To
The Principal,
Shri. Mohatadevi Shikshan Sanstha,
Pragati Mahavidyalaya,
Sawkheda, Tq. Sillod,
Dist. Aurangabad

Subject: Proposal for Certificate Course in *"Mathematical Finance"*

Respected Sir,

I am writing to propose the introduction of a certificate course entitled *"Mathematical Finance"*for the Mathematics department students for the academic year 2022-23. The course is designed to be comprehensive and will encompass a total of 32 hours of instruction.
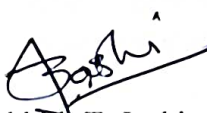
The objective of this course is to equip students with a foundational understanding of financial mathematics, which is increasingly becoming a crucial field in today's job market. The curriculum will cover essential topics such as financial instruments, risk management, and quantitative analysis techniques. By integrating this course into our curriculum, we aim to enhance the students' practical knowledge and provide them with valuable skills applicable in both academic and professional settings.

We believe that offering this course will not only enrich the students' learning experience but also contribute to their overall academic and professional growth. The course will be conducted by experienced faculty members and will include a mix of theoretical and practical sessions to ensure a comprehensive learning experience.

We kindly request your approval to proceed with the implementation of this course. We are confident that this initiative will be a valuable addition to our department and will greatly benefit our students.

Thank you for considering this proposal. We look forward to your positive response.

Yours sincerely,

Mr. Abhijit T. Joshi
Head of Department, Mathematics
Pragati Mahavidyalaya,
Sawkheda, Tq. Sillod,
Dist. Aurangabad

Ref No.: PMS/20 22-2023 /   Date : 06 / 09 / 2022

To

The Head of Department,

Mathematics,

Pragati Mahavidyalaya,

Sawkheda, Tq. Sillod,

Dist. Aurangabad

Subject: Sanction for Certificate Course in *"Mathematical Finance"*

Dear Sir,

I am pleased to inform you that your proposal for running the certificate course entitled *"Mathematical Finance"* has been approved.

The course, comprising 32 hours of instruction, is sanctioned for the academic year 2022-23. This course is expected to provide our Mathematics department students with significant insights into financial mathematics, thereby enhancing their knowledge and skills in this important field.

Please proceed with the necessary arrangements for the course, including the scheduling of sessions and coordination with the relevant faculty members. Ensure that all required resources are available to facilitate an effective learning experience for the students.
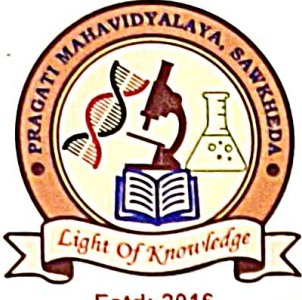
We are confident that this initiative will be a valuable addition to our academic offerings and will contribute positively to the students' professional development. Should you require any further assistance or resources for the successful implementation of this course, please do not hesitate to contact my office.

Thank you for your commitment to advancing our academic programs.

Yours sincerely,

PRINCIPAL
Pragati Mahavidyalaya
Sawkheda, Tq. Sillod, Dist. Aurangabad

Principal

Shri. Mohatadevi Shikshan Sanstha

Pragati Mahavidyalaya

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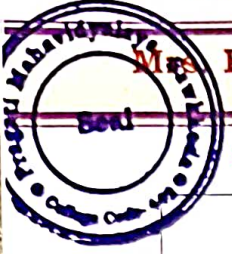Sawkheda, Tq. Sillod, Dist. Aurangabad.

Affiliated to: S.N.D.T. Women's University, Mumbai

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Estd: 2016

Mrs. Kaveri Palkar	Mrs. Archana Mukhekar	Dr. Varsha Phalke
President	Secretary	Principal

Ref No.: PMS/20 22 -20 23/03   Date : 09 / 09 /2022

NOTICE

Subject: Introduction of Certificate Course in *Mathematical Finance*

Dear Students,

We are pleased to announce the launch of a new certificate course titled *Mathematical Finance* for the academic year 2022-23. This course aims to provide you with a comprehensive understanding of financial mathematics and its applications.

Course Details:

- **Title:** *Mathematical Finance*
- **Duration:** 32 hours
- **Objective:** To equip students with essential skills in financial mathematics, including understanding financial instruments, risk management, and quantitative analysis.

