

**INTRODUCTION TO SOFTWARE ENGINEERING
(CSEN 4144)**

Time Allotted : 2½ hrs

Full Marks : 60

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
any 4 (four) from Group B to E, taking one from each group.*

Candidates are required to give answer in their own words as far as practicable.

Group - A

1. Answer any twelve:

12 × 1 = 12

Choose the correct alternative for the following

- (i) When user requirements are not complete and/or technical issues are not clear which model should be followed for software development?
 (a) Spiral model (b) Waterfall model
 (c) Prototyping model (d) RAD model
- (ii) "An SRS usually contains the following: User Characteristics, Module Structure, Functional Requirements, External Interface Requirements, and Non-Functional Requirements." – choose the odd one.
 (a) Module Structure (b) User Characteristics
 (c) Non-Functional Requirements (d) External Interface Requirements.
- (iii) Equivalence class partitioning is followed during the
 (a) white box testing (b) black box testing
 (c) verification (d) none of these
- (iv) The cyclomatic complexity of the following program fragment is
 intgcd (int x, int y) {
 while (x != y) {
 if (x > y) then
 x = x - y;
 else x = y - x;
 }
 (a) 2 (b) 3
 (c) 4 (d) 5
- (v) Which diagram is primarily used to model object interactions in a time-ordered sequence?
 (a) Use Case Diagram (b) Class Diagram
 (c) Sequence Diagram (d) State Chart Diagram
- (vi) From functional strength point of view the best type of cohesion is
 (a) coincidental (b) logical
 (c) functional (d) sequential
- (vii) The primary tool used in structured design is a
 (a) structure chart (b) data-flow diagram
 (c) program flowchart (d) module
- (viii) Which metric is used to measure the complexity of a program's control flow in White Box Testing?
 (a) Traceability Matrix (b) Equivalence Class Partitioning
 (c) Cyclomatic Complexity (d) Boundary Value Analysis
- (ix) What is the slack time (in time units) for an activity that is on the critical path of a project schedule?
 (a) One (b) Zero
 (c) Maximum (d) Infinite
- (x) What type of software maintenance will be needed to take care of a Banking system that sometimes produces incorrect Closing Balance values for account holders who make more than three withdrawals during one calendar month?
 (a) Corrective (b) Perfective
 (c) Preventive (d) Adaptive

Fill in the blanks with the correct word

- (xi) If all elements of a module perform similar operations, e.g. error handling, data input, data output, etc., the module is said to have _____ cohesion.
- (xii) When the two bubbles are interconnected directly it is referred to as _____.

- (xiii) _____ model will be preferred by a company that is planning to deploy an advanced version of the existing software in the market.
- (xiv) In UML, a _____ diagram is used to depict system states and transitions.
- (xv) Function Point Estimation considers five major components: External Inputs, External Outputs, External Inquiries, Internal Logical Files, and _____.

Group - B

2. (a) What is meant by "Non-functional Requirement" in a Software Requirement specification (SRS)? Mention three typical non-functional requirements in an SRS. [[CO1](Remember/LOCQ)]
 - (b) Provide examples of four important functional and non-functional requirements for an internet-based banking system which will allow bona fide account holders to make online transaction for payment through bank transfer within a maximum of 120 seconds any time of the day, either from a desktop / laptop or from a mobile / tab. [[CO1](Analyze/HOCQ)]
 - (c) What are the tools and techniques used for gathering requirements in SRS. [[CO1](Apply/IOCQ)]
- (1 + 2) + (3 + 3) + 3 = 12**
3. (a) What is a prototype, and under what circumstances is it beneficial to construct a prototype? Explain, in brief, using one suitable example. [[CO1](Remember/LOCQ)]
 - (b) Imagine that you have been made the Project Manager for a custom-made software application development project that is about to commence. What are the major factors you will consider before choosing a suitable SDLC model to be used for this project? Discuss in brief. [[CO1](Analyze/HOCQ)]
 - (c) Why DFD is used? What are the commonly made errors while constructing a DFD model? What are the shortcomings of DFD? [[CO1](Apply/IOCQ)]
- 4 + 3 + (1 + 2 + 2) = 12**

Group - C

4. (a) Draw a Class Diagram (methods / operations not needed) for the Materials Management System (MMS) for M/s Caddie-Luck, a famous automobile manufacturer. Make necessary assumptions and state those clearly. The following are the details as gathered from Mr. Choop Chap, the materials manager of Caddie-Luck, during the Requirement Analysis stage.
 - I. Supplier – identified by Supplier Id; has Supplier Name, City, and PIN; can supply one or more Part;
 - II. Part – identified by Part Id; has Part Name, and Price; can be supplied by one or more Supplier;
 - III. Supply – identified by Supplier Id, Part Id, and Supply Date; has Supply Quantity; can contain only one Part;
 - IV. Invoice – identified by Invoice No., and Invoice Date; has Invoice Amount; can refer to only one Supply [since partial Invoice against a Supply is not allowed];
 - V. Payment – identified by Payment No., and Payment Date; has Payment Amount, and Cheque No.; can refer to one or more Invoice [since partial Payment against an Invoice is allowed]; [[CO2](Analyse/HOCQ)]
 - (b) Represent the following situation using one UML class diagram: Bill is described by Bill-Number, Bill-Date, and Total-Amount, and must contain one or more Items; each Item is described by its Item-Name, Item-Unit-Price, Item-Quantity, and Item-Price. [[CO2](Apply/IOCQ)]
- 7 + 5 = 12**
5. A university plans to develop an automated admission system. The system should allow students to apply for multiple courses, track their application status, and submit required documents. Admission officers should be able to review applications, approve/reject candidates, and assign interview slots if needed. Professors should have access to student details once admitted. Payment processing for application fees should also be integrated.
 - (i) Draw a Use Case Diagram representing the major functionalities of the system. [[CO2](Create/IOCQ)]
 - (ii) Identify and describe at least three key actors (students, admission officers, professors) and their roles in the system. [[CO2](Analyse/LOCQ)]
- (6 + 6) = 12**

