Software Requirements Specification (SRS)

1. Introduction

1.1 Purpose

The Coulomb's Law Calculator is a web-based application designed to compute the force, charge, or distance between two charged particles using Coulomb's Law formula:

$$F = \frac{k \cdot q1 \cdot q2}{r^2}$$

The calculator allows users to input known values and compute the missing parameter by leaving one input field empty.

1.2 Scope

This application will:

- Accept user inputs for charge values (q1, q2), distance (r), and force (F).
- Calculate the missing value based on Coulomb's Law.
- Display results in a user-friendly format.
- Be implemented using **HTML, CSS, and JavaScript**.

1.3 Audience

The target users include:

- Students and educators in physics.
- Researchers requiring quick Coulomb's Law calculations.
- Professionals in electrical engineering and related fields.

1.4 References

- Coulomb's Law: https://en.wikipedia.org/wiki/Coulomb%27s_law

2. Functional Requirements

2.1 User Interface

- A web-based interface with labeled input fields.
- A "Calculate" button to compute the missing value.
- A result display section.

2.2 Calculation Logic

- If **q1** is missing, calculate:
  $$q1 = \frac{F \cdot r^2}{k \cdot q2}$$

- If **q2** is missing, calculate:
  q2=F·r2k·q1q2 = \frac{F \cdot r^2}{k \cdot q1}
- If **r** is missing, calculate:
  r=k·q1·q2Fr = \sqrt{\frac{k \cdot q1 \cdot q2}{F}}
- If **F** is missing, calculate:
  F=k·q1·q2r2F = \frac{k \cdot q1 \cdot q2}{r^2}
- Display an error if multiple or no values are missing.

3. Non-Functional Requirements

3.1 Performance

- The application should compute results instantly upon user input.

3.2 Usability

- Simple and intuitive user interface.
- Responsive design for mobile and desktop compatibility.

3.3 Reliability

- Must handle invalid inputs gracefully (e.g., empty fields, negative values).

3.4 Security

- The application should prevent XSS attacks by sanitizing input fields.

4. Constraints

- The application will not store or log user data.
- It will rely solely on **client-side JavaScript**.

5. Assumptions

- Users will enter values in standard SI units (Coulombs, meters, Newtons).
- Only one value will be left empty for calculation at a time.

6. Future Enhancements

- Provide unit conversion features.
- Include an interactive graph to visualize Coulomb's force.
- Add a history log for previous calculations.

7. Appendix

- Value of Coulomb's constant: **$k = 9 \times 10^9 \, Nm^2/C^2$**.
- Error handling messages for invalid inputs.