Course File

Software Engineering

Dr Paras Kothari

| | | Academic Session | 2021 |

For Techno India NJR Institute of Technology

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Dr. Pankaj Kumar Porwa'
(Principal)

Course Scheme: Software Engineering

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Teaching & Examination Scheme
B.Tech. : Computer Science & Engineering
2nd Year - III Semester

Academic Calendar

Notice: Academic Calendar 2021-2022

RAJASTHAN TECHNICAL UNIVERSITY KOTA

Academic Calendar for Odd Semester for Session 2021-22

Course: Bachelor of Technology (B.TECH.)

Semester	I	II	V	VII
Induction Program	*			
Commencement of Classes	*	20.09.2021	20.09.2021	01.09.2021
Commencement of First Mid Term	*	28.10.2021	25.10.2021	04.10.2021
Commencement of Second Mid Term	*	08.12.2021	29.11.2021	15.11.2021
Last Working Day	*	15.01.2022	24.12.2021	15.12.2021
Commencement of Practical Exams	*	17.01.2022	20.01.2022	16.12.2021
Commencement of Theory Exams	*	27.01.2022	05.01.2022	06.01.2022
Winter Break	Not Applicable			
Commencement of Classes for Even Semesters (2020-21)	II	IV	VI	VIII
	*	10.02.2022	27.01.2022	10.01.2022

Academic Calendar Odd Semester 2021-22				
Particulars	**B. Tech- I**	**B. Tech- III**	**B. Tech- V**	**B. Tech- VII**
Commencement of classes	*	20-09-2021	20-09-2021	01-09-2021
Last Working Day	*	15-01-2022	24-12-2021	15-12-2021
Course Progression Report-I	*	20-10-2021	20-10-2021	20-10-2021
First Mid Term Exam	*	28-10-2021	25-10-2021	25-10-2021
Remedial Class-I	*	08-11-2021	08-11-2021	08-11-2021
Course Progression Report-II	*	04-12-2021	20-11-2021	20-11-2021
Second Mid Term Exam	*	08-12-2021	29-11-2021	22-11-2021
Remedial Class-II	*	16-12-2021	09-12-2021	09-12-2021
Commencement of Theory Exam	*	27-01-2022	05-01-2022	05-01-2022
Commencement of Practical Exam	*	17-01-2022	20-01-2022	20-01-2022

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Theory Session

SN	Category	Course Code	Course Title	Contact hrs/week L	Contact hrs/week T	Contact hrs/week P	Exm Hrs	Marks IA	Marks ETE	Marks Total	Cr
			THEORY								
1	BSC	3CS2-01	Advanced Engineering Mathematics	3	0	0	3	30	120	150	3
2	HSMC	3CS1-02/ 3CS1-03	Technical Communication/ Managerial Economics and Financial Accounting	2	0	0	2	20	80	100	2
3	ESC	3CS3-04	Digital Electronics	3	0	0	3	30	120	150	3
4	PCC	3CS4-05	Data Structures and Algorithms	3	0	0	3	30	120	150	3
5	PCC	3CS4-06	Object Oriented Programming	3	0	0	3	30	120	150	3
6		3CS4-07	Software Engineering	3	0	0	3	30	120	150	3
			Sub Total	17	0	0		170	680	850	17

Practical Session

SN	Category	Course Code	Course Title	L	T	P		IA	ETE	Total	Cr
			PRACTICAL & SESSIONAL								
7	PCC	3CS4-21	Data Structures and Algorithms Lab	0	0	3		45	30	75	1.5
8	PCC	3CS4-22	Object Oriented Programming Lab	0	0	3		45	30	75	1.5
9		3CS4-23	Software Engineering Lab	0	0	3		45	30	75	1.5
10		3CS4-24	Digital Electronics Lab	0	0	3		45	30	75	1.5
11	PSIT	3CS7-30	Industrial Training	0	0	1		0	0	50	1
12	SODE CA	3CS8-00	Social Outreach, Discipline & Extra Curricular Activities							25	0.5
			Sub- Total	0	0	13		180	120	375	7.5
			TOTAL OF III SEMESTER	17	0	13		350	800	1225	24.5

Note: L: Lecture; T: Tutorial; Cr: Credits; ETE: End Term Exam; IA: Internal Assessment

Course Overview

Our mission is to prepare students in software engineering with a thorough understanding of subject concepts and experiential learning opportunities to apply that knowledge to solve real-world problems using software development and evolution, specify, abstract, verify, and validate solutions to large-size problems, to plan, develop and manage large software and learn emerging trends in software engineering.