Group - D

6. (a) Explain, in brief, 'Equivalence Class Partitioning' and 'Boundary Value Analysis' approaches for testing, with suitable example(s). [[CO3](Remember/LOCQ)]
 - (b) Identify the three equivalence classes for a module that computes the square root of an input integer than can assume values in the range of 1 to 100, both included. [[CO3](Apply/IOCQ)]
 - (c) Draw the Control Flow Graph (CFG) and work out the Cyclomatic Complexity (CC) for the following program segment:


```

int find_gcd(int m, int n) {
    while (m != n) {
        if (m > n)
            then m = m - n;
        else n = n - m;
    }
    return m;
}
      
```

[[CO3](Analyze/HOCQ)]
- 4 + 3 + (3 + 2) = 12**

7. (a) Design a White Box Test suite for the following code: (Draw the control flowgraph and determine the basis set of linearly independent paths)

```

intbinary_search(intnum){
int min, max;
min = 0;
max = 100;
while(min!=max) {
    if (arr[(min+max)/2]>num)
        max = (min+max)/2;
    else if(arr[(min+max)/2]<num)
        min = (min+max)/2;
    else return((min+max)/2); }
return(-1);
}

```

[[CO3](Analyse/HOCQ)]

- (b) Differentiate between each pair below:
- (i) Functional Testing and Non-Functional Testing.
 - (ii) Integration Testing and System Testing
 - (iii) Alpha Testing and Beta testing.

[[CO3](Remember/LOCQ)]

(c) What is Regression Testing? Explain its usefulness.

[[CO3](Apply/IOCQ)]

(3 + 2) + (2 × 2) + (1 + 2) = 12

Group - E

8. (a) Answer the following questions with respect to Project Planning:
- (i) You have been working as a Software Engineer (SE) for the last three years in a software services company named “Best Software”. Now, you want to manage a new project as a Project Manager (PM) there. List any three skills /potentials that your management will like to consider you for the role of PM.
 - (ii) List any three essential activities you need to carry out as the PM for planning of a new project to develop a software application code-named “Y”. Explain the precedence ordering among these planning activities for “Y” using a suitable schematic diagram.
 - (iii) What is the full form of SPMP? Mention the typical points covered either under sections Project Resources, and Staff Organization, or under section Risk Management, in your SPMP for project “Y”

[[CO5](Apply/HOCQ)]

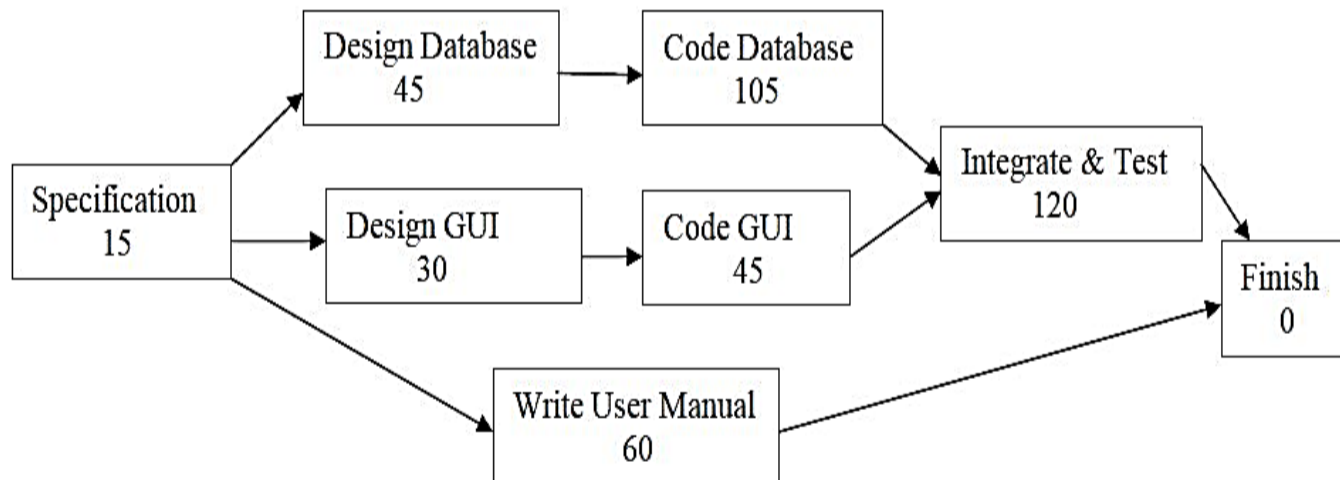
[[CO5](Analyze/IOCQ)]

[[CO5](Remember/LOCQ)]

3 + (3 + 3) + (1 + 2) = 12

9. (a) How does COCOMO II (or intermediate COCOMO) give a better estimation of the project than COCOMO I ?
- (b) For the given activity network, find the critical path and thus estimate the maximum time required to finish the project. Also draw the Gantt chart to complete the schedule.

[[CO5](Understand/LOCQ)]



[[CO6](Evaluate/HOCQ)]

3 + 2 + 1 + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	28.13	32.29	39.58

