

# DEEP SARKAR

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## EDUCATION

### National Institute of Technology, Rourkela

Bachelor of Technology – Biomedical Engineering

Expected June 2026

Rourkela, India

## QUANTITATIVE FINANCE PROJECTS

### Low-Latency C++ Matching Engine

C++17, Memory-Mapped I/O, Bit-Twiddling, Intrusive Lists

[GitHub Link](#)

- Designed and benchmarked four evolving versions of a limit-order book, progressing from a naïve STL-based prototype (5.8 s) to a cache-aware, mmap-accelerated engine (78 ms) that sustains sub-100 ms latency under 1 k concurrent clients.
- Eliminated dynamic memory allocation from the hot path with a lock-free object pool and intrusive linked lists, reducing CPU cache misses and boosting throughput by 70× on dense workloads.
- Replaced linear best-bid/ask scans with constant-time bitmap look-ups using `__builtin_clzll`, ensuring robust O(1) performance even on extremely sparse price levels.
- Hardened the system against I/O bottlenecks via memory-mapped file ingestion, shrinking data-load times from seconds to microseconds and removing file-stream parsing overhead.

### Options Strategy & Volatility Surface Visualizer

Python, Plotly, NumPy, SciPy, Streamlit

[GitHub Link](#)

- Developed a quantitative tool to model and visualize multi-leg options strategies (e.g., Straddles, Spreads) and calculate key P/L metrics, including max profit/loss and break-even points.
- Engineered a feature to fetch live options-chain data for any stock and calculate implied volatility for each contract by implementing a numerical root-finding algorithm for the Black-Scholes-Merton model.
- Rendered an interactive 3-D volatility surface plot using Plotly, providing an intuitive visualization of the volatility smile/skew across different strikes and expirations.

### Fama-French Factor Replication & Analysis

Python, Pandas, Statsmodels, yfinance

[GitHub Link](#)

- Replicated the seminal Fama-French three-factor model by programmatically sourcing market and fundamental data, constructing ‘Size’ (SMB) and ‘Value’ (HML) factor portfolios from scratch.
- Performed time-series regression using Statsmodels to analyze factor performance from 2015–2023, calculating alpha, beta, p-values, and R-squared to validate the model.
- Uncovered and quantified a statistically significant negative alpha for both factors during the analysis period, demonstrating a critical understanding of factor-performance cycles in modern markets.

### Interactive Market Data Dashboard

Python, Streamlit, Pandas, Plotly, pandas-ta

[GitHub Link](#)

- Built a dynamic dashboard to visualize real-time stock data, integrating price charts, key financial statistics, and technical indicators (RSI, MACD) via the yfinance API.
- Utilized Pandas for efficient data manipulation and pandas-ta for automated calculation of widely-used technical-analysis metrics.
- Created an intuitive and interactive user interface with Streamlit and Plotly, allowing on-the-fly analysis of different stock tickers.

## TECHNICAL SKILLS

**Languages:** Python, C++, SQL, JavaScript (ES6+), Swift

**Quantitative & Data:** Pandas, NumPy, SciPy, Statsmodels, Matplotlib, Plotly

**Web & Databases:** Streamlit, Node.js, React, PostgreSQL, MySQL, HTML/CSS

**Developer Tools:** Git, Docker, Linux, Jest, GitHub Actions, Postman

## WORK EXPERIENCE

### CodTech IT Solutions Pvt. Ltd.

May 2025 – Jul 2025

Backend Engineering Intern

- Engineered a real-time backend using Node.js and WebSockets to handle high-frequency data streams, achieving message latency under 100 ms for over 1,000 concurrent users.
- Designed and implemented a secure RESTful API with a PostgreSQL database, demonstrating strong data-modeling and management skills.
- Established a CI/CD pipeline with Docker and GitHub Actions, showcasing a disciplined approach to automated testing, deployment, and robust software development.

## ACHIEVEMENTS

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**Quantitative Research:** Independently replicated the Fama-French three-factor model and discovered that both Size (SMB) and Value (HML) factors yielded a statistically significant negative alpha for the 2015–2023 period.

**Competitive Programming:** Demonstrated elite problem-solving and algorithmic skills by placing in the **Top 16 %** (6.8 k/42 k+) in Codeforces Div. 2 and **Top 22 %** (7.8 k/35 k+) in Meta Hacker Cup 2024.