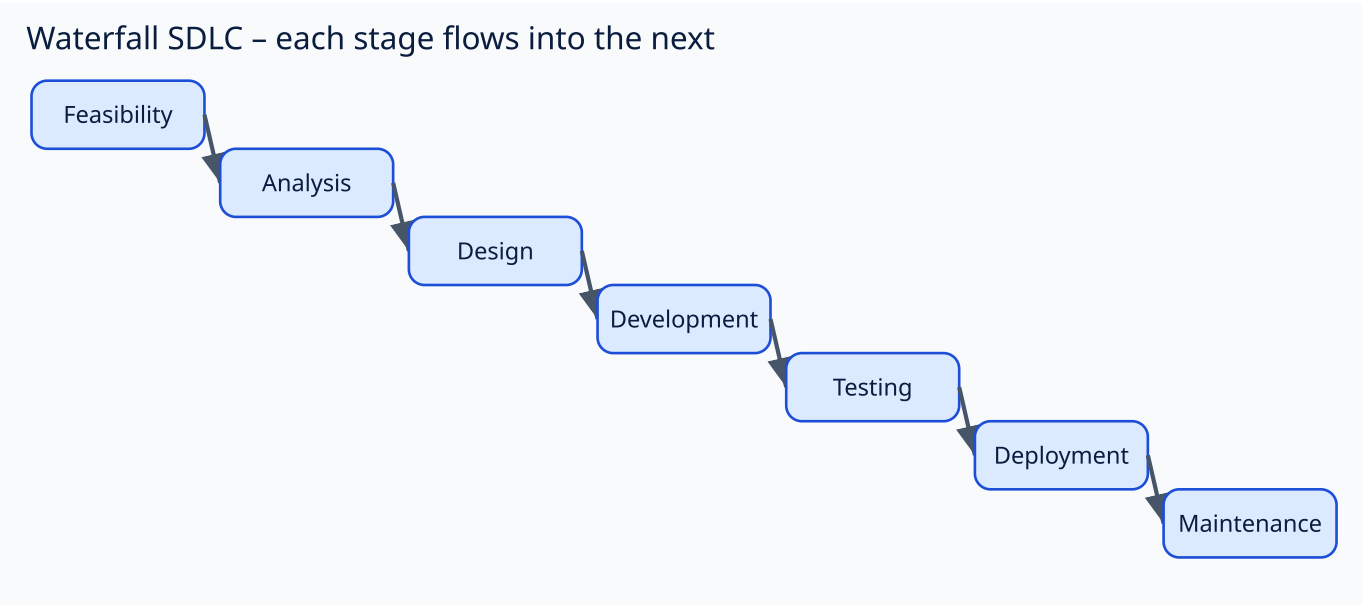
Grade 12 A/L ICT · Lesson 7

7.3 System Development Models and Methodologies

Syllabus 7.3. Software is built using a **development model**: **Waterfall**, **Spiral**, **Agile**, **Prototyping** or **RAD**. You learn the SDLC stages in Waterfall, the phases of Spiral, when each model fits, and the **structured** and **object-oriented** methodologies. A simple project plan shows the **critical path**.

1. Waterfall and the SDLC



Waterfall stages

In **Waterfall** each stage (feasibility → analysis → design → development → testing → deployment → maintenance) is finished and signed off before the next starts. It suits projects with **clear, stable requirements**.

2. Other models

Spiral
Repeated loops: planning → risk analysis → engineering → evaluation. Best for large, risky projects.

Agile
Short sprints deliver working parts; customer feedback each sprint. Best when requirements change.

Prototyping
Build a quick model, let users try it, refine. Best when users are unsure of needs.

RAD
Rapid Application Development: reusable components, time-boxed, heavy user involvement.

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3. Methodologies

Structured methodology splits the system into **processes and data flows** (DFDs, top-down). **Object-oriented** methodology models **objects** with attributes and methods (classes, inheritance, UML).

4. Planning a project: critical path

Task	Activity	Weeks	After	Earliest start	Earliest finish	Slack
A	Feasibility	2	–	0	2	0
B	Analysis	4	A	2	6	0
C	Design	3	B	6	9	0
D	Hardware order	2	B	6	8	5
E	Coding	4	C	9	13	0
F	Testing	2	D,E	13	15	0
G	Deployment	1	F	15	16	0

🧱 **Worked example: Find the project duration and the critical path.**
Forward pass: EF(E) = 13, EF(D) = 8, so F starts at 13. Duration = **16 weeks**. Tasks with zero slack form the **critical path A–B–C–E–F–G**. Task D has slack 5 weeks.

💡 A delay on any critical task delays the whole project; a delay within slack does not.

🚀 **Beyond the syllabus (2026 update)** *Not required for the exam – read for interest.* DevOps in 2026 joins development and operations with continuous integration and delivery (CI/CD) pipelines.

Key Words

SDLC – System Development Life Cycle – stages to build a system.

Waterfall model – Sequential stages, each finished before the next.

Spiral model – Risk-driven loops of planning, risk, engineering, evaluation.

Agile – Iterative short sprints with constant customer feedback.

Prototyping – Building a quick trial model for users to test.

RAD – Rapid development with reusable parts and time-boxing.

Structured methodology – Process and data-flow based top-down approach.

Object-oriented methodology – Models the system as interacting objects.

Sprint – Short fixed time box in Agile.

Risk analysis – Finding and reducing project risks.

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Critical path – Longest chain of tasks with zero slack.

Gantt chart – Bar chart of tasks against time.

Sample Q&A

1. When is Waterfall suitable?

> **Answer:** When requirements are clear and stable.

