Software Process Models:

Waterfall model

- The **Waterfall model** is mostly used on **smaller projects where the requirements are very well known, clear and fixed and there's no need to change them quickly**.
- It's a well-structured approach.
- The stages are well-defined and easy to understand for all.
- Small or medium-sized projects with well-defined, unchanging requirements.
- Projects that make use of a well-known technology stack and tools.
- Waterfall model was used to develop enterprise applications like Customer Relationship Management (CRM) systems, Human Resource Management Systems (HRMS), Supply Chain Management Systems, Inventory Management Systems, Point of Sales (POS) systems for Retail chains etc.

The V model (Verification and Validation model)

- An extension of the waterfall model. All the requirements are gathered at the start and cannot be changed.
- You have a corresponding testing activity for each stage. For every phase in the development cycle, there is an associated testing phase. highly disciplined, easy to understand, and makes project management easier.
- The V model a good choice for software where downtimes and failures are unacceptable.
- But it isn't good for complex projects or projects that have unclear or changing requirements.
- High confidence of customer is required for choosing the V-Shaped model approach. Since, no prototypes are produced, there is a very high risk involved in meeting customer expectations.
- Application of V-Shaped model:
    - This model is used in the medical development field, as it is strictly disciplined domain.

The **Incremental and Iterative Models:**

- A good match for large projects.
- Major requirements must be defined; however, some details can evolve with time.
- There is a need to get a product to the market early.
- A new technology is being used
- Initial versions of the software are generated early on.
- That facilitates customer evaluation and feedback.
- The incremental model is great for projects that have loosely-coupled parts and projects with complete and clear requirements.
- The incremental model isn't ideal for ongoing development as the next sequence cannot begin until the previous stage has fully completed.
- The **iterative model** allows you to see the results at the early stages of development. This makes it easy to identify and **fix any functional or design flaws**. It also makes it easier to manage risk and change requirements.
- The deadline and budget may change throughout the development process, especially for large complex projects. The iterative model is a good choice for large software that can be **easily broken down into modules**.

RAD model:

- Great for systems that need to be produced in a **short time (2 to 3 months of time) and have known requirements**.
- It should be used if there's high availability of designers for modelling and the budget is high enough to afford their cost along with the cost of automated code generating tools.

Spiral model

- The Spiral methodology is **suitable for large, complex, and expensive projects.**
- Its benefits are risk-management and stage-by-stage development.
- Used for projects with **unclear needs** or **projects still in research and development.**
- The **introduction of a new service or product**, as well as research and development activity.

Agile models:

- Suit **small- and medium-sized projects** with rapid changes required. (Start-up initiatives that require immediate feedback from end-users.
- **The customer is involved during each stage. Limited planning is required to get started with a project**.
- Businesses save **both money and time as each iteration is discussed closely between the customer and the development team**.
- Mid-sized projects in which business requirements cannot be confidently translated into detailed software requirements.
- Large projects can be broken down into small functional parts and developed incrementally over each iteration.

Which of the development process models would you follows for the following projects. Give justifications.

a) **A simple data processing project.**
   Ans: For above project go for waterfall model.
   Justification: In the given project, the **requirement will be fixed and there is no near chance of changing it**. Also for processing data, those basic operations will be fixed and we have delivered all the operations at a time. In waterfall model, we can very well implement all specified requirements and deliver the whole product at a time.

b) **A new system comparing finger prints**

Ans: For above project go for spiral model.
Justification: In the given project, requirement i.e. **finger print data will be added continuously so we need to consider it.** Even customer feedback i.e. usefulness of the project has to be checked every time. In spiral model, for each set of requirement we can follow up six activities and in turn that spiral way will be continuing till the project is delivered.

c) **An online inventory management system for an automobile industry.**
   Ans: For above project **go for incremental model**.
   Justification: In this project, we will be **delivering new services in every increment.** Hence, in online Management Information System at a time, it is not possible to deliver the entire module and we cannot, even delay the delivery. So for this reason, we can consider some features and deliver first increment. Later on, in each increment we can add new features and deliver the entire module increment by increment.

d) **A new missile tracking system.**
   Ans: For this project go for **waterfall model.**
   Justification: Here for missile tracking system **the frequency range for tracking missiles will be fixed**. All data will be provided at start only. Using this data, the entire system has to deliver at a time only so waterfall model is useful here.

e) A satellite launching system. It is not known if the current H/Wand S/W technology is nature enough to achieve the goals.

Ans: For this project go for prototype model.
Justification: Satellite launching system is **very costly system and current hardware and software are not matching**. The basic idea here is that instead of freezing is the requirement before any design or coding can proceed. Throwaway prototype is build to help understand the requirements. Development of the prototype obviously undergoes design, coding and testing but each of these phases is not done very formally or thoroughly.

f) An on-line inventory management for peripheral device manufacturing company.

