Chapter 1

INTRODUCTION
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1.1 Introduction:

The emergence of the market for derivative products, most notably forwards, futures, options and swap can be traced back to the willingness of risk-averse economic agents to guard themselves against uncertainties arising out of fluctuations in asset prices. By their very nature, the financial markets are marked by a very high degree of volatility. Through the use of derivative products, it is possible to partially or fully transfer price risks by locking-in asset Prices. As instruments of risk management, these generally do not influence the Fluctuations in the underlying asset prices. However, by locking-in asset prices, Derivative products minimize the impact of fluctuations in asset prices on the Profitability and cash flow situation of risk-averse investors.

Derivatives are risk management instruments, which derive their value from an underlying asset. The underlying asset can be bullion, index, share, bonds, Currency, interest, and so on. Banks, Securities firms, companies and investors to hedge risks, to gain access to cheaper money and to make profit, use derivatives. Derivatives are likely to grow even at a faster rate in future.
Financial derivatives are contracts which derive their values from the underlying assets. The underlying assets can be equity, bonds, interest rate and foreign exchange. Equity derivatives have increased sustainability in the Indian capital market and attract not only foreign but also local investors who stayed away from market due to its vulnerability.

The most important derivative contract types are futures and options. A futures contract is an agreement between two parties to buy or sell an asset at a certain future time and at a certain price and is exchange traded. An option is the right, but not the obligation, to buy or sell the underlying asset at a stated date at a stated price. The writer of option grants the right to the option holder in exchange for option premium. Unlike in future contract market, one party to an option contract is not obligated to transact. In case of a futures contract, both buyer and seller are obligated to perform but the future buyer do not pay the seller whereas option buyer has to pay the seller an option price (Option Premium). Consequently, the risk-reward features of the two types of contracts are different. While the option buyer retains all the benefits minus the option price, the maximum benefit an option writer realizes is only the option price (Premium) set against the downside risk of unlimited loss. So, investors use future contracts to protect against symmetric risk but use options
contracts to protect against asymmetric risk.

A forward contact is an agreement to buy and sell a specified asset on a predetermined date and is OTC traded. The underlying asset can be anything from commodities such as rice, wheat and cotton, metals, crude oil, stock of a company, to foreign currency. There are two legs or parties of forward contract. The party to the contract, who agrees to buy the underlying asset on a specified future date for a specified price is said to have assumed the long position in the forward contract. Conversely, the one, who assumes a short position, agrees to sell the asset on the same date for the same price.

The contract of Swap is defined as an agreement to exchange cash flows in future according to a pre-arranged formula. It is the most important form of OTC derivative. Swaps are of flexible instrument because there is almost no constraint on the nature of the cash flows that are exchanged. The exact amount of the cash flows at future dates need not be known in advance so long as there is a formula or methodology which allows the cash flow to be determined at the date when it has to occur. Cash flow could depend on future interest rates, exchange rates or other market prices. Figure 1.1 depicts the pictorial representation of different derivative products.
An option is the right, but not the obligation to buy or sell certain security at a specified date and at a predetermined price. The writer grants the right to the buyer in exchange for option Premium. The option contract is divided into two parts, namely call option and put option. The right to purchase a specified number of stocks at a specified price on a specified date is called the call option, while the right to sell a specified number of stocks at specified price on at specified date is called a put option.

### 1.2 Participants in the Derivative Market:

Derivative is a financial asset the value of which depends on another underlying asset or security. Derivatives markets have been successful since its inception. The main reason is that they
have attracted different types of traders, investors and have a
great deal of liquidity. When an investor wants to take one side of
a contract, there is usually no problem in finding counter party
who is prepared to take the other side.

Three broad categories of traders can be identified among the
players in the derivative market like equity and debt market:
hedgers, speculators, and arbitrageurs. Hedgers use futures,
forwards, and options to reduce the risk that they face from
potential future changes in a market variable. Speculators use
them to bet on the future direction of a market variable.
Arbitrageurs take offsetting positions in two or more instruments
to lock in a price with an intention of earning riskless profit.