2. Name the four Spiral phases.

> **Answer:** Planning, risk analysis, engineering, evaluation.

3. Why is Agile popular?

> **Answer:** It handles changing requirements and delivers working software early.

4. What is a prototype?

> **Answer:** A quick working model shown to users to refine requirements.

5. Structured vs object-oriented?

> **Answer:** Structured: processes and data flows; OO: objects with data and methods.

6. What is the critical path?

> **Answer:** The longest path of dependent tasks; it fixes the project duration.

MCQ

1. Sequential stages each signed off before the next describes

A. Agile
B. Waterfall
C. Spiral
D. RAD
E. Prototyping

2. A model driven by risk analysis in loops is

A. RAD
B. Agile
C. Spiral
D. Prototyping
E. Waterfall

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3. Short sprints with customer feedback describe

A. Spiral
B. Waterfall
C. closed system
D. Agile
E. TPS

4. Users unsure of needs try a quick model in

A. Spiral only
B. Prototyping
C. Waterfall
D. Direct changeover
E. ESS

5. Classes, objects and inheritance belong to

A. structured methodology
B. Waterfall stages
C. DFD level 0
D. pilot deployment
E. object-oriented methodology

6. For the plan in this note, project duration is

A. 11 weeks
B. 14 weeks
C. 20 weeks
D. 18 weeks
E. 16 weeks

7. Critical path tasks have slack of

A. zero
B. the largest value
C. one week
D. negative only
E. equal to duration

8. In the plan, which task is NOT critical?

A. C
B. A
C. D
D. E
E. F

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9. Which term means: “System Development Life Cycle – stages to build a system”?

A. SDLC
B. Spiral model
C. Object-oriented methodology
D. RAD
E. Critical path

10. Which term means: “Sequential stages, each finished before the next”?

A. Sprint
B. Waterfall model
C. Gantt chart
D. Agile
E. Structured methodology

11. Which term means: “Risk-driven loops of planning, risk, engineering, evaluation”?

A. Spiral model
B. Prototyping
C. Risk analysis
D. Object-oriented methodology
E. SDLC

12. Which term means: “Iterative short sprints with constant customer feedback”?

A. Critical path
B. Sprint
C. Waterfall model
D. RAD
E. Agile

13. Which term means: “Building a quick trial model for users to test”?

A. Spiral model
B. Gantt chart
C. Risk analysis
D. Prototyping
E. Structured methodology

14. Which term means: “Rapid development with reusable parts and time-boxing”?

A. SDLC
B. Critical path
C. Object-oriented methodology
D. RAD
E. Agile

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15. Which term means: “Process and data-flow based top-down approach”?

A. Waterfall model
B. Prototyping
C. Structured methodology
D. Sprint
E. Gantt chart

16. Which term means: “Models the system as interacting objects”?

A. Object-oriented methodology
B. Spiral model
C. RAD
D. SDLC
E. Risk analysis

17. Which term means: “Short fixed time box in Agile”?

A. Structured methodology
B. Waterfall model
C. Sprint
D. Agile
E. Critical path

18. Which term means: “Finding and reducing project risks”?

A. Object-oriented methodology
B. Prototyping
C. Gantt chart
D. Risk analysis
E. Spiral model

19. Which term means: “Longest chain of tasks with zero slack”?

A. RAD
B. Critical path
C. SDLC
D. Sprint
E. Agile

20. Which term means: “Bar chart of tasks against time”?

A. Risk analysis
B. Prototyping
C. Waterfall model
D. Structured methodology
E. Gantt chart

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Structured Questions

1. List the Waterfall SDLC stages in order. *(6 marks)*

> Feasibility; analysis; design; development; testing; deployment; maintenance.

2. Describe the Spiral model phases. *(5 marks)*

> Planning; risk analysis; engineering; evaluation; repeated each loop.

3. Compare Agile with Waterfall. *(4 marks)*

> Agile iterative and flexible; Waterfall sequential; Agile delivers early; Waterfall needs fixed requirements.

4. When would you use prototyping or RAD? *(4 marks)*

> Unclear user needs; short deadline; reusable components; users available.

5. Find the duration and critical path of the given plan. *(4 marks)*

> Forward pass; duration 16 weeks; path A–B–C–E–F–G; D slack 5.

Summary

- Waterfall: sequential, stable requirements.
- Spiral: risk-driven loops.
- Agile, prototyping and RAD handle change.
- Structured vs object-oriented methods.
- Critical path = longest zero-slack chain.

MCQ answer key – 7.3

1. **B** – Waterfall.
2. **C** – Spiral.
3. **D** – Agile.
4. **B** – Prototyping.
5. **E** – OO.
6. **E** – Longest path.
7. **A** – Zero slack.
8. **C** – D has slack 5.
9. **A** – SDLC – System Development Life Cycle – stages to build a system.
10. **B** – Waterfall model – Sequential stages, each finished before the next.
11. **A** – Spiral model – Risk-driven loops of planning, risk, engineering, evaluation.
12. **E** – Agile – Iterative short sprints with constant customer feedback.
13. **D** – Prototyping – Building a quick trial model for users to test.

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14. **D** – RAD – Rapid development with reusable parts and time-boxing.
15. **C** – Structured methodology – Process and data-flow based top-down approach.
16. **A** – Object-oriented methodology – Models the system as interacting objects.
17. **C** – Sprint – Short fixed time box in Agile.
18. **D** – Risk analysis – Finding and reducing project risks.
19. **B** – Critical path – Longest chain of tasks with zero slack.
20. **E** – Gantt chart – Bar chart of tasks against time.

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