

**MAR IVANIOS COLLEGE  
(AUTONOMOUS)  
THIRUVANANTHAPURAM**



**Department of Mathematics**

**Syllabus for Mathematics  
(Complementary)**

**FDP**

**BA (Economics)**

**Academic Year 2018-19 onwards**

<b>FDP BA ECONOMICS (Complementary)</b>			<b>Instructi onal h/week</b>	<b>Credit</b>	<b>ESE durat ion (h)</b>	<b>CE (%)</b>	<b>ESE (%)</b>
<b>Sem ester</b>	<b>Paper Code</b>	<b>Title of Course</b>					
1	AUMM 131.1a	Differential Calculus of Functions of One Variable	3	2	3	20	80
2	AUMM 231.1a	Multivariate Differential Calculus, Sequences and Series	3	3	3	20	80
3	AUMM 331.1a	Integral Calculus and Linear Algebra	3	3	3	20	80
4	AUMM 431.1a	Differential Equations, Difference Equations and Linear Programming	3	3	3	20	80

## SEMESTER-1

### AUMM 131.1a: MATHEMATICS FOR ECONOMICS-I (Differential Calculus of Functions of One Variable)

**Total Teaching Hours: 54**

**No of Lecture Hours/Week: 3**

**Max Marks: 80**

**Credits: 2**

**Course Outcomes:**

- **CO1:** Intended for Economics students lays emphasis on the increased use of mathematical methods in Economics.
- **CO2:** To get working knowledge on limits, continuity and functions.
- **CO3:** Learn Differentiation and its basic applications in Economics, to study how quickly quantities change over time, understand slope of a curve as rate of change.
- **CO4:** Study the concepts of increasing and decreasing functions, maxima and minima, and find its applications through functions familiar in Economics.

**Text:** Knut Sydsaeter, Peter J. Hammond: *Mathematics for Economic Analysis*, Pearson, 1995

**Module 1 Functions of One Variable**

**Total Teaching Hours: 18**

(Make a quick review and discussion on the following topics from Chapter-1. These topics may not be included in the end semester examination; but, be used as Seminar topics or topics for Assignments. The topics are: Why Economists use Mathematics, Scientific Method in the Empirical science, the use of symbols in Mathematics, the real number system, a few aspects of Logic, Mathematical proof, Set theory.)

After this review, the main topics to be discussed in the module are the following:

**Functions of one variable:** Introduction, Functions of one real variable, graphs, graphs of functions, linear functions.

(Now make a quick review of chapter 3. These topics may not be included in the end semester examination; but, be used as Seminar topics or topics for Assignments. The topics are: quadratic functions, examples of quadratic optimization problems, polynomials, power functions, exponential functions, the general concept of a function).

After this review, the main topics to be discussed in the module are the following:

**Limits, Continuity and Series:** Limits, continuity, continuity and differentiability.

**[The topics to be discussed in this module can be found in  
Chapters 1, 2, 3; Chapter 6 Sections 1-3]**

**Module 2 Differentiation of Functions of One Variable**

**Total Teaching Hours: 18**

**Single Variable Differentiation:** Slopes of curves, the slope of the tangent and the derivative, rates of change and their economic significance, a dash of limits, simple rules for differentiation, differentiation of sums, products and quotients, second and higher order derivatives.

**More on Differentiation:** The generalised power rule, composite functions and the chain rule, implicit differentiation, linear approximations and differentials, polynomial approximation, elasticities.

**[The topics to be discussed in this module can be found in Chapters 4, 5]**

**Module 3 Single Variable Optimization**

**Total Teaching Hours: 18**

**Implications of Continuity and Differentiability:** The intermediate-value theorem, the extreme value theorem, the mean value theorem, Taylor's formula, intermediate forms and L' Hopital's rule, inverse functions.

**Single-Variable Optimization:** Some basic definitions, a first-derivative test for extreme points, alternative ways of finding maxima and minima, local maxima and minima, convex and concave functions and inflection points.

**[The topics to be discussed in this module can be found in  
Chapter 7; Chapter 9 Sections 1-5]**

**Reference**

1. G D Allen, Mathematical Analysis for Economics, AITBS Publishers, D-2/15. Krishnan Nagar, New Delhi
2. Taro Yamane, Mathematics for Economists, An Elementary Survey, PHI, New Delhi.
3. Chiang A.C. and K.Wainwright, Fundamental Methods of Mathematical Economics, 4<sup>th</sup> Edition, McGraw-Hill, New York, 2005.(cw)
4. Dowling E.T, Introduction to Mathematical Economics, 2nd Edition, Schaum's Series, McGraw- Hill, New York, 2003(ETD)
5. Mary George, Thomaskutty, A Text Book of Mathematical Economics, Discovery Publishers, New Delhi.

