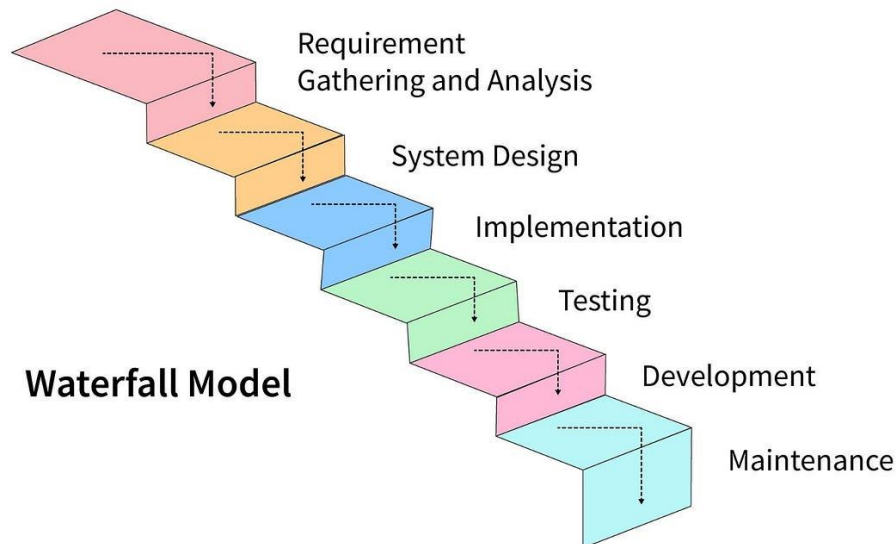


Assignment 3: Research and compare SDLC models suitable for engineering projects. Present findings on Waterfall, Agile, Spiral, and V-Model approaches, emphasizing their advantages, disadvantages, and applicability in different engineering contexts.

Waterfall Model:



- Winston Royce introduced the Waterfall Model in 1970. This model has five phases: Requirements analysis and specification, design, implementation, and unit testing, integration and system testing, and operation and maintenance. The steps always follow in this order and do not overlap. The developer must complete every phase before the next phase begins. This model is named "Waterfall Model", because its diagrammatic representation resembles a cascade of waterfalls.

Advantages:

- Sequential approach: Well-defined phases (requirements, design, implementation, testing, deployment) ensure clarity and structure.
- Easy to understand and manage: Progression through phases is linear, making it suitable for projects with stable requirements and predictable outcomes.
- Documentation-driven: Emphasizes documentation at each phase, facilitating traceability and compliance with regulatory standards.

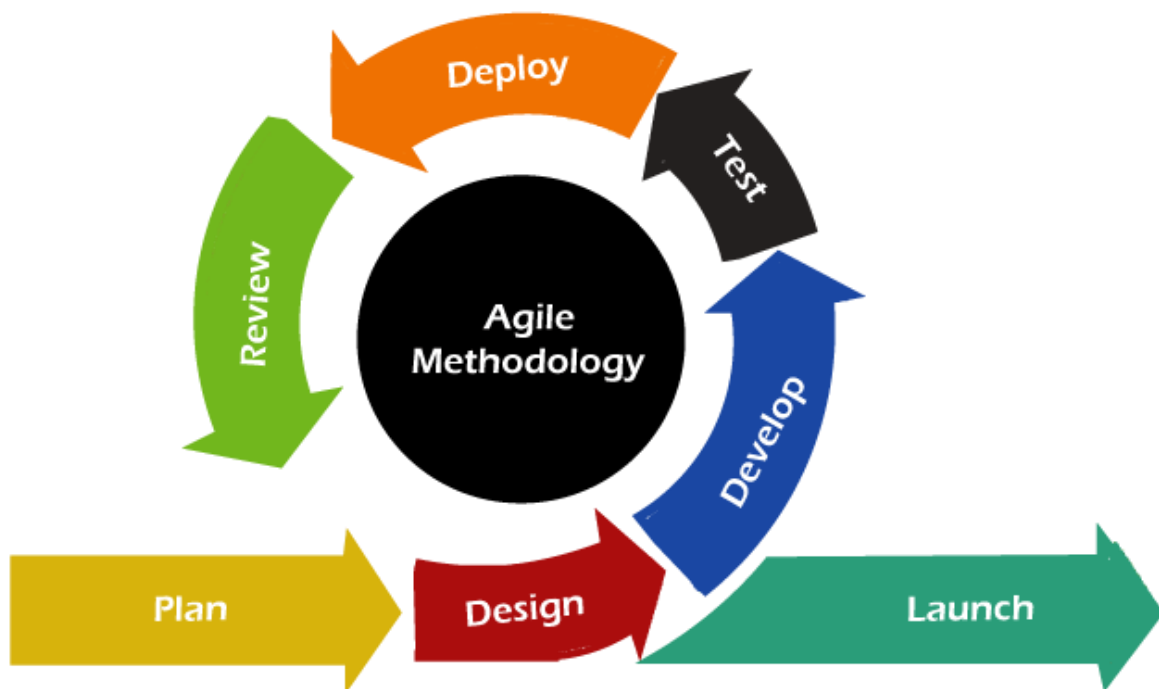
Disadvantages:

