FIRST COURSE HANDOUT,
INTRODUCTION TO STOCHASTIC CALCULUS (MTH614),
2018-19 EVEN SEMESTER

Instructor: Suprio Bhar
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1. Pre-requisites

Courses MTH309 or MTH754, Instructor's preference

2. Course contents and References

- Preliminaries: σ-fields, random variables, Expectation, L^p spaces with respect to Probability measures (4 Lectures)
- Conditional Probability and Conditional Expectation (2 Lectures)
- Brownian motion: Definition, Construction/Proof of existence, path properties and Martingale property (12 Lectures)
- Stochastic/Itô Integration: Construction, Itô isometry, properties of Itô integral, Girsanov's Theorem. (If time permits) Martingale Representation Theorem (12 Lectures)
- Stochastic Differential Equation: various notions of solutions, existence and uniqueness results (8 Lectures)
- Application to Mathematical Finance: Black-Scholes formula (4 Lectures)

References:

- Bernt Oksendal, *Stochastic Differential Equations - an introduction with applications*, sixth edition. Universitext, Springer-Verlag, 2003.
- Ioannis Karatzas & Steven E. Shreve, *Brownian Motion and Stochastic Calculus*, 2nd Edition. Graduate Texts in Mathematics 113, Springer-Verlag, 1991.
- Philip E. Protter, *Stochastic Integration and Differential Equations*, second edition. Stochastic Modelling and Applied Probability. Springer-Verlag, 2004.
- Achim Klenke, *Probability Theory - A Comprehensive Course*, Springer, 2007.

Supplimentary texts:

- Probability & Measure Theory (2nd Edition), Robert B. Ash and Catherine A. Doléans-Dade. Elsevier.
- Probability: Theory and Examples (4th Edition), Rick Durrett. CUP.
- Probability Essentials (2nd Edition), Jean Jacod and Philip Protter. Springer.
- Probability with Martingales, David Williams, CUP.
- Probability and Measure (3rd Edition), Patrick Billingsley. Wiley.
- Ali Hirsa & Salih N. Neftci, *An Introduction to the Mathematics of Financial Derivatives*, 3rd Edition. Academic Press, Elsevier, 2014.

3. Lecture, Tutorial, Lab Schedule & Venue

Lectures: Mondays & Wednesdays 8:00 - 8:50 hrs, Thursdays 14:00 - 14:50 hrs
No tutorials or lab work are included in this course.

4. Office hours

Wednesdays 14:00 - 15:00 hrs (make appointments through email)

5. Weightages for different components of evaluation (out of 100)

Component Name	Weightage
Mid-semester Examination	30
End-semester Examination	40
Assignments	15
Quizzes	15

- Assignments ($3 \times 5 = 15$): There will be 3 assignments, 5 marks in each.
- Quizzes ($3 \times 5 = 15$): 3 Quizzes (MCQ, 5 marks in each). Schedule TBA.

6. Course Policies: Attendance, Honesty Practices, Withdrawal

- No extra weightage for attendance.
- Make-up option for exams would be given only if the student produces a medical certificate or a proof of sanctioned leave. There will be no make-up opportunity for the quizzes or assignments.
- Discussion/collaborations for solving the assignments is encouraged. However, students are expected to write down the solutions on their own.
- Any dishonest practice during examinations or quizzes will be reported to DOAA and appropriate action would be taken to penalize such action.
- Students are allowed to withdraw from the course as per guidelines set by DOAA.