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Software Engineering (SE) is core subject in world of Computer Engineering (Software) and Application, which creates base for the development in field of software. SE comprises the core principles consistent in software construction and maintenance, fundamental software processes and life-cycles, mathematical foundations of software engineering, requirements analysis, software engineering methodologies and standard notations, principles of software architecture and re-use, software quality frameworks and validation, software development, and maintenance environments and tools.

Objectives

- To introduce the students with basic principles of Software Engineering
- To learn the Software Engineering concepts, methodologies and best practices
- To train the students on Software Engineering principles and approach used in Industry

Consequences (Outcomes)

- Learn basic principles of SE to solve problems regarding SRS, Design, Testing and Implementation in software development.
- Understand Software Engineering concepts, methodologies and best practices to provoke, analyze and specify software requirements through a productive working relationship with project team.
- Learn Software Engineering principles and approach used in industry to evaluate the impact of potential solutions to software problems in a global development culture, using their knowledge of contemporary issues and emerging trends, models, tools, and techniques.

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Course Outcomes:

3CS407	Cognitive Level	Software Engineering Year of study: 2020-21
CO23407.1	Comprehension	Student will be able to list process, pros and cons of various SDLC approaches in software engineering, SDLC Phases, software requirements specification, formal requirements specification and verification
CO23407.2	Application	Student will learn about Software Project Management and able to calculate the cost based on line of code.
CO23407.3	Application	Student will be able to prepare various documents such as requirement analysis (SRS) and Structured analysis.
CO23407.4	Knowledge	Student will learn fundamental software design and Effective modular design.
CO23407.5	Design	Student will be able to design UML diagrams for a given requirement specifications.

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Software Engineering Year of study: 2020-21															
Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO23407.1	2	2	0	0	0	0	0	0	0	0	0	1	2	2	1
CO23407.2	2	2	1	0	0	0	0	0	0	0	0	1	1	0	1
CO23407.3	2	2	1	0	0	0	0	0	0	0	0	1	2	2	1
CO23407.4	2	2	1	0	0	1	0	0	0	0	0	1	1	0	1
CO23407.5	2	2	1	0	2	1	0	0	0	0	0	1	1	2	1

Note: Relationship Matrix between Objectives and Outcome need to be furnished during course implementation period.

Prerequisites

- Understanding of programming and object oriented concept
- Aware with design engineering concepts and implementation
- Thoughtfulness of problem understanding & solving and information gathering

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Course Syllabus: Software Engineering

Theory Classes

3CS4-07: Software Engineering

Credit-3
3L+0T+0P

Max. Marks : 150 (IA:30,ETE:120)
End Term Exam: 3 Hours

SN	CONTENTS	Hours
1	Introduction, software life-cycle models, software requirements specification, formal requirements specification, verification and validation.	8
2	Software Project Management: Objectives, Resources and their estimation, LOC and FP estimation, effort estimation, COCOMO estimation model, risk analysis, software project scheduling.	8
3	Requirement Analysis: Requirement analysis tasks, Analysis principles. Software prototyping and specification data dictionary, Finite State Machine (FSM) models. Structured Analysis: Data and control flow diagrams, control and process specification behavioral modeling	8
4	Software Design: Design fundamentals, Effective modular design: Data architectural and procedural design, design documentation.	8
5	Object Oriented Analysis: Object oriented Analysis Modeling, Data modeling. Object Oriented Design: OOD concepts, Class and object relationships, object modularization, Introduction to Unified Modeling Language	8
	TOTAL	**40**

Lecture Plan: (40 Hours)