The course will be conducted by experienced faculty members and will consist of both theoretical and practical sessions. This is a valuable opportunity to enhance your knowledge and skills in a field that is highly relevant in today's job market.

We encourage all interested students to register for this course and take advantage of this opportunity to further your academic and professional growth.

For any questions or further details, please contact the Mathematics Department office.

Best regards,

Head of Department, Mathematics

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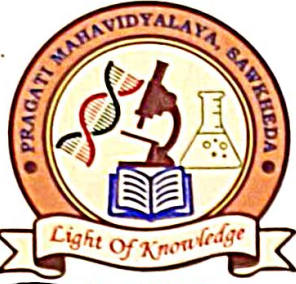
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Syllabus of Certificate Course in *Mathematical Finance*

Duration: 32 Hours

Course Overview: This course provides an introduction to the mathematical concepts and techniques used in finance. It covers fundamental principles of financial mathematics, including financial instruments, risk management, and quantitative analysis. The course combines theoretical knowledge with practical applications to equip students with skills necessary for financial analysis and decision-making.

Week 1: Introduction to Financial Mathematics (4 hours)

- **Overview of Financial Mathematics**
  - Definition and scope
  - Importance in modern finance
- **Basic Financial Concepts**
  - Time value of money
  - Simple and compound interest
  - Annuities and perpetuities

Week 2: Financial Instruments and Markets (4 hours)

- **Types of Financial Instruments**
  - Bonds, stocks, and derivatives
- **Financial Markets**
  - Overview of financial markets and instruments
  - Market participants and their roles

Week 3: Interest Rates and Discounting (4 hours)

- **Interest Rate Calculation**
  - Nominal and effective interest rates
  - Yield to maturity
- **Discounting and Present Value**
  - Discount factors
  - Calculating present and future values

Week 4: Risk and Return (4 hours)

- **Measuring Risk**
  - Standard deviation and variance
  - Value at Risk (VaR)
- **Return on Investments**
  - Expected return
  - Risk-return tradeoff

Week 5: Portfolio Theory (4 hours)

- **Introduction to Portfolio Theory**

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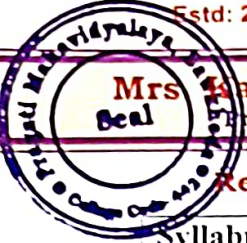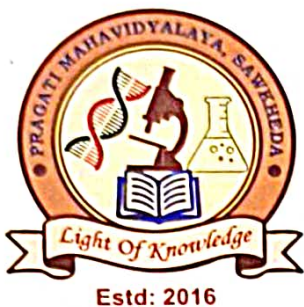
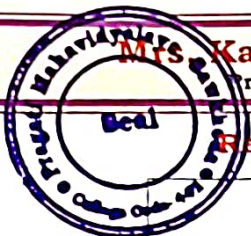Sawkheda, Tq. Sillod, Dist. Aurangabad.
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- o Diversification and its benefits
- **Efficient Frontier**
  - o Constructing an efficient portfolio
  - o Capital Asset Pricing Model (CAPM)

Week 6: Options and Derivatives (4 hours)
- **Introduction to Derivatives**
  - o Futures, options, and swaps
- **Valuation of Options**
  - o Black-Scholes model
  - o Greeks and their applications

Week 7: Risk Management (4 hours)
- **Overview of Risk Management**
  - o Hedging strategies
  - o Risk management tools and techniques
- **Practical Applications**
  - o Case studies and real-world examples

Week 8: Quantitative Analysis in Finance (4 hours)
- **Statistical Methods for Finance**
  - o Regression analysis
  - o Time series analysis
- **Introduction to Financial Modeling**
  - o Building financial models
  - o Scenario analysis

Week 9: Review and Practical Applications (4 hours)
- **Review of Key Concepts**
  - o Summary of major topics covered
- **Practical Applications and Case Studies**
  - o Real-life financial problems and solutions
  - o Group discussions and presentations

Assessment:
- **Assignments:** Regular assignments to reinforce learning
- **Project:** A final project involving financial modeling or analysis
- **Examination:** A written examination covering the course material

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Final Examination: *Mathematical Finance*
Duration: 1 hour
Total Marks: 30
Instructions:
- Choose the correct answer for each question.
- Each question carries 1 mark.
- No negative marking for incorrect answers.