1.2.1 Hedgers

Hedging is a processing of minimization of risk by using any of the
derivative instruments such as: Forward, futures, options and
swaps. Hedging is the most important reason which has led to the
emergence of derivatives. The availability of derivatives allows one
to undertake many activities at a considerably lower risk. Hedgers,
therefore, are important players of the derivatives markets.
Hedgers are the traders who wish to eliminate the risk associated
with the price of an asset and they may take a long position or
short position on a commodity or financial asset to lock in existing
price. The main purpose is to reduce the volatility of a portfolio, by
reducing the risk. Nevertheless, while a forward and future contract requires no payment, an option contract involves an initial cost namely option premium. In the event of call is not exercised, the premium paid for it becomes a net loss while if it is exercised, the pay-off resulting from the call exercise compensates the premium.

1.2.2 Speculators

Hedgers are the people who wish to avoid the price risk; while speculators are those who are willing to take such risk. These are the people who take positions in the market and assume risks, to make profit from fluctuations in market prices. In fact, the speculators consume information, make forecasts about the price
volatility and put their money in these assets or securities. In this process, they feed information into prices and hence contribute to market efficiency. By taking positions, they are betting that a price would go up or they are betting that it would go down. Depending on their perceptions, they may take long or short positions on futures or options or may hold spread positions. Derivatives make speculation very easy with least investment. In the absence of the derivatives, speculative activity would become very difficult as it might require huge funds to be invested.

Speculators in the derivatives market may be categorized as scalpers, day traders and position traders. Scalpers attempt to profit from small changes in the contract price, they carry on transactions at hyper speed and hold security for few minutes. Day traders speculate on the price movements during intra-day, thus open and close positions many times a day but do not carry any position at the end of the day. They monitor the prices continuously and generally attempt to make profit from just a few ticks per trade. On the other hand, the position traders attempt to gain from price fluctuations by keeping their positions open for longer durations, say, for a few days, weeks or even months. They use fundamental analysis, technical analysis, EMH and other information available to them to form their opinions on the likely price volatility.
1.2.3 Arbitrageurs

Arbitrageurs attempt to earn risk-free profits by exploiting market imperfections. An arbitrageur profits by trading a given commodity, security, currency or other asset that sell for different prices in different markets. Thus, arbitrage involves making riskless profit by simultaneously purchasing and selling in two or more markets. If a certain share is quoted at a lower rate on the National Stock Exchange (NSE) and at a higher rate on the Bombay Stock Exchange (BSE), an arbitrageur would make profit by buying the share at NSE and simultaneously selling it at BSE. This type of arbitrage is “arbitrage over space”. If an arbitrageur feels that the futures are being quoted at a high level considering the cost of carry, the arbitrageur would buy securities underlying today and sell the future in market maturing in a month or two hence. Similarly, since futures and options with various expiration dates are traded in the market, there are likely to be several arbitrage opportunities in trading. Thus, if a trader believes that the price differential between the futures contracts on the same underlying asset or security with differing maturities is more or less than what the arbitrageur perceives them to be, then appropriate positions in them may be taken to make profits.

It may be noted that the continuation of well-functioning derivatives markets alters the flow of information into the prices.
This is because, in a purely cash market, speculators feed information into the spot prices. On the contrary, the presence of a derivatives market ensures that a major part of the change of information into prices, due to lower transactions costs and investment implicated in derivative market, and then it gets transmitted to the cash markets. Thus, the arbitrageurs provide a connection between the derivatives market the cash market by balancing the prices in the two markets. Thus, through their dealings, the arbitrageurs provide a critical link between the cash and derivatives markets.

1.3 Significance of derivative market:

The derivatives market performs a number of economic functions; they are:

   a. **Price determination:** Prices in an organized derivatives market reflect the perception of market participants about the future and lead the prices of underlying to the perceived future level. The prices of derivatives congregate with the prices of the underlying at the expiration of the derivative contracts. Thus derivatives help in ascertainment of future as well as current prices.

   b. **Shipment of Risk:** Due to the inherent association of derivatives market with the underlying cash market,
c. witnesses higher trading volumes because of participations by more players who would not have otherwise participated for lack of an arrangement to transfer risk.