Lecture #	Unit Based Mapping	Lecture Title
1		**Subject Introduction**
2-4	1	Software Engineering Introduction; Software life-cycle models
5-7		Software requirements specification
8		Verification and validation.
9		**Introduction to Software Project Management**
10		Software Project Management: Objectives & Resources.
11-12		Resources & size estimation (LOC and FP estimation).
13	2	Effort estimation
14-15		COCOMO estimation model
16		Risk analysis
17		Software project scheduling.
18		**Introduction to Requirement Analysis**
19-20		Requirement analysis tasks & Analysis principles
21		Software prototyping and specification data dictionary
22	3	Finite State Machine (FSM) models.
23		Structured Analysis: Data and control flow diagrams
24		Control and process specification behavioral modeling
25		**Introduction to Software Design & its importance**
26-27		Design fundamentals
28-29	4	Effective modular design: Data architectural and procedural design
30-31		Design documentation
32		**Introduction to Object Oriented Analysis**
33		Object oriented Analysis Modeling
34		Object oriented Analysis Modeling & Data modeling
35	5	Object Oriented Design: OOD concepts
36		Class and object relationships & object modularization
37-38		Object modularization & Introduction to Unified Modeling Language
39-40	**ALL UNITS**	**Course Summarization**

Learning Resources

Text Books/Reference Books

- Software Engineering: A Practitioner's Approach by Roger S. Pressman, Tata McGraw Hills. ISBN: 9339212088
- Software Engineering by Ian Summerville. ISBN: 9332582699
- Software Engineering: A Precise Approach by Pankaj Jalote. ISBN: 9788126523115
- Software Engineering Fundamental By Ali Behforooz, Frederick J Hudson, Oxford University Press. ISBN: 0195681460

Online References

- *Slides* of **Ian Summerville**
  https://iansommerville.com/software-engineering-book/slides/
- *Notes* by **www.geeksforgeeks.org**
  https://www.geeksforgeeks.org/software-engineering/
- NPTEL *Videos*
  https://nptel.ac.in/courses/106/105/106105182/

Teaching Resources

- Presentations, during classroom discussion, will be available on Google in PDF format
- Various online and offline resources will be shared during course compilation

Assessment

Internal

- Online Quiz during course compilation with tools like Kahoot, Google forms etc.
- Assignment Submission through Google Classroom after every Unit of Syllabus.
- Case studies and Problem Scenario discussion after every topic
- Presentation and Report on Final Assignment

External

- As per Rajasthan Technical University – Kota's guidelines
- Previous Years Question Papers are available on www.rtu.ac.in or Examination Cell of www.technonjr.org

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Assignment -1

Answer all questions. Each carry equal marks i.e. 5

1. How to apply business and data modeling phases in RAD model [**CO1**]
2. Describe advantages and disadvantages of prototype model [**CO1**]
3. List out project management approaches   [**CO2**]
4. Describe objectives of project management   [**CO2**]
5. Define role of project manager in context of software engineering   [**CO2**]

Assignment -2

Answer all questions. Each carry equal marks i.e. 5

1. Define any 3 characteristics and 3 measuring parameters of software. **[CO1]**
2. Differentiate between verification and validation in context of V-Model of SDLC. **[CO1]**
3. List out any 7 task of project manager from both categories. **[CO2]**
4. Explain the need for SRS in context of software engineering [**CO3**]
5. Define the requirement process with its 3 phases **[CO3]**

Assignment -3 AND 4

Answer all questions. Each carry equal marks i.e. 5

[NEED TO BE COMPILED AFTER COMPILITION OF UNIT4 AND 5]

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Viva Voice Questions

Unit I – Software Development Life Cycle and Approaches
1. Why software development process is considered as life cycle?
2. What is your opinion about requirement analysis?
3. How testing effects, the quality of software?
4. What is the difference between Validation and Verification?
5. Tell me about two information gathering tools.

Unit II – Software Project Management
1. What is the difference between software development and project development?
2. What is LOC and KLOC and project estimation is compiled?
3. What is COCOMO and how it helps in project management?
4. What is RISK? What is the role of risk analysis in project management?
5. Tell me something Project Scheduling and its tools.

Unit III – Requirement Analysis
1. What are basic principles of requirement analysis?
2. What is Finite State Machine Model in Software Engineering?
3. What is Data Dictionary?
4. Discuss Data Dictionary Components.
5. Tell me role of Decision Table in structure analysis.

