

Syllabus template

Semester: 1	
Course : Economics	
Paper Title: MATHEMATICAL METHODS IN ECONOMICS–I	
Paper code: C1EC230121T	Credits: 4
Hours/week : 4	
Category: Core/MDC/SEC/VAC : Core	
Theory / Practical / Composite : Theory	
No of Modules : 2	
Course Overview:	
<ol style="list-style-type: none"> 1. To study two fundamental mathematical tools—set operations and functions—that form the basis of all mathematical reasoning. 2. To study sequences and series in order to build intuition about infinity and infinitesimally small quantities, along with their economic applications such as discounting future streams of payments or receipts for investment valuation. 3. To study the role of continuous functions in economic modelling and to understand the implications when continuity fails, especially in contexts where discontinuities carry important economic meaning. 4. To study the basic concepts of integration of functions and the fundamentals of difference equations as essential tools for economic analysis. 	
Course Outcome:	
Module 1:	
<ol style="list-style-type: none"> 1. Identify foundational mathematical concepts including logic, proof techniques, sets, relations, functions, and number systems. 2. Explain the behavior of different types of single-variable functions—such as polynomial, power, exponential, and logarithmic—and describe limits, sequences, and series along with their key properties. 3. Apply the concepts of continuity, differentiation, and higher-order derivatives to solve mathematical and economic problems involving change, growth, and approximation. 4. Analyze algebraic and geometric properties of functions, including concavity and convexity, to examine their implications in optimization contexts. 5. Evaluate conditions for local and global optima using geometric reasoning and calculus-based criteria, and justify optimal choices in economic models. 6. Formulate mathematical representations and models that integrate optimization principles, functional behavior, and derivative-based techniques to address theoretical and applied economic problems. 	
Module 2:	
<ol style="list-style-type: none"> 1. Recognize fundamental methods of integration and basic forms of difference equations. 2. Explain different techniques of integration and describe the interpretation of a definite integral as the area under a curve. 3. Use integration methods to solve definite and indefinite integrals relevant to mathematical and economic problems. 4. Analyze first-order and second-order difference equations by examining their structure and dynamic behavior 5. Evaluate economic models involving difference equations by justifying the choice of appropriate functional forms and solution methods. 	

6. Construct integrated analytical solutions by developing mathematical applications of integration and difference equations to real-world economic contexts.

Prerequisites: *No prior knowledge required*

SYLLABUS

UNIT/Module	CONTENT	HOURS or NUMBER OF CLASSES	CO Mapping	COGNITIVE LEVEL
I.	<p>1. Preliminaries:</p> <ul style="list-style-type: none"> • Logic and proof techniques • sets and set operations; relations • functions and their properties • number systems. <p>2. Functions of one variable:</p> <ul style="list-style-type: none"> • Graphs • elementary types of functions: quadratic, polynomial, power, exponential, logarithmic • sequences, series and limits • algebraic properties and applications • continuous functions: characterizations: properties with respect to various operations and applications • differentiable functions: characterizations: properties with respect to various operations and applications • second and higher order derivatives: properties and applications. <p>3. Single-variable optimization:</p> <ul style="list-style-type: none"> • Geometric properties of functions: linear concave and convex functions, their characterizations and applications • local and global optima: geometric characterizations, characterizations using calculus and applications. 	3 classes per week	CO1, CO2, CO3, CO4, CO5, CO6	K1, K2, K3, K4, K5, K6

II.	<ul style="list-style-type: none"> Integration of Functions: Methods of integration, Definite Integral as area under curve; Difference Equations: First order and second order with economic applications 	1 class per week	CO1, CO2, CO3, CO4, CO5, CO6	K1, K2, K3, K4, K5, K6
Text Books				
1. K.Sydsaeter and Hammond, Mathematics for Economic Analysis, Pearson Educational Asia: Delhi, 2002.				
2. E. Silberberg and Suen, Structure of Economics, McGraw-Hill				
3. A. Mukherjee and S. Guha, Mathematical Methods & Economic Theory, Oxford University Press, 2011.				
Suggested readings				
1. K.G. Binmore, Mathematical Analysis, Cambridge University Press, 1991.				
2. Alpha Chiang and Kevin Wainwright, Fundamental Methods of Mathematical Economics, Fourth Edition, Mc-graw Hill, 2005.				
Web Resources				
NA				
Evaluation :CIA: 30 (20+5+5)+ End Semester:70				
Paper Structure for Theory Semester Exam:				
Module	No. of questions to be answered	No. of alternatives given	Marks	
Module 1 (35 marks)	3	4	3×5=15	
	4	5	4×10=40	
Module 2 (35 marks)	1	2	1×5=5	
	1	2	1×10=10	
		Total	70	

Course outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive levels
	Module 1	
CO1	Identify foundational mathematical concepts including logic, proof techniques, sets, relations, functions, and number systems.	K1
CO2	Explain the behavior of different types of single-variable functions—such as polynomial, power, exponential, and logarithmic—and describe limits, sequences, and series along with their key properties.	K2
CO3	Apply the concepts of continuity, differentiation, and higher-order derivatives to solve mathematical and economic problems involving change, growth, and approximation.	K3
CO4	Analyze algebraic and geometric properties of functions, including concavity and convexity, to examine their implications in optimization contexts.	K4

CO5	Evaluate conditions for local and global optima using geometric reasoning and calculus-based criteria, and justify optimal choices in economic models.	K5
CO6	Formulate mathematical representations and models that integrate optimization principles, functional behavior, and derivative-based techniques to address theoretical and applied economic problems.	K6
	Module 2	
CO1	Recognize fundamental methods of integration and basic forms of difference equations..	K1
CO2	Explain different techniques of integration and describe the interpretation of a definite integral as the area under a curve.	K2
CO3	Use integration methods to solve definite and indefinite integrals relevant to mathematical and economic problems.	K3
CO4	Analyze first-order and second-order difference equations by examining their structure and dynamic behavior	K4
CO5	Evaluate economic models involving difference equations by justifying the choice of appropriate functional forms and solution methods.	K5
CO6	Construct integrated analytical solutions by developing mathematical applications of integration and difference equations to real-world economic contexts.	K6