understand the structure and characteristics of these subgroups.
3. Students will be introduced to and have knowledge of many mathematical concepts studied in abstract mathematics such as permutation groups, factor groups and Abelian groups.
4. Students will see and understand the connection and transition between previously studied mathematics and more advanced mathematics. The students will actively participate in the transition of important concepts such homomorphisms & isomorphisms from discrete mathematics to advanced abstract mathematics.
5. Students will gain experience and confidence in proving theorems. A blended teaching method will be used requiring the students to prove theorems give the student the experience, knowledge, and confidence to move forward in the study of mathematics.

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Unit	Syllabus	Periods
UNIT - I	Definition and basic properties of groups, subgroups, subgroups generated by a subset, Cyclic groups and simple properties.	8
	समूह की परिभाषा एवं सामान्य प्रगुण, उपसमूह, उपसमुच्चय से जनित उपसमूह, चक्रीय समूह एवं सामान्य प्रगुण ।	
UNIT - II	Coset decomposition, Lagrange's Theorem and its corollaries including Fermat's Theorem , Normal subgroups. Quotient groups.	8
	सह समुच्चय वियोजन, लैग्रान्ज प्रमेय एवं इनकी उप प्रमेय फर्मा प्रमेय, प्रासामान्य उपसमूह , विभाग समूह ।	
Unit-III	Homomorphism and Isomorphism of groups, Fundamental theorem of homomorphism . Transformation and permutation group. $S_n$ ( Various subgroups of $s_n$ , $n > 5$ to be studied ), Cayley's theorem .	8
	समूह की समाकारिता एवं तुल्यकारिता, समाकारिता का मूलभूत प्रमेय, रूपांतरण एवं क्रमचय समूह $s_n$ ( $s_n$ के विभिन्न उपसमूह, संकल्पित है कि $n < 5$ ), कैली प्रमेय ।	
Unit-IV	Group Automomorphism , Inner Automorphism , group of Automorphisms, Conjugacy relation and Centraliser , Normalisar , Counting Principle and Class equation of a finite group, Cauchy's theorem for finite abelian groups and non-abelian groups.	8
	समूह स्वाकारिता, अंतः स्वाकारिता, स्वाकारिताओं का समूह, संयुग्मिता संबंध और केन्द्रीयकारक, प्रसामान्यक, गणना सिद्धांत एवं परिमित समूह का वर्ग समीकरण । परिमित आबेली एवं अन-आबेली समूह के लिए कौशी का प्रमेय ।	
UNIT - V	Definition and basic properties of rings, Ring homomorphism, subrings, Ideals and Quotient rings, polynomials rings and its properties , Integral domain, principal idea domains, Eculidean domains and unique factorization domains, Field and Quotient fields .	8
	वलय की परिभाषा एवं सामान्य प्रगुण, वलय समाकारिता, उपवलय, गुणजावली एवं विभाग वलय, बहुपद वलय एवं उनके प्रगुण, पूर्णांकीय प्रांत । मुख्य गुणजावली प्रांत, यूक्लीडियन प्रांत एवं अद्वितीय गुणनखण्डीकरण प्रांत, क्षेत्र एवं विभाग क्षेत्र ।	

**Text Books:**

- 1 Topics in Algebra by I.N.Herstien, Wiley Eastern Ltd. New Delhi.1977
- 2 Basic Abstract Algebra by PB Bhattacharya, S.K.Jain and S.R. Nagpal, Wiley Eastern, New Delhi, 1977.
- 3 म०प्र० हिन्दी ग्रंथ अकादमी पुस्तकें।

**References Books:**

- 1 A Text Book of Modern Abstract Algebra by Shantinayayan , S.Chand and Company, New Delhi.
- 2 A Text Book of modern Algebra by Surjeet Singh.
- 3 Basic Algebra by N.Jacobson, Voll and II, W.H.Freeman.
- 4 Algebra by I.S.Luther and I.B.S.Passi, Vol.I and II, Narosa Publishing House.

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<b>Class</b>		B.Sc
<b>Semester/Year</b>		II Year
<b>Subject &amp; Subject Code</b>		Mathematics-BMATH20Y202
<b>Paper</b>	English	Advanced Calculus-II
	हिन्दी	उच्च कलन
<b>Max. Marks</b>		30 (ETE) + 20(IA) = 50
<b>Credit</b>		3
<b>Total Credits</b>		
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**Course Objectives:**

The goal of this course is for students to gain proficiency in calculus computations. In calculus, we use three main tools for analyzing and describing the behavior of functions: limits, derivatives, and integrals. Students will use these tools to solve application problems in a variety of settings ranging from physics and biology to business and economics.