Unit IV – Software Design
[NEED TO BE COMPILED AFTER COMPILITION OF UNIT4]

Unit V – Software Design
[NEED TO BE COMPILED AFTER COMPILITION OF UNIT 5]

Question Papers

Dec 2019

Roll No. _____

3E1140

Total No of Pages: 3

3E1140

B. Tech. III - Sem. (Main / Back) Exam., Dec. 2019
PCC Computer Science & Engineering
3CS4-07 Software Engineering
Common For CS, IT

Time: 3 Hours   Maximum Marks: 120

Instructions to Candidates:

Attempt all ten questions from Part A, five questions out of seven questions from Part B and four questions out of five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL _____   2. NIL _____

PART – A

(Answer should be given up to 25 words only)   [10×2=20]

All questions are compulsory

Q.1 Define system engineering?

Q.2 Mention the three key elements of software engineering.

Q.3 What is the objective of various model in software engineering?

Q.4 Define the merits of the various model in software engineering.

Q.5 Why accuracy is important in the data dictionary?

Q.6　What is behavior modeling?

Q.7　What is a finite state machine model?

Q.8　Why design documentation is important in software engineering?

Q.9　Write the objective of software project planning

Q.10　What is sequence diagram in the context of UML?

PART – B

(Analytical/Problem solving questions)　　　　　　　[5×8=40]

Attempt any five questions

Q.1　Describe the Computer Based system as an organizational information system with an example. http://www.rtuonline.com

Q.2　Explain the software development life cycle with a diagram.

Q.3　What do you understand by data dictionary where and how it is used?

Q.4　Explain the object modular radiation with example.

Q.5　What is SDLC? Explain the MIS oriented SDLC model?

Q.6　Explain COCOMO estimation model in software project management.

Q.7　What is UML? Explain how it is useful in object – oriented modeling.

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions)　　　[4×15=60]

Attempt any four questions

Q.1　Discuss merits and demerits of various models of software development.

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Q.2 Write a short not on a Finite State Machine (FSM).

Q.3 Explain object – oriented analysis and its approach and explain classes and object relationship model.

Q.4 Explain major elements of DFD & CFD.

Q.5 Explain the use case diagram and state diagram in the context of UML.

3EU3024

B.Tech. III-Sem. (Main/Back) Exam Jan. 2019
Computer Science Engineering
3CSU04 Software Engineering
3EU3024
(Common to CS/IT)

Time: 3 Hours

Maximum Marks: 100
Min. Passing marks: 33

Instructions to candidates: -

PART A : Short answer questions (up to 25 words) 10 x 2 marks = 20 marks.
All ten questions are compulsory.

PART B :Analytical/Problem Solving questions (up to 100 words) 6 x 5 marks
= 30 marks. Candidates have to answer six questions out of eight.

PART C :Descriptive/ Analytical/Problem solving questions 5 x 10 marks = 50
marks. Candidates have to answer five questions out of seven.

PART A

Q1. Explain the term Software and Software Engineering.
Q2. Explain the following myth about the software "Once we write the
program and get it to work, our job is done".
Q3. Explain the following principal about the Software "The reason it all
exists."
Q4. Explain the following principal about the Software "Kiss."
Q5. What do you mean by coding? State its purpose.
Q6. Write the difference between alpha and beta testing.
Q7. Define the term cost estimation.
Q8. What is software reliability?
Q9. Discuss boundary value analysis technique.
Q10. Discuss Software Quality Assurance (SQA).

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PART B

Q1. What is software crisis? Discuss the main reasons of software crisis.

Q2. Explain functional and Non-functional requirements of Software.

Q3. What are the various responsibilities of system analyst?

Q4. Discuss software testing principles. Explain why exhaustive testing is not possible.

Q5. Differentiate between a software product and a software process.

Q6. A company needs to develop digital signal processing software for one of its newest inventions. The software is expected to have 40000 lines of code. The company needs to determine the effort in person-months needed to develop this software using the basic COCOMO model. The multiplicative factor for this model is given as 2.8 for the software development on embedded systems, while the exponentiation factor is given as 1.20. What is the estimated effort in person-months?

Q7. Write the difference between black box and white box testing methods.

