Fixed Income Securities and Their Derivatives

Target Audience: This course is targeted at core Finance PGP-II students. Non-Finance students are likely to find that the rigour and depth of this course is unsuitable for them.

Objective:
Fixed income securities constitute a significant portion of the capital market and represent the entire money market. It is imperative for a student of Finance to get adequate exposure to this topic, from the perspective of a future career in Finance. Derivative products based on such products have their own intricacies and consequently in many business schools they are covered in this course rather than in the Financial Derivatives course. Derivatives, fixed income products, and foreign exchange are inextricably linked and a student specializing in Finance should ensure that he or she gets adequate exposure to all these areas.

This course, as the name suggests, deals with the entire gamut of Fixed Income Securities as well as derivatives with such securities as the underlying. At the completion of this course, the students should have developed a good understanding of the Fixed Income Markets, issues related to Fixed Income Markets, Fixed Income Products and derivative contracts on such products. The students should also be reasonably proficient on the related quantitative techniques that are used in the design, pricing as well as analysis of such instruments.

The course assumes a basic understanding of mathematics and mathematical applications. There is no rocket science expected and the important thing is that students should be reasonably comfortable with quantitative Finance, and more importantly not have a phobia.

This course will revisit topics such as time value of money, to ensure that students are adequately prepared, since mastery of such first-year concepts is a sin qua non for this course.
The course will involve extensive use of EXCEL and students should be in possession of a laptop at all times.

Learning Outcomes:
At the end of this course students should be able to:

1. Understand the different types of fixed income products and the mathematics behind their valuation.
2. Appreciate how the macro economy of a country, as well as the global economy, impacts fixed income products.
3. Understand mortgages and mortgage backed securities, and the principles behind their valuation.
4. Understand forward contracts, futures contracts, and options on interest rate products, and the use of such instruments in risk management.

Primary Text:

- "Bond Markets, Analysis and Strategies"; Frank Fabozzi, 7th edition, Pearson Education

Additional Readings:

- "Fixed Income Securities and Their Derivatives"; Suresh Sundaresan

Handouts:

- Relevant handouts where required will be handed out and students are expected to refer to the material covered in the handouts during the course.

Evaluation:

The evaluation pattern will be as follows:

- **Mid Term:** The midterm shall have 40% weightage and shall be an in class multiple choice questions based exam
- **End Term:** The end term shall have 40% weightage and shall be an in class multiple choice questions based exam
- **Group Based Homework:** Group based homework shall contribute to 20% of the course evaluation

Session wise plan

The detailed session wise plain is as follows:

Sessions 1 – 5: Fundamentals of Bonds and Bond Markets

- Time Value of Money (A Revisit)
  - Simple versus Compound Interest
  - Concept of Future Value
  - Concept of Present Value
  - Effective versus Nominal Rates
  - Annuities

    - Annuity Dues and Perpetuities
    - The Concept of Amortization
- Plain Vanilla Debt
    - Valuation on a coupon date
    - Price versus Yield
    - Par, Discount, and Premium Bonds
- Zero Coupon Bonds
- Floating Rate Bonds
- LIBOR
- Callable and Puttable Bonds
- Convertible Bonds
- Valuation of a Bond In Between Coupon Dates
- The concept of accrued interest
    - Clean versus dirty prices
    - Day-Count Conventions
- Long First Coupons
- Short First Coupons
- Yields
    - Current Yield
    - YTM
    - Sources of Returns from a Bond
    - The Reinvestment Assumption
    - Reinvestment Risk
    - Realized Compound Yield
    - Holding Period Returns
    - Yield to Call
    - Portfolio Yield
- Coupon Rolls
- Pricing a Roll
- Inflation Indexed bonds
    - P-linkers
    - C-linkers
- Yield to Average Life
- Yield to Equivalent Life
- Treasury Auctions
    - Uniform price yield versus discriminatory price yield auctions
    - When issued trading
- Primary Dealers and Open Market Operations
- The macroeconomics of Fixed Income Markets
    - Aggregate Demand

    - Consumption
    - Residential Investment
    - Capital Expenditure
    - Government Spending
    - Inventories
    - Foreign Trade
    - Inflation
    - Unemployment
    - Interest Rates
- International Bond Markets
    - Eurobonds
    - Foreign Bonds
- Risks Inherent in Bonds
    - Credit Risk
    - Credit Evaluation
    - Credit Rating Agencies
    - Bond Insurance
    - Liquidity Risk
    - Interest Rate Risk
    - Inflation Risk
    - Timing Risk
    - Foreign Exchange Risk