**Course Outcome:**

The Students will be able to:

1. Learn to work with infinite sequences and series.
3. Learn to work with infinite sequence is bounded.
4. Learn to work with an infinite sequence is monotonic.
5. Learn different test of Cauchy's .
6. Learn continuity and differentiability.
7. Learn Taylor's and Euler's theorem.
8. Learn double and triple integrals.

**Student Learning Outcomes (SLO):**

Students will:

1. Determine if an infinite sequence is bounded.
2. Determine if an infinite sequence is monotonic.
3. Determine if an infinite series converges absolutely or conditionally.
4. Able to solve Leibnitz's test.
5. Able to solve Darboux's intermediate value theorem for derivatives.
6. Able to solve Envelopes, Evolutes, Maxima and Minima of function of two variables.
7. Able to solve Beta and Gamma Function .
8. Able to solve Double and triple integrals.

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Unit	Syllabus	Periods
UNIT - I	Definition of a sequence , Theorems on limits of sequence , indeterminate forms , Bounded and monotonic sequence, Cauchy's convergence criterion, series of non-negative terms, comparison test, Cauchy's integral test , Cauchy's roots test, ratio tests, Raabe's tests, logarithmic tests , Alternating series . Leibnitz's test , Absolute and conditional convergence, absolute and condition convergence of series of real and complex terms, rearrangement of series .	8
	अनुक्रम की परिभाषा, अनुक्रम की सीमा पर प्रमेय, अनिश्चर्य रूप, परिवर्द्ध एवं एकदिष्ट अनुक्रम काशी का अभिसरण मापदण्ड, अक्रणात्मक पदों की श्रेणी , तुलना परीक्षण, काँशी का समाकल परीक्षण, काँशी का मूल परीक्षण, अनुपात परीक्षण, राबी का परीक्षण, लघुगणकीय परीक्षण, एकांतर श्रेणी , लैबनीज परीक्षण, निरपेक्ष एवं परिवंधी अभिसरण, वास्तविक एवं सम्मिश्र पदों की श्रेणियों का निरपेक्ष एवं प्रतिबंधमयी अभिसरण।	
UNIT - II	Continuity of function of single variable, sequential continuity, properties of continuous functions. Uniform continuity, chain rule of differentiability , Mean value theorem and their geometrical interpretation . Darboux's intermediate value theorem for derivatives.	8
	सांतत्य (एक चर फलन), अनुक्रमणीय सांतत्य, संतत फलनों के गुणधर्म, एक समान सांतत्य, अवकलनीयता का श्रृंखला नियम, मध्यमान प्रमेय एवं उनका ज्यामितीय अर्थ, अवकलों के लिए डार्बू का मध्यवर्ती मान प्रमेय।	
Unit-III	Limit and continuity of functions of two variable, partial differentiation , change of variable, Euler's theorem on homogeneous function, Taylor's theorem for function of two variables, Jacobians.	8
	दो चरों के फलों की सीमा एवं सांतत्य, आंशिक अवकलन, चरों का परिवर्तन, समघात फलनों पर आयलर का प्रमेय, दो चरों के फलनों के लिए टेलर का प्रमेय, जेकोबियन।	
Unit-IV	Envelopes, Evolutes, Maxima and Minima of function of two variables, Lagrange's multiplier method, Beta and Gamma Function .	8
	अन्चालोप, केन्द्रज, दो चरों के फलनों का उच्चिष्ठ एवं निम्निष्ठ, लेग्रांज के गुणांको की विधि, बीटा एवं गामा फलन।	
UNIT - V	Double and triple integrals, volumes and surfaces of solids of revolution Dirichlet's integrals, change of order of integration in double integrals.	8
	द्विक एवं त्रिक समाकल, ठोस के परिभ्रमण से जनित आयतन एवं पृष्ठ, ड्रीचलेटस् समाकल, द्विक समाकल के क्रम का परिवर्तन।	

Text Books:

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- 1 Real Analysis by R.R.Goldbeg,Oxford & I.B.H.Publishing Co.,Ne Delhi.
- 2 Differential Calculus by Gorakh Prasad,Pothishala Pvt.Ltd. Allahabad.
- 3 म०प्र० हिन्दी ग्रंथ अकादमी पुस्तकें

References Books:

- 1 Mathematical Analysis by Gabriel Klaumber,Marcel Dekkar,Inc.New York,1975.
- 2 Mathematical Analysis by T.M.Apostol,Narosa Publishing Housse,New Delhi.1985.
- 3 A First Course in mathematical Analysis by D.Soma Sundaram and B.Choudhary-  
,Narosa.Publishing,House,New Delhi,1997.
- 4 Theory and problems of advance Calculus by Murray R. Spiegel, Schauma Publishing
- 5 An Introduction to Secquence by O.E. Stanaitis,Series and improper Integrals.