1. What is the time value of money concept primarily concerned with?
a) Future value calculation
b) Present value calculation
c) Interest rate determination
d) Both a and b

2. The formula for compound interest is given by:
a) $A=P(1+r/n)^{nt}$
b) $A=P(1+r)^{t}$
c) $A=P+Prt$
d) $A=P(1+rt)$

3. Which of the following is a type of financial derivative?
a) Stock
b) Bond
c) Option
d) Mutual Fund

4. The Black-Scholes model is used to value:
a) Bonds
b) Futures
c) Options
d) Swaps

5. What does the term 'Value at Risk (VaR)' measure?
a) Potential return on investment
b) Maximum potential loss at a given confidence level
c) Expected return on investment
d) None of the above

6. Which of the following is not a characteristic of a bond?
a) Face value
b) Coupon rate
c) Maturity date
d) Market price

In the Capital Asset Pricing Model (CAPM), what does the beta coefficient represent?

a) Market risk

b) Systematic risk relative to the market

c) Unsystematic risk

d) Total risk

8. Which of the following is true about the risk-return tradeoff?

a) Higher risk typically results in lower return

b) Lower risk typically results in higher return

c) Higher risk typically results in higher return

d) There is no relationship between risk and return

9. An annuity due differs from an ordinary annuity in that:

a) Payments are made at the end of each period

b) Payments are made at the beginning of each period

c) The interest rate is different

d) The number of payments is different

10. The efficient frontier represents:

a) The set of portfolios offering the highest return for a given level of risk

b) The set of portfolios offering the lowest return for a given level of risk

c) The maximum level of risk for a given level of return

d) The minimum return for a given level of risk

11. In portfolio theory, diversification helps to:

a) Increase the overall risk

b) Decrease the overall return

c) Decrease the overall risk

d) Increase the overall risk and return

12. The yield to maturity (YTM) of a bond is:

a) The annual coupon payment divided by the face value

b) The return expected on the bond if held until maturity

c) The difference between the bond's face value and its current market price

d) The bond's annual interest rate

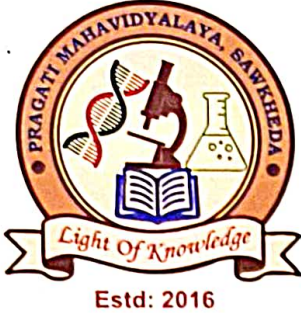**13. What is a perpetuity?**

a) A financial instrument with a fixed maturity date

b) A financial instrument that pays a fixed amount periodically indefinitely

c) A bond with no coupon payments

d) A stock with a fixed dividend

14. The standard deviation of a portfolio measures:

a) The average return of the portfolio

b) The risk of the portfolio

c) The correlation between portfolio assets

d) The return on investment

15. The Greek letters in options pricing models represent:

a) Different types of financial derivatives

b) Various risk factors affecting option pricing

c) Interest rates and their impacts

d) Market indices

16. Which financial instrument is a contract to buy or sell an asset at a future date for a price agreed upon today?

a) Futures

b) Options

c) Bonds

d) Stocks

17. Which of the following is NOT typically included in financial modeling?

a) Forecasting financial statements

b) Scenario analysis

c) Regression analysis

d) Technical analysis of market trends

18. A high beta value indicates:

a) Low systematic risk relative to the market

b) High systematic risk relative to the market

c) Low unsystematic risk

d) High return on investment

19. In financial terms, 'discounting' refers to:

a) Increasing the value of a future cash flow

b) Calculating the present value of a future cash flow

c) Reducing the interest rate on a loan

d) None of the above

20. What is the primary purpose of risk management in finance?

a) To eliminate all risks

b) To minimize the potential losses

c) To increase investment returns

d) To forecast financial markets

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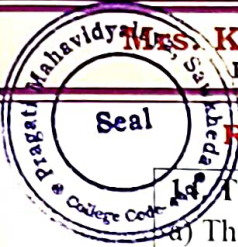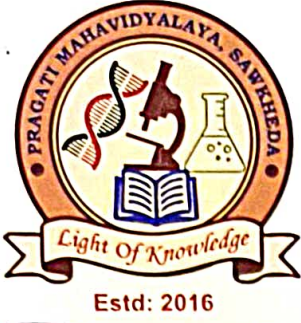
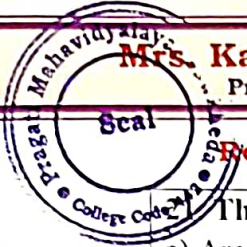Sawkheda, Tq. Sillod, Dist. Aurangabad.