Q8. Explain the following terms   i) Cohesion   ii) Coupling

PART-C

Q1. What is SRS. Write the characteristics of good SRS document.

Q2. What is Project planning? Write all the activities carried out in planning phase. http://www.rtuonline.com

Q3. What is the importance of models in software engineering? Explain with examples any two process models which are commonly used.

Q4. Discuss Risk Analysis: also give examples of various types of risk possible.

Q5. What is modularity? List important properties of modular system.

Q6. What do you mean by feasibility study? Explain different types of feasibilities.

Q7. An engineering project is modeled by the activity network shown below. The activities are represented by the arcs. The number in brackets on each arc gives the time, in days, to complete the activity. Each activity requires one worker. The project is to be completed in the shortest time
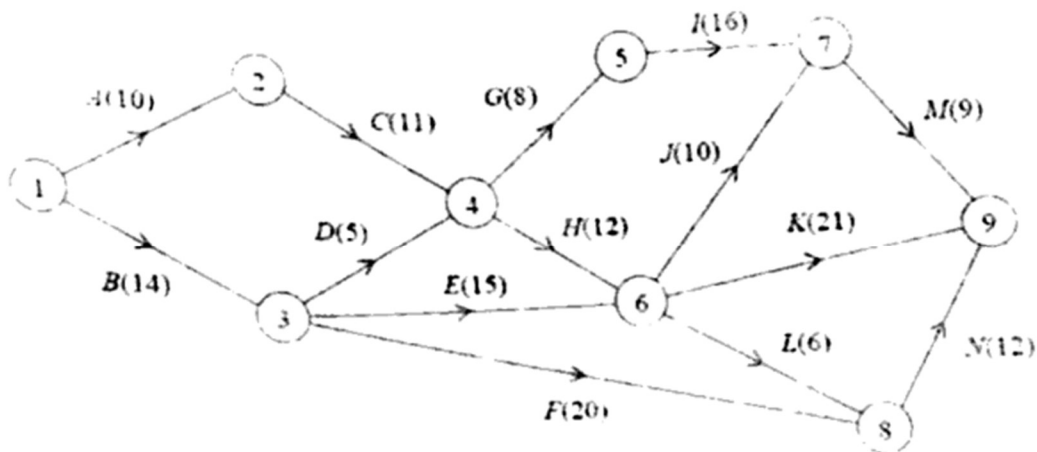
(a) Calculate the early time and late time for each event Write these in boxes in Diagram 1 in the answer book

(b) State the critical activities

(c) The chief engineer visits the project on day 15 and day 25 to check the progress of the work Given that the project is on schedule, which activities must be happening on each of these two days?

Quiz Questions: Set 1

Software Engineering Multiple Choice Questions :-

1. What are the characteristics of software?

A. Software is developed or engineered; it is not manufactured in the classical sense.
B. Software doesn't " wear out ".
C. Software can be custom built or custom builD.
D. All mentioned above

ANSWER: All mentioned above

2. Compilers, Editors software come under which type of software?

A. System software
B. Application software
C. Scientific software
D. None of the above.

ANSWER: System software

3. Software Engineering is defined as systematic, disciplined and quantifiable approach for the development, operation and maintenance of software.

A. True
B. False

ANSWER: True

4. RAD Software process model stands for _____ .

A. Rapid Application Development.
B. Relative Application Development.
C. Rapid Application Design.
D. Recent Application Development.

ANSWER: Rapid Application Development.

5. Software project management comprises of a number of activities, which contains _____.

A. Project planning
B. Scope management
C. Project estimation
D. All mentioned above

ANSWER: All mentioned above

6. COCOMO stands for _____ .

A. COnsumed COst MOdel
B. COnstructive COst MOdel
C. COmmon COntrol MOdel
D. COmposition COst MOdel

ANSWER: COnstructive COst MOdel

7. Which of the following is not defined in a good Software Requirement Specification (SRS. document?

A. Functional Requirement.
B. Nonfunctional Requirement.
C. Goals of implementation.
D. Algorithm for software implementation.

ANSWER: Algorithm for software implementation.

8. What is the simplest model of software development paradigm?

A. Spiral model
B. Big Bang model
C. V-model
D. Waterfall model

9. Which of the following is the understanding of software product limitations, learning system related problems or changes to be done in existing systems beforehand, identifying and addressing the impact of project on organization and personnel etc?