## SEMESTER-2

### AUMM 231.1a: MATHEMATICS FOR ECONOMICS -II (Sequences, Series and Multivariate Differential Calculus)

**Total Teaching Hours: 54**

**No of Lecture Hours/Week: 3**

**Max Marks: 80**

**Credits: 3**

**Course Outcomes:**

- **CO1:** Learn sequences and infinite series and apply it in determining the present discounted values and investment projects.
- **CO2:** Learn exponentials and logarithms and their applications in solving economic problems such as, compound interest and present discounted values.
- **CO3:** Understand partial differentiation and its applications in Economics.

**Text:** Knut Sydsaeter, Peter J. Hammond: *Mathematics for Economic Analysis*, Pearson, 1995

**Module 1 Sequences and Series**

**Total Teaching Hours: 18**

**Sequences and Series:** Infinite sequences, geometric series, general series, present discounted values and investment projects.

**Exponential and Logarithmic Functions:** The natural exponential function, the natural logarithmic function, generalizations, applications of exponentials and logarithms, compound interest and present discounted values.

[The topics to be discussed in this module can be found in  
Chapter 6 Sections -6 & Chapter 8]

**Module 2 Differentiation of Functions of Several Variables**

**Total Teaching Hours: 18**

**Functions of Several Variables:** Functions of two or more variables, geometric representations of functions of several variables, partial derivatives with two variables, partial derivatives and tangent planes, partial derivatives with many variables, partial derivatives in Economics, linear models with quadratic objectives.

[The topics to be discussed in this module can be found in Chapter 15 Sections 1-7]

<b>Module 3 Applications of Multivariable Calculus</b>	<b>Total Teaching Hours: 18</b>
<p><b>Tools for Comparative Statics:</b> The chain rule, more general chain rules, derivatives of functions defined implicitly, partial elasticities, homogeneous functions of two variables, linear approximations and differentials, systems of equations.</p> <p><b>Multivariable Optimization:</b> Simple two-variable optimization.</p> <p style="text-align: center;"><b>[The topics to be discussed in this module can be found in Chapter 16 Sections 1-5, 8, 9 &amp; Chapter 17 Section 1]</b></p>	
<p><b>Reference</b></p> <ol style="list-style-type: none"> <li>1. G D Allen, Mathematical Analysis for Economics, AITBS Publishers, D-2/15. Krishnan Nagar, New Delhi</li> <li>2. Taro Yamane, Mathematics for Economists, An Elementary Survey, PHI, New Delhi.</li> <li>3. Chiang A.C. and K.Wainwright, Fundamental Methods of Mathematical Economics, 4<sup>th</sup> Edition, McGraw-Hill, New York, 2005.(cw)</li> <li>4. Dowling E.T, Introduction to Mathematical Economics, 2nd Edition, Schaum's Series, McGraw- Hill, New York, 2003(ETD)</li> <li>5. Mary George, Thomaskutty, A Text Book of Mathematical Economics, Discovery Publishers, New Delhi.</li> </ol>	

