


MATHEMATICAL FINANCE

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TYPE OF COURSE : Rerun | Elective | UG/PG
COURSE DURATION : 12 weeks (20 Jul'20 - 09 Oct'20)
EXAM DATE : 18 Oct 20

PRE-REQUISITES : Background in basics of probability theory

INTENDED AUDIENCE : Students at advanced undergraduate and postgraduate level in Mathematics, Statistics and allied areas as well as students of Engineering and Management interested in this field.

INDUSTRIES APPLICABLE TO : Finance Industry

COURSE OUTLINE :

The course on 'Mathematical Finance' gives an introduction to this interesting and growing area. In particular, the course will cover two Nobel-prize winning frameworks, namely portfolio theory and the option pricing theory.

ABOUT INSTRUCTOR :

Prof. Selvaraju has more than ten years of teaching experience (in addition to research experience) in the areas of financial mathematics, financial engineering, stochastic calculus and portfolio theory and has offered several courses to the B.Tech. (Mathematics and Computing) and M.Sc. (Mathematics and Computing) students of IIT Guwahati.

Prof. Chakrabarty has more than ten years of teaching experience (in addition to research experience) in the areas of financial engineering, computational finance, portfolio theory and financial risk management and has offered several courses to the B.Tech. (Mathematics and Computing) and M.Sc.

COURSE PLAN :

Week 1**:** Introduction to financial markets, financial instruments, bonds, stocks and financial derivatives.

Week 2**:** Time value of money, simple and compound interest rate, net present value, internal rate of return and annuities.

Week 3**:** Markowitz portfolio theory, risk and return, two and multi asset portfolio theory, efficient frontier.

Week 4**:** Capital Asset Pricing Model and portfolio performance analysis.

Week 5**:** No arbitrage principle, pricing of forwards and futures, properties of options.

Week 6**:** Derivative pricing by replication in binomial model.

Week 7**:** Discrete probability spaces, filtration, conditional expectation

Week 8**:** Discrete time martingales, Markov chain, risk-neutral pricing in binomial model for European and American derivatives.

Week 9**:** General probability spaces, conditional expectation, Brownian motion.

Week 10**:** Ito integral, Ito formula, Girsanov's theorem, martingale representation theorem, stochasticdifferential equation.

Week 11**:** Black-Scholes-Merton (BSM) model, pricing of European derivatives in BSM framework.

Week 12**:** Valuation of European options in BSM model, BSM formula, BSM partial differential equation, hedging, model completeness, fundamental theorems of asset pricing.