**d. Regulated Speculative Trading:** Speculative trades shift to a more controlled environment due to the existence of derivatives market. In the dearth of an organized derivatives market, speculators trade in the underlying cash markets and margining, monitoring and surveillance of the activities of various participants become extremely difficult in derivative markets.

**e. Financial System:** An important incidental benefit that flows from derivatives trading is that it acts as a means for new entrepreneurial activity. The derivative has a history of attracting many bright, creative, well-educated people with an entrepreneurial attitude. They often strengthen others to craft new business, new products and new employment opportunities, the benefit of which is immense.

**f. Increasing Volume of trade and investment:** Derivatives market help to increase savings and investment in the long run and transfer of risk enables the market participants to expand their volume of activity and involve in supplementary risky trade.
1.4 Options Market in India:

The national Stock Exchange Limited in India has introduced trading in S & P CNX Nifty options from June 4\textsuperscript{th}, 2001 and Options on individual securities from July 2\textsuperscript{nd}, 2001. The Mumbai Stock Exchange (BSE) also started trading on options on Sensex from June 4\textsuperscript{th}, 2001 and Options on individual securities from July 2001. But the investors and the traders skeptical as these instruments are new to the Indian Market and the derivatives market in the world is very dull on account of the scams in the derivatives dealing in the late nineties. Today, both in terms of volume and turnover, NSE is the largest derivatives exchange in India. Currently, the derivatives contracts have a maximum of 3-month expiration cycles. Three contracts are available for trading, with 1 month, 2 months and 3 months expiry. A new contract is introduced on the next trading day following the expiry of the near month contract and settled on last Thursday of every month. If last Thursday happens to be a holiday then day before the holiday happens to be expiration day.

1.4.1 Functions:

As introduced in its official website, National Stock Exchange admits members on its derivatives segment in accordance with the rules and regulations of the exchange and the norms specified by Securities Exchange Board of India (SEBI). NSE follows two tier
membership structure stipulated by SEBI to enable wider participation. Those interested in taking membership on Futures and Options segment are required to take membership of clearing member (CM) and F&O segment. Trading and clearing members are admitted separately. Essentially, a clearing member does clearing for all his trading members (TMs), undertakes risk management and performs actual settlement. There are three types of CMs:

**a. Self clearing member:**
A SCM clears and settles trades executed by him only either on his own account or on account of his clients.

**b. Trading member clearing member:**
TM–CM is a CM who is also a TM. TM–CM may clear and settle his own proprietary trades and client’s trades as well as clear and settle for other TMs.

**c. Professional Clearing Member:**
PCM is a CM who is not a TM. Typically, banks or custodians could become a PCM and clear and settle for TMs.

**1.4.2 Trading Mechanism:**
The futures and options trading system of NSE, called National Exchange for Automated Trading-Futures and Options (NEAT-F&O) trading system, provides a fully automated screen-based trading for Nifty futures & options and stock futures & options on a
nationwide basis and an online monitoring and surveillance mechanism. It supports an anonymous order driven market which provides complete transparency of trading operations and operates on strict price–time priority. It is similar to that of trading of equities in the Cash Market segment. The NEAT-F&O trading system is accessed by two types of users. The Trading Members have access to functions such as order entry, order matching, and order and trade management. Various conditions like Immediate or Cancel, Limit/Market price, Stop loss, etc. can be built into an order. The Clearing Members uses the trader workstation for the purpose of monitoring the trading member(s) for whom they clear the trades. Additionally, they can enter and set limits to positions, which a trading member can take.

1.4.3 Settlement Procedure:

In a case of equity index options and equity stock options contracts, option buyer (holder) is required to pay option premium to the option seller (writer) to acquire the right in the options. When a person buys or sells options the premium amount will be debited or credited to the separate bank account of the clearing member with the Clearing Corporation. At the BSE and the NSE this premium normally debited or credited on transaction and one extra day (T+1) basis. After entering into an option contract, a client can square off his position by entering in to a reverse
contract of same series with the same strike price.