- Limited flexibility: Changes to requirements late in the project lifecycle can be costly and time-consuming to implement.
- Risk of late defect detection: Testing occurs towards the end of the project, increasing the likelihood of discovering defects during later stages.
- Not suitable for complex or evolving projects: Inflexibility may lead to mismatches between customer expectations and delivered product.

Applicability:

- Well-suited for projects with clearly defined requirements and low levels of uncertainty.
- Commonly used in industries with stringent regulatory compliance requirements, such as aerospace and defense.

Agile Model:



- The meaning of Agile is swift or versatile. "Agile process model" refers to a software development approach based on iterative development. Agile methods break tasks into smaller iterations, or parts do not directly involve long term planning. The project scope and requirements are laid down at the beginning of the development process. Plans regarding the number of iterations, the duration and the scope of each iteration are clearly defined in advance.

Advantages:

- Iterative and incremental: Allows for flexibility and adaptation to changing requirements throughout the project lifecycle.
- Customer collaboration: Emphasizes continuous feedback and involvement of stakeholders, ensuring alignment with user needs.
- Faster time to market: Small, frequent releases enable quicker delivery of usable increments of the product.

Disadvantages:

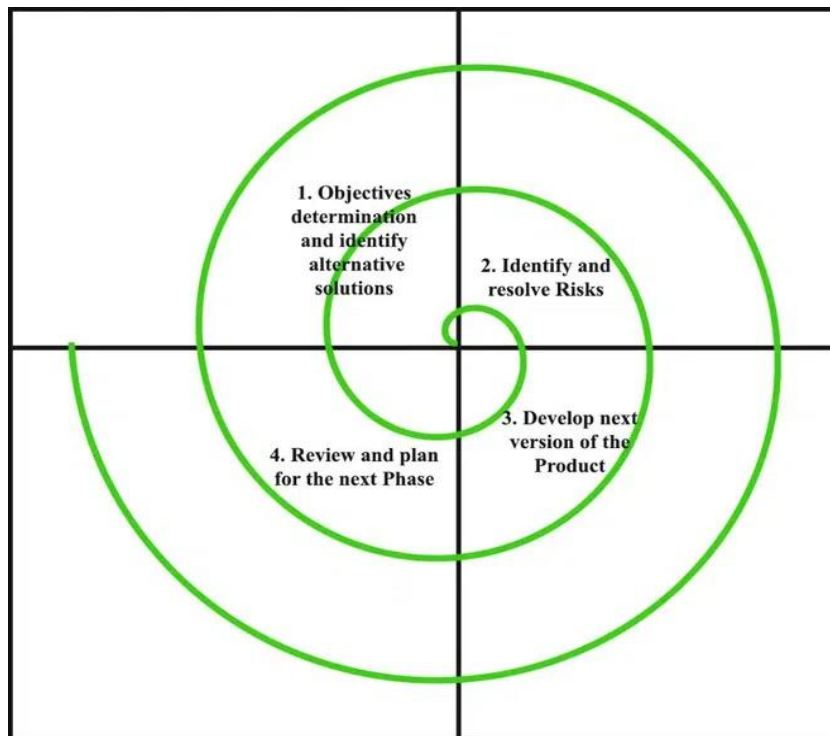
- Requires active customer involvement: Heavy reliance on customer feedback may pose challenges if stakeholders are unavailable or indecisive.
- Lack of upfront planning: Limited initial documentation may lead to misunderstandings or inconsistencies in project requirements.
- May not be suitable for large-scale projects: Agile methodologies may encounter scalability issues when applied to complex projects with extensive dependencies.