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<b>Class</b>		B.Sc
<b>Semester/Year</b>		II Year
<b>Subject &amp; Subject Code</b>		Mathematics-BMATH20Y203
<b>Paper</b>	English	Differential Equations-III
	हिन्दी	अवकल समीकरण
<b>Max. Marks</b>		30 (ETE) + 20(IA) = 50
<b>Credit</b>		3
<b>Total Credits</b>		
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**Course Objectives:**

This course is intended to expose you to the basic ideas of Differential Equations combined with some ideas from Linear Algebra. To be successful, a student must be able at the end of the class to solve the majority of the problems with no external help. All assignments and exams are geared towards and measure how much this goal has been accomplished.

**Course Outcome:**

The Students will be able to:

1. Solve Power series method.
2. Solve Legendre's and Bessel's equations.
3. Solve Laplace transformation equations.
4. Solve Partial differential equations of the first order.
5. Solve Lagrange's and Charpit's methods.
6. Solve Partial differential equations of second and higher orders.
7. Solve heat equation Laplace's equation and their solutions.

**Student Learning Outcomes (SLO):**

Students will:

1. Able to explain the concept of differential equation.
2. Explains the meaning of solution of a differential equation.
3. Determines the type of a linear differential equation systems.
4. Will be able to use the Laplace transform in finding the solution of linear differential equations.
5. Explains basic properties of Laplace transform.
6. Expresses the inverse Laplace transform.
7. Finds Laplace transforms solution of linear differential equation with constant coefficients.
8. Explain Partial differential equations of second and higher orders








Unit	Syllabus	Periods
UNIT - I	Series solution of differential equations, Power series method, Bessel's and Legendre's equations, Bessel's and Legendre's functions and their properties recurrence and generating function. Orthogonality of functions .	8
	अवकल समीकरण का श्रेणी हल, घात श्रेणी विधि बेसल एवं लेजेन्ड्रे समीकरण, बेसल एवं लेजेन्ड्रे फलन एवं उनके गुणधर्म, पुनरावृत्त एवं जनक फलन, फलन की लाम्बिकता ।	
UNIT - II	Laplace Transformation, Linearity of the laplace transformation, Existence theorem for laplace transforms, Laplace transforms of derivatives and integrals, shifting theorem, Differentiation and integration of transforms .	8
	लॉप्लास रूपांतरण, लॉप्लास रूपांतरण की रैखिकता, लॉप्लास रूपांतरण के लिए अस्तित्व प्रमेय । अवकलजों एवं समाकलों का लॉप्लास रूपांतरण, स्थानांतर प्रमेय, रूपांतरणों का अवकलन एवं समाकलन ।	
Unit-III	Inverse Laplace transforms, Convolution theorem , Application of Laplace transformation for solving initial value problems of second order linear differential equations with constant coefficients.	8
	प्रतिलोम लॉप्लास रूपांतरण, संवलन प्रमेय, प्रारम्भिक मान समस्याओं के लिए द्वितीय कोटि के अचर गुणांकों सहित रैखिक अवकल समीकरणों को हल करने में लॉप्लास रूपांतरणों के अनुप्रयोग ।	
Unit-IV	Partial differential equations of the first order, Lagrange's solution, Some special types of equations which can be solved easily by method other than the general method, charpit's general method .	8
	प्रथम कोटि के आंशिक अवकल समीकरण, लैग्रांज विधि, विशिष्ट प्रकार के अवकल समीकरण का व्यापक विधि के अतिरिक्त अन्य विधि द्वारा सरलता से हल , चारपिट की व्यापक विधि ।	
UNIT - V	Partial differential equations of second and higher orders, Classification or Partial differential equation of second order , Homogeneous and non-homogeneous equation with constant coefficients , Partial differential equations reducible to equations with constant coefficients , equations of vibrating string, heat equation Laplace's equation and their solutions.	8
	द्वितीय व उच्च कोटि के आंशिक अवकल समीकरण , द्वितीय कोटि के आंशिक अवकल समीकरणों का वर्गीकरण , अचल गुणांकों के समघात एवं असमघात समीकरण , अचर गुणांकों में समानेय आंशिक अवकल समीकरण, कम्पनेय डोरी का समीकरण , उष्मा समीकरण, लाप्लास समीकरण एवं इनके हल ।	

Text Books:

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Text Books:

- 1 Integral Transform by Sharma and Gupta, Pragati, Prakashan Meerut.
- 2 Differential Equation by Sharma and Gupta, Pragati Prakashan Meerut.
- 3 Differential Equation by Raysinghania, S.Chand & Company, New Delhi.
- 4 म०प्र० हिन्दी ग्रंथ अकादमी पुस्तकें।

References Books:

- 1 Introductory course in differential equation D.A.Murray , Orient Longman, India, 1967.
- 2 An introduction to Ordinary differential equations by E.A. Coddington, Prentice Hall of
- 3 Elementary Treatise on Differential equations and their applications by H.T.H. Piaggio, C.B.S. Publisher .and Distributors, Delhi, 1985,
- 4 Special Functions The Macmillan Company by E.D. Rainville, New York.