1.4.4 Turnover at NSE:

The trading volume on NSE’s derivatives market has seen a steady increase since the launch of the first derivatives contract of index futures in June 2000. In the study conducted by Ghanathe Ramesh at al., (2013) it is observed that Derivative market (Future and Option) has increased drastically from 2001 to 2013 around 300 times and can further increase in future. This change affected by some factors like government policies budgets, bullion market, inflation, political condition.

The NSE day wise turnover on 17, June, 2014 in index option is 3768514 contracts with a turnover of Rs. 142861.4 Cr., and on stock options it is 357463 contracts with a turnover of Rs. 14192.95 Cr.

1.5 Historical Background: Ascertainment of value derivatives has a long history. As far back as 1900, the French mathematician Louis Bachelier reported one of the earliest attempts in his doctoral thesis, although the formula he derived was flawed in many ways. Succeeding researchers handled the movements of stock prices and interest rates more successfully. But all of these attempts suffered from the same fundamental drawback that is risk premium were not dealt with in a correct way. The value of an option to buy or sell a share depends on the uncertain
development of the stock price to the date of expiry. It is therefore natural to suppose, as did preceding researchers that valuation of an option requires taking a stance, on which risk premium to use, in the same way as one has to ascertain which risk premium to use when determining present values in the evaluation of a future physical investment project with uncertain returns. Assigning a risk premium is difficult, however, in that the accurate risk premium depends on the investor's attitude towards risk. Whereas the attitude towards risk can be strictly defined in theory, it is hard or impossible to observe in reality.

In the late 1960s, Fisher Black finished his doctorate in mathematics at Harvard. Passing up a career as mathematician, he went to join for Arthur Little, a management-consulting organisation in Boston. There Black met a young MIT finance professor Mr. Myron Scholes, and both began an interchange of ideas on how financial markets worked. Afterwards Black joined the MIT finance faculty, where he made many contributions in the area of assets’ pricing; of course other than options. Black and Scholes then began studying options, which at that time were only traded on the over-the-counter (OTC) market. They first reviewed the attempts of previous researchers to find the option pricing formula.

Black and Scholes took two approaches to find the price. One
approach assumed that all assets were priced according to Capital Assets Pricing Model (CAPM). The other approach used the stochastic or Non deterministic calculus. They developed an equation using the first approach, but the second method left them with a differential equation they were unable to solve. But they gave priority to this mathematical model; therefore they continued to work on this unsolved formula, which they had not thought would create a history. Fisher Black started out working to create a valuation model for stock warrants. This work involved calculating a derivative to measure how the discount rate of a warrant changes with time and stock price. The result of this calculation held a striking resemblance to a well-known heat transfer equation. Black eventually found that the differential equation could be transformed into the same one that described the movement of heat as it travels across the object. There was already a known solution, and Black and Scholes applied it to their problem and finally obtained the correct formula, which they had obtained by the first method. Black and Scholes' improvements on the Boness model come in the form of a proof that the risk-free interest rate is the correct discount factor, and with the absence of assumptions regarding investor's risk preferences. Their paper reporting and findings was rejected by two academic journals before finally being published in the “Journal of Political Economy”
which reconsidered an earlier decision to reject the paper. During this time, another young financial economist at MIT, Robert Merton, was also working on option pricing. Merton discovered many of the arbitrage rules. Merton also co-incidentally simultaneously derived the formula. Merton’s modesty compelled him to ask a journal editor that his paper not to be published before of Black and Scholes. Both papers were published, with Merton’s paper appearing in the “Bell Journal of Economics and Management Science” at about the same time. Merton, however, did not receive as much credit as Black and Scholes at the initial stage. Black and Scholes names become permanently associated with the model. Fisher Black left academia in 1983 and went to work for the Wall Street firm of Goldman Sachs. Black demised in 1995 at the age of 57 only. Scholes and Merton remained in the research and extensively involved in real-world derivatives applications. In 1997 the Nobel Committee awarded the Nobel Prize for Economic Sciences to Myron Scholes and Robert Merton, while recognizing the contributions of Fisher Black. Thus even if one does not agree with everything about the model, knowing something about it, is important for surviving in the options market. In India, for exchange traded equity and index options, the starting option prices are offered as per the Black-Scholes Model formula at the Equity Stock exchanges (which is
mandatory). Thousands of traders and investors now use this formula every day to value stock options in markets throughout the world. Don M. Chance and Robert Brooks (2008)^2