Applicability:

- Ideal for projects with evolving or unclear requirements, where flexibility and adaptability are paramount.
- Commonly used in software development, digital product development, and startups seeking rapid prototyping and iteration.

Spiral Model:

- The spiral model, initially proposed by Boehm, is an evolutionary software process model that couples the iterative feature of prototyping with the controlled and systematic aspects of the linear sequential model. It implements the potential for rapid development of new versions of the software. Using the spiral model, the software is developed in a series of incremental releases. During the early iterations, the additional release may be a paper model or prototype. During later iterations, more and more complete versions of the engineered system are produced.

**Advantages:**

- Risk-driven: Incorporates risk analysis and mitigation strategies at each phase, enabling proactive management of project risks.
- Flexibility: Allows for iterative development and refinement of project deliverables, accommodating changes in requirements and scope.
- Suitable for large-scale projects: Can be scaled up to handle complex projects with multiple iterations and feedback loops.

Disadvantages:

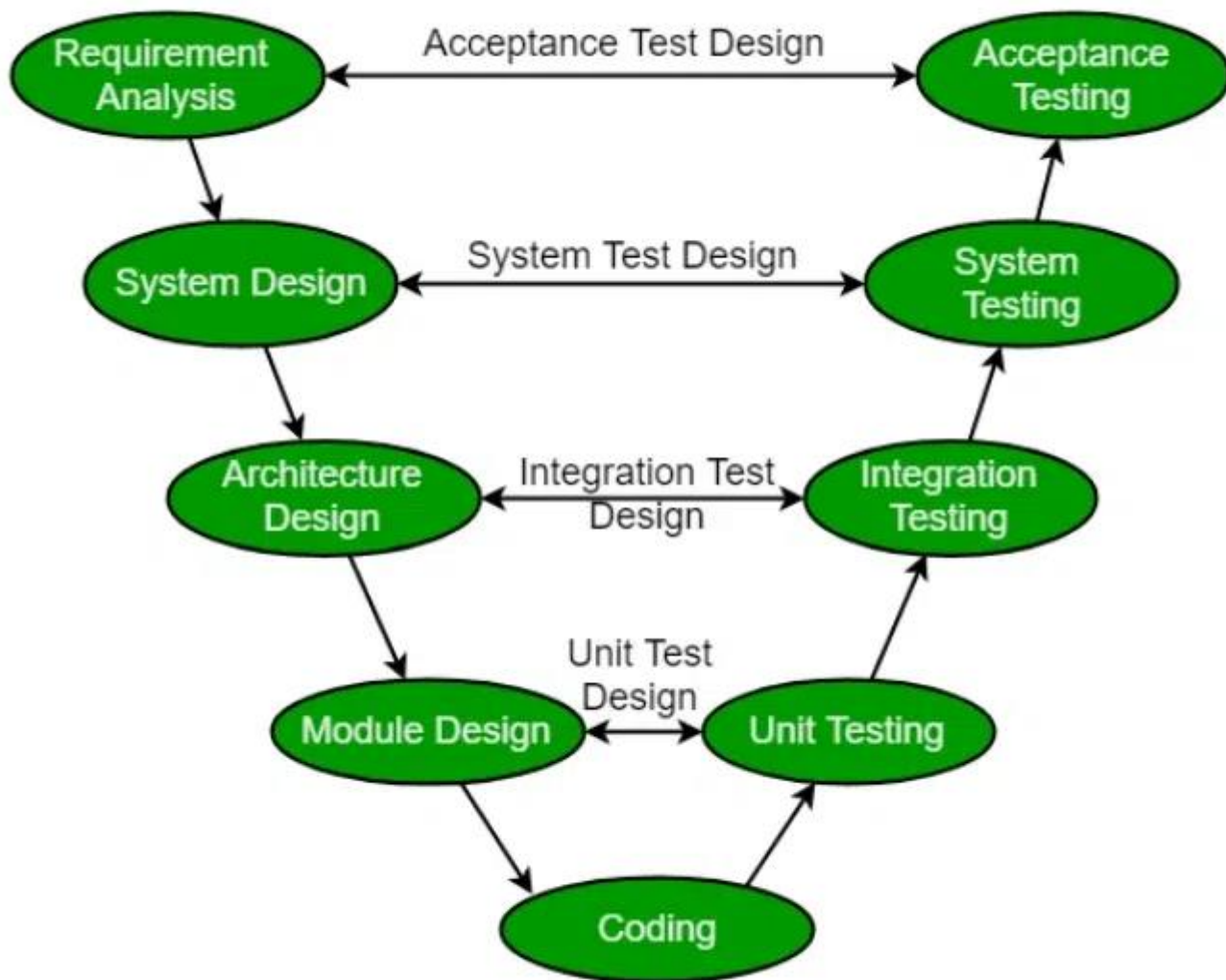
- Complexity: Requires experienced project managers and skilled team members to effectively navigate the iterative nature of the model.
- Time and resource-intensive: Involves extensive documentation, risk analysis, and prototyping activities, which can increase project overhead.
- Not suitable for small projects: Overhead associated with risk analysis and iteration may outweigh the benefits for smaller-scale projects.

Applicability:

- Well-suited for projects with high levels of uncertainty, where risk management and flexibility are critical.
- Commonly used in software development, system integration, and projects with evolving requirements or emerging technologies.