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<b>Class</b>		<b>B.Sc. Mathematics</b>	
<b>Semester/Year</b>		<b>II Year</b>	
<b>Subject &amp; Subject Code</b>		<b>Mathematics-BMATH20Y204</b>	
<b>Paper</b>		<b>Linear and Computer Programming- IV</b>	
<b>Max. Marks</b>		<b>30 (ETE) + 20 (IA) =50</b>	
<b>Credit</b>		<b>Total Credits</b>	
<b>L</b>	<b>T</b>	<b>P</b>	<b>5</b>
3	2	0	

**Course Objectives:**

This course aims at introducing students into linear optimization theory and its applications. The field of linear programming provides the appropriate methods for the efficient computation of optimal solutions of a problem which is modeled by a linear objective function and a set of linear constraints. At the end of this course, the students will be ready to model a problem as a linear programming problem and to apply the appropriate method in order to find an optimal solution. The course aims to provide exposure to problem-solving through programming. It aims to train the student to the basic concepts of the Computer programming .

**Course Outcome:**

The Students will be able to:

1. Obtain an overview of the kinds of problems linear and computer programming has been used to solve.
2. Learn how to develop linear programming models for simple problems.
3. Be able to identify the special features of a model that make it a linear and computer programming model.
3. Learn how to solve two variable linear programming models by the graphical solution procedure.
4. Understand the importance of extreme points in obtaining the optimal solution.
5. Know the use and interpretation of slack and surplus variables.
6. Be able to interpret the computer solution of a linear programming problem.
7. Understand how alternative optimal solutions, infeasibility and unboundedness can occur in linear programming problems.
8. Understand Conversion to and from decimal systems.
9. Learn how to solve Arithmetic and logical operations on numbers.

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**Student Learning Outcomes (SLO):**

Students will:

1. Be able to mathematically formulate an applied word problem involving revenue, costs, and constraints as a linear program.
2. Be able to geometrically solve a linear program in two variables.
3. Be able to convert a linear programming problem into standard form.
4. Be able to apply the simplex algorithm to solve a linear programming problem.
5. Be able to find alternate solutions to a linear program problem.
6. Be able to utilize computer software to solve a linear and computer programming problem.
7. Be able to solve a linear programming with unrestricted-in-sign variables.
8. Be able to analyze small changes to a linear and computer programming problem.
9. Be able to produce the dual of a linear program.
10. Be able to describe Algorithms and flow charts for solving numerical analysis problems..
11. Be able to use shadow prices to analyze changes to a linear and computer programming problem's optimal solution.
12. Be able to solve Arithmetic and logical operations on numbers.

Unit	Syllabus	Periods
UNIT - I	Linear Programming problems ,basic solution,basic feasible solution and optimal solution.	8
	रेखीय प्रकमन समस्याएं,मूलभूत हल,मूलभूत संभव एवं इषटतम हल।	
UNIT - II	Graphical method and simplex method of solutions,Duality Transportation and assignment problems.	8
	हलों के लिए ग्राफीय एवं सिम्लेक्स विधि,द्वैतता,परिवहन एवं निर्धारण समस्याएं।	
Unit-III	Computer Programming,Binary system,Arithmetic and logical operations on numbers, Octal and Hexadecimal systems.	8
	संगणक प्रकमन:द्विचर निकाय संख्याओं पर अंकगणितीय एवं तार्किक संक्रियाएं,अष्ट एवं षोडश आधारी दशमलव पद्धति।	
Unit-IV	Conversion to and from decimal systems,Algebra of binary numbers ,Elements of computer system and concept of memory.	8
	दाशमिक पद्धति से एवं दाशमिक पद्धति में रूपांतरण,द्विचर संख्याओं का बीजगणित,संगणक निकाय के तत्व तथा स्मृति की अवधारणा।	
UNIT - V	Representation of unsigned integers,signed and reals ,double precision reals and long integers.Algorithms and flow charts for solving numerical analysis problems.	8
	अचिन्हित पूर्णाकों एवं वास्तविक संख्याओं का निरूपण,द्विक यथार्थ वास्तविक एवं दीर्घ पूर्णांक,संख्यात्मक विश्लेषण समस्या के हल हेतु तर्क प्रवाह एवं प्रवाह चित्र।	

**References Books:**

- 1 Programming in ANSI-C by E Balagurusamy,Mc Grawhill.
- 2 Computers fundamentals by Pradeep K.Sinha \$ Priti Sinha,BPB Publication.
- 3 Linear Programming by R.K.gupta,Krishna Publication.