1.6 Problem Statement:

The present study gauges to resolve the following problems:

- How to compute implied volatility of stock under study by using Black-Scholes option pricing model?

- How to select the Exercise or strike prices in the light of implied volatilities of the stock prices to determine the net option pay-off?

- What is the optimum time to maturity (TTM) for which fund is invested in the stock options contract of the companies under study?

- To identify the most desirable, consistent and reliable company out of the four companies under study.

To resolve the above mentioned problem in the current study an attempt is made to compute option pay-offs in the light of implied volatility for selection of strike prices by using Black and Scholes option pricing model which assist the investors and traders.
1.7 Present Study:

The present study focuses on finding a solution to the problem faced by investors and traders in the option market with respect to the selection of strike prices and the period for which the fund is parked to augment profit. In this study an attempt is made to observe option pay-offs in the light of implied volatility by using Black and Scholes option pricing model for selection of strike prices and deciding the time frame for which fund is locked up in the option contract. In order to achieve the objective the present study is conducted by obtaining the stock prices of select four companies of NSE.

1.8 Need of the study:

The present study is conducted to assist investors and traders who deal with the option market for taking position in the option contract. The significance of the study is highlighted based on the following points:

- In volatility based strategy there is a need to determine implied volatility to select the best strike price to achieve optimum level of net option pay-off. Hence, the present study is conducted to acquaint with implied volatility and relevant option strategies.
To understand the significance of implied volatility in option strategies.

To help investor in deciding the timing of investment for net pay-off maximisation.

To understand the sensitivity of options.

1.9 Scope of the Study:

This study is made on the stocks options of IOC, BPCL, Hindpetro and ONGC which are traded from January 2010 to December 2014 in National Stock Exchange. This scope of the study is to focus the stock options, that too call option only, as the Black and Scholes model is basically designed for call options. The present empirical study is made on Indian stock option market, which is only about fifteen years old.

1.10 Objectives of Research

According to the arguments in the introduction, the need of the study, and the statement of the problem, the present study purports to achieve the following objectives:

1. To study conceptual framework of option market.

2. To investigate implied Volatility and relevant option
strategies.

3. To compute and compare the implied volatilities in selection of strike prices and timing of investment to assist investors.

4. To compare and analyse variance in the net option pay-offs of companies under the study by way of option contract dealing in Oil and Gas sector of NSE.

1.11 Limitations:

The study suffers from the following limitations:

- The study is confined to only call options in Indian stock market and no comparison is made with the foreign options market.

- Strike prices of stocks which are not traded are excluded from the study.

- Implied volatility at certain strike prices can not be calculated because GOAL SEEK command of MS EXCEL does not support, it is due to lack of synchronization among strike price, spot price and option premium.
The study is confined to only energy sector of Equity derivative of NSE and no comparison is made with other sectors.

The empirical analysis focuses on selected four stock options of Oil and Gas sector of NSE and ignores the stocks of other sector. The period of the study is during 2010 to 2014.

1.12 Chapterisation:

The entire thesis is divided into seven chapters followed by Bibliography and Appendices which includes:

Chapter1: Introduction

Chapter2: Reviews of literature on implied volatility and option strategies.

Chapter3: Conceptual framework of Options

Chapter4: Study of Organisation

Chapter5: Research Methodology

Chapter6: Data analysis and Interpretation

Chapter7: Findings, conclusion, Suggestions and scope for further research.

Bibliography and Appendices.