**QN1**. Explain what software engineering is and discuss its importance in the technology industry

**ANS:** Software engineering is a systematic and procedural approach to the development, operation and maintenance of a software

* Its practices help to ensure that software products meet quality standards. High-quality software reduces the occurrence of failure thus enhances user satisfaction
* Through scalability, software engineering principle help design systems that can handle increased loads without compromising performance
* It promotes teamwork and collaboration among developers. Designers and testers using tools like version control and collaborative platforms such as Jira
* By identifying potential risks early in the development process allows teams to mitigate them proactively

**QN2.** Identify and describe at least three key milestones in the evolution of software engineering.

**ANS:**

* Birth of Software Engineering (1968) – In a conference, they highlighted the need of a more structured approach to software development in relation to engineering disciplines. This event marked the formal recognition of software engineering as a distinct discipline leading to the establishment of principles and practices that form the foundation
* Introduction of Structured Programming (1970s)- Structured programming emerged as a key paradigm aimed at improving the clarity and efficiency of software development. Through Dijkstra work which entailed use of control structure, it led to better-organized code, making it easier to understand, maintain and debug
* The Agile Manifesto (2001) – It introduced a new approach to software development that emphasizes flexibility, collaboration and customer satisfaction. This shift addresses many of the short comings of the earlier models such as long development cycles. It led to emergence of framework such as Scrum

**QN3.** List and briefly explain the phases of the Software Development Life Cycle.

**ANS:**

* Planning- Involves defining the scope and purpose of the project. Feasibility study may be conducted to access whether the project is workable
* Requirement Gathering and Analysis- Detailed requirements are gathered from stakeholders and then they are analyzed, documented and approved ensuring mutual understanding.
* Design- Creating the architecture of the software based on the requirements gathered. Design documents serve as blueprints for developers.
* Coding- Through collaboration, developers write the actual code based on the design specifications. Also involves unit testing that ensure the components work correctly
* Testing- Various types of testing are conducted to ensure that the software meets the specified requirements and functions as intended
* Deployment- Once the software is deemed ready, it is deployed to the production environment. Also involves user training and documentation
* Maintenance- Includes fixing bugs, making enhancements and ensuring compatibility with new technologies

**QN4.** Compare and contrast the Waterfall and Agile methodologies. Provide examples of scenarios where each would be appropriate.

**ANS:**

* **WATERFALL METHODOLOGY** – is a linear approach where each phase must be completed before moving onto the next.

**CHARACTERISTICS**

Each phase has specific deliverables and a review process

Extensive documentation is required at each stage

Timeline and budget are easier to estimate due to its linear nature

Limited flexibility

**SCENARIO**

Project that require strict compliance such as healthcare which have clear documentation and traceability

* **AGILE METHODOLOGY –** is an iterative and incremental approach that focuses on customer collaboration. Development occurs in small teams delivering work in short cycles called sprints

**CHARACTERISTICS**

Development is in small increments allowing for regular feedback and adjustments

Continuous collaboration ensures the product evolves based on user feedback

Adaptable since changes can be made at any point in the development process

**SCENARIO**

When developing complex systems that require ongoing testing and refinement such as an e-commerce platform

**QN5.** Describe the roles and responsibilities of a Software Developer, a Quality Assurance Engineer, and a Project Manager in a software engineering team.

**ANS:**

* **SOFTWARE DEVELOPER**

**Roles:** Designing, coding, testing and maintaining software applications

**Responsibilities:**

Understand and analyze project requirements

Create software architecture and design specifications based on requirements

Write code using appropriate programming languages and frameworks

Conduct unit testing and participate in integration testing to ensure functionality

Identify and fix bugs or issues in the software

Stay updated with the latest technologies, tools and best practices in software development

* **QUALITY ASSURANCE ENGINEER**

**Roles**: Ensure the quality of the software product through systematic testing and validation processes

**Responsibilities:**

Develop test plans, strategies and test cases based on project requirements

Conduct various testing to identify defects

Implement automated testing frameworks and scripts to improve testing efficiency

Log and track defects using issues tracking tools

Collaborate with stakeholders to validate that the software meets business needs during UAT phases