V-Model:

- V-Model also referred to as the Verification and Validation Model. In this, each phase of SDLC must complete before the next phase starts. It follows a sequential design process same as the waterfall model. Testing of the device is planned in parallel with a corresponding stage of development.



Advantages:

- Emphasizes verification and validation: Ensures that requirements are thoroughly tested and validated at each stage of development.

- Clear traceability: Aligns testing activities with corresponding development phases, facilitating traceability and defect tracking.
- Predictable outcomes: Sequential structure provides clarity and visibility into project progress and deliverables.

Disadvantages:

- Limited flexibility: Changes to requirements late in the project lifecycle may require significant rework and impact project timelines.
- Lack of stakeholder involvement: Focus on verification and validation activities may lead to limited customer engagement and feedback.
- Resource-intensive testing: Comprehensive testing activities at each stage may require significant time and resources.

Applicability:

- Well-suited for projects with stable requirements and a focus on rigorous testing and quality assurance.
- Commonly used in safety-critical industries such as healthcare, automotive, and pharmaceuticals, where thorough validation and compliance are essential
- So, each SDLC model offers distinct advantages and disadvantages, making them suitable for different engineering contexts depending on project requirements, complexity, and level of uncertainty. Waterfall and V-Model provide structure and predictability, making them ideal for projects with stable requirements and stringent quality assurance requirements. Agile and Spiral models offer flexibility and adaptability, making them well-suited for projects with evolving or unclear requirements where rapid iteration and customer collaboration are essential.