A. Software Design
B. Feasibility Study
C. Requirement Gathering
D. System Analysis

ANSWER: System Analysis

10. Which design identifies the software as a system with many components interacting with each other?

A. Architectural design
B. High-level design
C. Detailed design
D. Both B & C

ANSWER: Architectural design

Quiz Questions: Set 2

1. Software is defined as _____
   a) set of programs, documentation & configuration of data
   b) set of programs
   c) documentation and configuration of data
   d) None of the mentioned

2. What is Software Engineering?
   a) Designing a software
   b) Testing a software
   c) Application of engineering principles to the design a software
   d) None of the above

3. Who is the father of Software Engineering?
   a) Margaret Hamilton
   b) Watts S. Humphrey
   c) Alan Turing
   d) Boris Beizer

4. What are the features of Software Code?
   a) Simplicity
   b) Accessibility
   c) Modularity
   d) All of the above

5. _____ is a software development activity that is not a part of software processes.
   a) Validation
   b) Specification
   c) Development
   d) Dependence

6. Define Agile scrum methodology.
   a) project management that emphasizes incremental progress
   b) project management that emphasizes decremental progress
   c) project management that emphasizes neutral progress
   d) project management that emphasizes no progress

7. CASE stands for
   a) Computer-Aided Software Engineering
   b) Control Aided Science and Engineering

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c) Cost Aided System Experiments

d) None of the mentioned

8. _____ is defined as the process of generating analysis and designing documents?

a) Re-engineering

b) Reverse engineering

c) Software re-engineering

d) Science and engineering

9. The activity that distributes estimated effort across the planned project duration by allocating the effort to specific software developing tasks is _____

a) Project scheduling

b) Detailed schedule

c) Macroscopic schedule

d) None of the mentioned

10. What is a Functional Requirement?

a) specifies the tasks the program must complete

b) specifies the tasks the program should not complete

c) specifies the tasks the program must not work

d) All of the mentioned

Answer Set with Explanation

1. Answer: a

    Explanation: Software is a collection of programmes; it also includes documentation and data setup to enable the programmes to function. Microsoft windows, excel, word, PowerPoint, etc. are a few examples of software.

2. Answer: c

    Explanation: Software engineering is the application of engineering principles to the design, development, and support of software and it helps to solve the challenges of low-quality software projects.

3. Answer: b

    Explanation: Watts S. Humphrey created the Software Process Program at Carnegie Mellon University's Institute (SEI) in the 1980s, and served as its director from 1986 through the early 1990s. This program was designed to help participants understand and manage the software development process.

4. Answer: c

   Explanation: Software code should be written in a clear, succinct, and easy-to-understand way. Simplicity should be preserved in the program code's organization, implementation, and design. These codes should be constructed in such a way that software components (such as files and functions) are readily available. The software may be broken down into numerous parts to make it easier to comprehend and troubleshoot.

5. Answer: d

   Explanation: A software dependency is an external independent library that can range in size from a single file to numerous files and directories arranged into packages to accomplish a specified purpose and is an attribute and not an engineering activity for process.

6. Answer: a

   Explanation: Agile scrum methodology is a style of project management that emphasizes incremental progress. Each iteration is divided into two to four-week sprints, with the goal of completing the most important features first and delivering a possibly deliverable product at the end of each sprint.

7. Answer: a

   Explanation: The CASE tool's purpose is to make the work of software development and maintenance easier and more reliable.

8. Answer: b

   Explanation: The method of reverse engineering is used to uncover difficult, unknown, and hidden information about a software system.

9. Answer: a

   Explanation: Software project scheduling is the process of allocating anticipated effort to specific software developing activities and distributing it across the project's intended length. A macroscopic schedule is created in the early phases of project planning.

10. Answer: a

    Explanation: A functional requirement is a specification that describes a system or one of its components. It specifies the tasks the program must complete. A function is made up of three parts: inputs, behavior, and outputs.

References:
- https://www.sanfoundry.com/software-engineering-questions-answers/
- https://engineeringinterviewquestions.com/software-engineering-multiple-choice-questions-and-answers/