Session 6-7: Money Markets

- The role of the central bank
- Keys dates for cash market instruments
- The Inter-bank market
- BBA LIBOR
- Interest Computation Methods
- Term Money Market Deposits
- T-bills
    - Re-openings
    - Discount Yields
    - Bond Equivalent Yields
    - Money Market Yields
    - Concept of Carry
    - Concept of a Tail
- Repos
    - Margins
    - General collateral versus Specials

- Sale and Buy-back
- Negotiable CDs
- Commercial Paper
- LCs and Bank Guarantees
- Yankee Paper
- Credit Rating of Paper
- Bills of Exchange
- Bankers' Acceptances
- Eurocurrency Deposits
- **Movie: How the Bond Market Works**

Session 8-9: Bond Mathematics

- Sensitivity Analysis
    - Present Value of Basis Point
    - Duration
        - Macaulay's Duration
        - Modified Duration
        - Dollar Duration
    - Properties of Duration
    - Variables Influencing Duration
    - Duration of annuities and perpetuities
    - Convexity
    - Properties of Convexity
    - Variables influencing convexity
    - Dispersion

Session 10: Yield Curve Analysis

- Introduction to Yield Curves
- Coupon Yield Curves
- Par Bond Yield Curves
- Forward Rates and Spot Rates
- Term Structure Analysis
- The Expectations Hypothesis
- The Liquidity Premium Hypothesis
- Yield Curve construction using:
    - Bootstrapping
    - Nelson – Siegel model

Session 11-12: Interest Rate Futures

- Eurodollars

- T-bills
- Federal Funds
- ED Futures
- Bundles & Packs
- Locking in a borrowing rate
- Locking in a lending rate
- The no-arbitrage pricing equation
- Hedging rates for periods not equal to 90 days
- Creating fixed rate loans
- LIBOR futures
- Euroyen futures
- T-bill futures
- The TED Spread
- Fed Funds Futures
- The cash market
- The futures market
- Conversion factors
- Calculating the Invoice Price
- The Cheapest to deliver Bond
- Seller's Options
- Hedging
- Using Bond Futures to Change the Duration

Session 13: Bonds with Embedded Options

- Drawbacks of Traditional Yield Spread Analysis
- Static Spreads
- Callable Bonds and Their Investment Characteristics
- Putable Bonds
- Convertible and Exchangeable Bonds
- Components of a Bond with an Embedded Option
- Option Adjusted Spread
- Effective Duration and Convexity

Session-14: Floating Rate Bonds

- Characteristics of Floating Rate Notes
- Current Yield
- Holding-Period Yield
- Simple Margin
- Adjusted Price
- Adjusted Simple Margin

- Total Margin
- Adjusted Total Margin
- Yield to Maturity
- Discounted Margin

Session 15: Fundamentals of Mortgage Loans

- Mortgage origination
- Mortgage servicing and insurance
- The traditional mortgage
- Variable-rate mortgages
    - Rate caps
    - Payment Caps
    - Negative Amortization
- Graduated Payment Mortgages

Session 16-17: Mortgage-backed Securities

- Key Concepts in Securitization
- Key players in Securitization
- WAC and WAM
- Pass-through Securities
- Extension Risk and Contraction Risk
- Sequential Pay CMOs
- Accrual Bonds
- Floating Rate Tranches
- Notional IO Tranche
- IO and PO Strips
- PAC Bonds
- Agency Pass-Throughs

Session 18-19: Fixed Income Options

- Models of the short rate: Equilibrium and No Arbitrage models
    - Ho and Lee model
    - Black, Derman and Toy model
    - Heath Jarrow Morton model
    - Calibrating the Ho and Lee Model
    - Calibrating the Black-Derman-Toy Model
- Valuing Plain Vanilla Bonds
- Valuing Zero Coupon Bonds

- Valuing Callable Bonds
- Caps, Floors, and Collars
- Drawbacks of Traditional Yield Spread Analysis
- Static Spreads
- Option Adjusted Spread
- Effective Duration and Convexity

Sessions 20: Swaps

- Introduction to Swaps
    - Plain vanilla Interest Rate Swaps
    - Basis Swaps
    - Cross Currency Swaps
    - Cross Currency Interest Rate Swaps
- Uses of Swaps and Swaptions
- Basic valuation tools
    - Setting the initial rates for a swap
    - Valuing a matured swap
    - Offsetting swaps