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The Capital Asset Pricing Model (CAPM) assumes that investors:

a) Are risk-averse and seek to maximize utility

b) Are risk-seeking and prioritize high returns

c) Have no preference for risk

d) Avoid all financial risk

22. In the Black-Scholes model, the 'Greeks' measure:

a) Market volatility

b) Sensitivity of option prices to various factors

c) Bond yields

d) Interest rates

23. What is an example of a financial instrument that provides a fixed income over time?

a) Stock

b) Option

c) Bond

d) Futures

24. Which of the following statements about futures contracts is true?

a) They represent ownership in a company

b) They are settled at the end of the contract period

c) They are standardized contracts to buy or sell an asset at a future date

d) They involve payment of dividends

25. What does the term 'expected return' refer to?

a) The average return of an asset in the past

b) The return on investment after deducting taxes

c) The weighted average of all possible returns

d) The return on investment adjusted for risk

26. In financial mathematics, which of the following is a common method for valuing options?

a) Monte Carlo simulation

b) Binomial model

c) Discounted cash flow analysis

d) Both a and b

27. A stock's dividend yield is calculated as:

a) Dividend per share divided by the stock's price per share

b) Earnings per share divided by the stock's price per share

c) Total dividends paid divided by the number of shares outstanding

d) Stock price divided by the earnings per share

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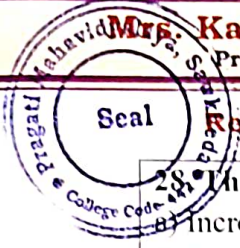Sawkheda, Tq. Sillod, Dist. Aurangabad.
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28. The primary goal of diversification in a portfolio is to:
a) Increase the number of assets
b) Decrease the risk of the portfolio
c) Maximize returns
d) Concentrate investments in high-performing assets

29. The 'present value' of a future cash flow is:
a) The amount of money needed today to achieve that cash flow in the future
b) The future amount of money adjusted for inflation
c) The total amount to be received in the future
d) The future amount before discounting

30. In financial analysis, what does 'scenario analysis' involve?
a) Evaluating the performance of different investment options
b) Estimating future cash flows based on different assumptions
c) Calculating the risk of a single investment
d) Analyzing historical market trends

Answer Key:

1. d) Both a and b
2. a) $A=P(1+r/n)nt$ $A = P(1 + r/n)^{nt}$ $A=P(1+r/n)nt$
3. c) Option
4. c) Options
5. b) Maximum potential loss at a given confidence level
6. d) Market price
7. b) Systematic risk relative to the market
8. c) Higher risk typically results in higher return
9. b) Payments are made at the beginning of each period
10. a) The set of portfolios offering the highest return for a given level of risk
11. c) Decrease the overall risk
12. b) The return expected on the bond if held until maturity
13. b) A financial instrument that pays a fixed amount periodically indefinitely
14. b) The risk of the portfolio
15. b) Various risk factors affecting option pricing
16. a) Futures
17. d) Technical analysis of market trends
18. b) High systematic risk relative to the market
19. b) Calculating the present value of a future cash flow
20. b) To minimize the potential losses

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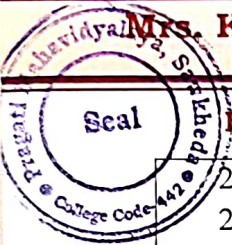# PRAGATI MAHAVIDYALAYA

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21. a) Are risk-averse and seek to maximize utility

22. b) Sensitivity of option prices to various factors

23. c) Bond

24. c) They are standardized contracts to buy or sell an asset at a future date

25. c) The weighted average of all possible returns

26. d) Both a and b

27. a) Dividend per share divided by the stock's price per share

28. b) Decrease the risk of the portfolio

29. a) The amount of money needed today to achieve that cash flow in the future

30. b) Estimating future cash flows based on different assumptions

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