Software Development Models: Agile, Scrum, Waterfall, Spiral

1. Waterfall Model

A linear and sequential model. Each phase (requirements -> design -> development -> testing -> deployment) is completed before the next begins.

Best for: Well-defined, low-change projects. Not good if changes are expected.

Example: Building an online exam system where all requirements are fixed and signed off before coding starts.

2. Agile Model

An iterative model focused on delivering small, working features quickly and adapting based on feedback.

Sprints (1-4 weeks) -> Deliver feature -> Get feedback -> Improve

Best for: Dynamic projects with changing needs. Needs high team involvement.

Example: Food delivery app where login, search, cart, and checkout are built and improved over several sprints.

3. Scrum Framework (Agile Subset)

A structured Agile method with fixed roles and rituals:

- Roles: Product Owner, Scrum Master, Dev Team
- Events: Sprint Planning, Daily Standup, Sprint Review, Retrospective

Best for: Teams needing structure within Agile

Example: Banking portal built sprint-by-sprint with weekly demos and daily syncs.

4. Spiral Model

Combines Waterfall with iterative risk analysis. Each loop includes planning, risk analysis, prototyping, and review.

Best for: High-risk, complex systems (e.g., defense, aviation)

Example: Hospital system built loop-by-loop:

- Loop 1: Prototype + test data privacy
- Loop 2: Add billing + simulate errors
- Loop 3: Add dashboard + evaluate scalability

Summary Table

Waterfall: One-time, rigid, sequential

Agile: Quick sprints, fast feedback, evolving features

Scrum: Agile with roles and meetings

Spiral: Careful loops, reduce risks before building

Choose Waterfall for stable projects, Agile for flexibility, Scrum for structure, Spiral for high-risk systems.