## SEMESTER-3

### AUMM 331.1a: MATHEMATICS FOR ECONOMICS -III (Integral Calculus and Linear Algebra)

<b>Total Teaching Hours: 54</b>	<b>No of Lecture Hours/Week: 3</b>
<b>Max Marks: 80</b>	<b>Credits: 3</b>
<b>Course Outcomes:</b> <ul style="list-style-type: none"><li>• <b>CO1:</b> Learn different methods integration and apply it to find the area under a curve.</li><li>• <b>CO2:</b> Understand the applications of integration through functions familiar in Economics.</li><li>• <b>CO3:</b> Learn basics of matrix algebra.</li></ul>	
<b>Text: Knut Sydsaeter, Peter J. Hammond: <i>Mathematics for Economic Analysis</i>, Pearson, 1995</b>	
<b>Module 1 Introductory Linear Algebra</b>	<b>Total Teaching Hours: 18</b>
<b>Linear Algebra - Vectors and Matrices:</b> Systems of linear equations, vectors, geometric interpretation of vectors, the scalar product, lines and planes, matrices and matrix operations, matrix multiplication, rules for matrix multiplication, the transpose. <b>Determinants and Matrix Inversion:</b> Determinants of order 2, determinants of order 3, determinants of order n, basic rules for determinants, expansion by cofactors, inverse of a matrix, a general formula for the inverse, Cramer's rule. <b>[The topics to be discussed in this module can be found in Chapters 12, 13]</b>	
<b>Module 2 Further Topics in Linear Algebra</b>	<b>Total Teaching Hours: 18</b>
<b>Further Topics in Linear Algebra:</b> Linear independence, The rank of a matrix, Eigen values. Cayley Hamilton theorem and its applications, power of a matrix. <b>[The topics to be discussed in this module can be found in Chapter 14 Sections 1-4]</b>	
<b>Module 3 Integration and Applications</b>	<b>Total Teaching Hours: 18</b>
<b>Integration:</b> Areas under curves, indefinite integrals, the definite integral, economic application of integration. <b>Further Topics in Integration:</b> Integration by parts, integration by substitution, extending the concept of the integral, a note on income distribution and Lorenz curves. <b>[The topics to be discussed in this module can be found in Chapters 10, 11]</b>	
<b>Reference</b> <ol style="list-style-type: none"><li>1. G D Allen, <i>Mathematical Analysis for Economics</i>, AITBS Publishers, D-2/15. Krishnan Nagar, New Delhi</li><li>2. Taro Yamane, <i>Mathematics for Economists, An Elementary Survey</i>, PHI, New Delhi.</li><li>3. Chiang A.C. and K.Wainwright, <i>Fundamental Methods of Mathematical Economics</i>, 4<sup>th</sup> Edition, McGraw-Hill, New York, 2005.(cw)</li></ol>	

4. Dowling E.T, Introduction to Mathematical Economics, 2nd Edition, Schaum's Series, McGraw- Hill, New York, 2003(ETD)
5. Mary George, Thomaskutty, A Text Book of Mathematical Economics, Discovery Publishers, New Delhi.



## SEMESTER-4

### AUMM 431.1a: MATHEMATICS FOR ECONOMICS -IV (Linear Programming, Differential Equations and Difference Equations)

**Total Teaching Hours: 54**

**No of Lecture Hours/Week: 3**

**Max Marks: 80**

**Credits: 3**

**Course Outcomes:**

- **CO1:** To use linear programming methods in economic decision problems.
- **CO2:** To solve problems in Economics using difference equations.
- **CO3:** To learn various types of differential equations and methods to solve them.

**Text:** Knut Sydsaeter, Peter J. Hammond: *Mathematics for Economic Analysis*, Pearson, 1995

**Module 1 Linear programming**

**Total Teaching Hours: 18**

**Linear programming:** Preliminaries, introduction to duality theory, the duality theorem, a general economic interpretation, complementary slackness.

[The topics to be discussed in this module can be found in Chapter 19]

**Module 2 Difference Equations**

**Total Teaching Hours: 18**

**Difference Equations:** First order difference equations, compound interest and present discounted values, linear equations with a variable coefficient, second order equations, second order equations with constant coefficients.

[The topics to be discussed in this module can be found in Chapter 20]

**Module 3 Differential Equations**

**Total Teaching Hours: 18**

**Differential Equations:** First order differential equations, the direction is given – find the path, separable differential equations-I, separable differential equations-II, first order linear differential equations-I, first order linear differential equations-II, qualitative theory and stability, second order differential equations, second order differential equations with constant coefficients.

[The topics to be discussed in this module can be found in Chapter 21]

**References**

1. G D Allen, *Mathematical Analysis for Economics*, AITBS Publishers, D-2/15. Krishnan Nagar, New Delhi
2. Taro Yamane, *Mathematics for Economists, An Elementary Survey*, PHI, New Delhi.
3. Chiang A.C. and K.Wainwright, *Fundamental Methods of Mathematical Economics*, 4<sup>th</sup> Edition, McGraw-Hill, New York, 2005.(cw)
4. Dowling E.T, *Introduction to Mathematical Economics*, 2nd Edition, Schaum's Series, McGraw- Hill, New York, 2003(ETD)

5. Mary George, Thomaskutty, A Text Book of Mathematical Economics, Discovery Publishers, New Delhi.
6. J. K. Sharma, Operations Research-Theory and Applications, 3rd, MacMillan India Ltd, Delhi.