Ans: For this project go for **waterfall model.**
Justification
This software is not so much costly. The software team gets all the information from the user and then analysis will be frozen. After the analysis frozen system has developed.

g) A data entry system for office staff that have never used computers before. The user interface and user friendliness are extremely important.

Ans: For this project go for **increment model**.
Justification:
This software is also not so much costly. The basic idea is such that the software is developed in increment, each increment adding some functional capability to the system until the system is implemented. At each step, extensions and design modifications can be made. An advantage of this approach is that it can result in better testing because testing each increment is likely to be easier then testing the entire system as in the waterfall model.

h) **Assume that a software development company is already experienced in developing payroll software and has developed similar software for several customers (organizations). Assume that the software development company has received a request from a certain customer (organization), which was still using manually processing its payrolls.**

The waterfall model seems an ideal choice here.
No other model seems a reasonable alternative.
Strengths:
a. Considering that the company is software development, it is large and bureaucratic, requiring documentation and good project visibility. Waterfall documentation satisfies this.
b. Since they have already developed the software many times, the application type is well known to the company, so a thorough user requirements analysis should be possible early on
c. The company has a good reputation to maintain in this area as they have built the product many times, so quality control will be essential. Waterfall emphasis of requirements-before-design and design-before-coding will emphasise quality

i) **Giving reasons for your answer based on the type of system being developed, suggest the most appropriate software process model which might be used as a basis for developing the following systems:**
   - **A virtual reality system to support software maintenance;**
   - **A university accounting system that replaces an existing system;**
   - **An interactive system for railway passengers that finds train times from terminals installed in stations.**

1. Virtual reality system This is a system where the requirements will change and there will be an extensive user interface component. Incremental development with, perhaps, some UI prototyping is the most appropriate model. An agile process may be used.

2. University accounting system This is a system whose requirements are fairly well-known and are stable therefore the waterfall model.

3. Interactive travel planning system This is a system with a complex user interface but which must be stable and reliable. An incremental development approach is the most appropriate as the system requirements will change as real user experience with the system is gained.

j) Give an example of a software project that would benefit from using the spiral model. Explain your reasoning.

- A large scale, in-house project e.g. a flight control system developed in house would be a candidate for the spiral model.
- A small system or any form of contract software would be unsuitable. E.g. a database conversion program developed under contract.

k) Explain the difference between iterative and incremental development.

- Iterative means that the waterfall model phases are executed in multiple and successive cycles. Incremental means that at the end of each iteration working software is produced

l) Describe the sort of project that would be an ideal application for incremental approach?

- Any software project that has significant functionality that must be delivered in a very tight (too tight) time frame is a candidate for the incremental approach. The idea is to deliver functionality in increments.
    - E.g. A sophisticated software product that can be released to the marketplace with only partial functionality – new and improved version to follow.
    - Situation where the incremental model would not be suitable: for software controlling a nuclear power plant, where everything has to work together from the beginning, or an air traffic control system.

m) A well-understood data processing application

Iterative Waterfall model.

Justification: It is the most cost effective model of development for well-understood application

n) A new software that would connect computers through satellite communication. Assume that your team has no previous experience in developing satellite communication software.

For this project go for prototype model.

Justification: Satellite launching system is very costly system and current hardware and software are not matching. The basic idea here is that instead of freezing is the requirement before any design or coding can proceed. Since the team members has no previous experience in developing satellite communication software.

o) A software that would function as the controller of a telephone switching system.

For this project go for prototype model or iterative model, based on familiarity of development team in developing similar products.

p) A new library automation software that would link various libraries in the city.

For this project go for prototype model or iterative model, based on familiarity of development team in developing similar products.

q) An extremely large software that would provide, monitor, and control cellular communication among its subscribers using a set of revolving satellites.

For this project go for Spiral model, since the project is large, based on familiarity of development team in developing similar products.

r) A new text editor

For this project go for prototype model or iterative waterfall model.

s) A compiler for a new language

For this project go for prototype model or iterative waterfall model.

t) The graphical user interface part of a large software.

For this project go for prototype model since the users often change their mind regarding various features of user interface.

Question?

Suggest a suitable life-cycle model for a software project which your organisation has undertaken on behalf of certain customer who is unsure of his requirements and is likely to change his requirements frequently, since the business process of the customer (organisation) is of late changing rapidly. Give the reasoning's behind your answer.

Ans: For this project go for prototype model. The prototype can be changed until the customer freezes the requirements and after that development can be started.