



**NATIONAL UNIVERSITY OF ENGINEERING  
COLLEGE OF SCIENCES  
MATHEMATICS PROGRAM**

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**CM474 – STOCHASTIC PROCESSES**

**I. GENERAL INFORMATION**

<b>CODE</b>	: CM474 Stochastic Processes
<b>SEMESTER</b>	: 8
<b>CREDITS</b>	: 4
<b>HOURS PER WEEK</b>	: 6 (Theory – Practice – Seminar)
<b>PREREQUISITES</b>	: CM274 Statistics and Probabilities CM411 Measurement Theory
<b>CONDITION</b>	: Mandatory

**II. COURSE DESCRIPTION**

To give the student basic knowledge of stochastic processes. Know the concept of Brownian movement, and the Itô integral.

**III. LEARNING UNITS**

**1. Preliminary concepts**

Variation of a Function / Riemann Integral and Stieltjes Integral / Lebesgue Integration Method / Other results.

**2. Concept of Probability Theory**

Discrete Models of Probability / Continuous Models of Probability / Expectation and Lebesgue Integral / Transformations and Convergence / Independence and Covariance / Normal Distribution (Gaussian) / Conditional Expectation / Continuous Time Stochastic Processes.

**3. Basic Stochastic Processes**

Brownian Movement / Brownian Movement Properties / Brownian Movement Martingales / Markov Properties of the Brownian Movement / Hard Times and Exit Times / Brownian Movement, Maximum and Minimum / Distribution of Hard Times / Reflection Principle and Common Distribution / Brownian Movement Zeros / Arcsine Law / Increased Size of Brownian Movement / Brownian Movement in Higher Dimension / Random Path / Stochastic Integral in Discrete Time / Poisson Process.

**4. Calculation of the Brownian Movement**

Definition of the Itô Integral / Itô Integral. Itô Integral and Gaussian Process / Itô Formula for the Brownian Movement / Itô Process and Differential Stochastics / Itô Formula for Itô Processes / Higher Order Itô Process.

#### **IV. BIBLIOGRAPHY**

- Klebaner. Fima C., Introduction to Stochastic Calculus with Applications.
- Parzen, E., Stochastic Processes.
- Gregory F. Lawler, Introduction to Stochastic Processes.
- Edward P. C. Kao, An Introduction to Stochastic Processes.
- Zdzislaw Brzezniak, Tomasz Zastawniak, Basic Stochastic Processes.
- Sidney I. Resnick, Adventures in Stochastic Processes.