Create and maintain documentation related to testing processes, results and quality metrics

Provide feedback to developers regarding quality issues and suggest improvements in code

* **PROJECT MANAGER**

**Roles:** Oversee the planning, execution and delivery of software projects ensuring they are completed on time within the budget

**Responsibilities:**

Define project scope, objectives, deliverables, timelines and resource allocation

Identify potential risks and develop mitigation strategies to minimize impact on the project

Act as the eyes of stakeholders by keeping them informed about project progress and changes

Facilitate collaboration among team members to ensure alignment on goals

Track project deliverables; adjust plans as necessary to keep the project on schedule

Manage project budgets, ensuring resources are allocated effectively while controlling costs

**Qn6.** Discuss the importance of Integrated Development Environments (IDEs) and Version Control Systems (VCS) in the software development process. Give examples of each.

**ANS:**

**Qn7.** What are some common challenges faced by software engineers? Provide strategies to overcome these challenges

**ANS:**

* Frequent changes in project requirements can lead to confusion and delays; Hold regular meetings with stakeholders to clarify expectations and align on changes.
* Accumulation of quick fixes can lead to increased complexity and maintenance challenges; Implement regular code review to ensure adherence to coding standards and best practices. Emphasize quality over speed to avoid rushing features
* Identifying and fixing bugs in large codebases can be time-consuming; Use systematic debugging techniques such as binary search or logging to isolate issues effectively

**Qn8**. Explain the different types of testing (unit, integration, system, and acceptance) and their importance in software quality assurance.

**ANS:**

* Unit Testing; Testing individual components or modules of a software application in isolation to verify that each part functions correctly

Importance

* Identifies bugs at an early stage, making them easier and cheaper to fix
* Encourages developers to write modular code, enhancing maintainability and readability
* Serves as a form of documentation for the code, helping new developers understand its functionality
* Integration testing; Focuses in verifying the interaction between integrated components to ensure they work as one

Importance

* Identifies problems that occur when components interact such as data format mismatch
* Ensures data is passed correctly between modules which is crucial for overall system functionality
* Helps in identifying issues early in the integration phase, reducing the risk of failures in later stages
* System Testing; Evaluates the complete and integrated software application to ensure it meets specified requirements and performs as expected in real-world environment

Importance

* Validates the entire systems’ functionality, performance and security before deployment
* Tests the application from an end-user perspective to ensure it meets usability standards
* Ensures the software complies with relevant standards and regulations
* Acceptance Testing; Determines whether the software meets acceptance criteria and is ready for delivery to the end-users

Importance

* Involves actual user or stakeholders to validate that the software meets their needs and expectations
* Helps identify any remaining issues before the software goes live, reducing the risk of post-deployment failures
* Acts as the final verification step to confirm that all requirements have been met before release
* Ensures that the delivered product aligns with user expectations, leading to higher satisfaction rates

**QN9**. Define prompt engineering and discuss its importance in interacting with AI models

**ANS:**

Prompt Engineering refers to the process of designing and refining the input prompts given to AI models particularly language models, to elicit the most accurate, relevant and useful responses.

Importance

* Improved Output Quality; By providing clear context or specific instructions, users can reduce ambiguity and improve the model’s understanding
* Task Specifications; allows the user to specify whether they need a summary, a detailed explanation, a creative piece or a factual information thus tailoring the AI’s output to meet specific needs
* Effective prompts can lead to quicker and more satisfactory interactions
* By carefully designing prompts, users can help mitigate biases in AI responses
* Understanding how to effectively engineer prompts empowers users to take control of their interactions with AI, making them more effective collaborators in generating content or solving problems

**Qn10.** Provide an example of a vague prompt and then improve it by making it clear, specific, and concise. Explain why the improved prompt is more effective.

**ANS:**

Vague Prompt: Tell me about it

Improved Prompt: Can you provide a brief summary of the main theme in Heal the World by Michael Jackson

Explanation

* Clarity- the improved prompt clearly specifies the subject matter “Heal the World by Michael Jackson”
* Specificity- by asking for a brief summary of the main themes
* Task Definition- improved prompt defines the type of responses desires (summary of themes) which helps the AI generate a more relevant and structured output