SOFTWARE ENGINEERING
(CSEN 3201)

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) Which of the following is not a non-functional requirement?
(a) Usability
(b) Reliability
(c) Performance
(d) Security.

(ii) Which of the following best describes a product backlog?
(a) A set of failed test cases from a previous iteration of development
(b) Some feature that was implemented in the background of the system
(c) A list of "to do" items for the development team which may include features desired by the customer
(d) None of the other choices.

(iii) In an object-oriented software system, instances of classes communicate amongst themselves through which of the following?
(a) Attributes
(b) Method calls
(c) Constructors
(d) None of the other choices.

(iv) A component that performs a single task, requiring little interaction with other components in other parts of a system indicates relatively high levels of which of the following?
(a) Optimization
(b) Efficiency
(c) Cohesion
(d) Coupling.

(v) Which of the following is depicted in a class diagram in the Unified Modelling Language (UML)?
(a) Intercommunication between classes
(b) Attributes and methods of classes
(c) Conditional logic in the methods of classes
(d) All of the other choices.

(vi) McCabe's cyclomatic complexity determines
(a) upper bound on the number of linearly independent paths
(b) lower bound on the number of linearly independent paths
(c) the time complexity of the linearly independent paths
(d) the space complexity of the linearly independent paths

(vii) Which statement below is wrong about a Linearly independent path?
(a) May contain some edges that belong to some other linearly independent paths
(b) Will contain some edges that do not belong to some other linearly independent paths
(c) Will always be from start node to end node
(d) None of the above

(viii) The objective of Boundary Value analysis is
(a) to increase the number of test cases
(b) to reduce the number of test cases
(c) to design an exhaustive set of test cases
(d) to avoid errors like < instead of <=

(ix) Suppose a software is found to have a bug which has to be fixed. This type of maintenance is called
(a) Adaptive maintenance
(b) Perfective maintenance
(c) Corrective maintenance
(d) Preventive maintenance.

(x) Function Point is better than LOC
(a) Because Function point only considers coding activity
(b) Because Function points avoid coding complexities
(c) Because function point considers different problem characteristics
(d) Because Function point calculation is easy.

Fill in the blanks with the correct word

(xi) The most important feature of spiral model is _____.

(xii) Coupling between two modules is nothing but a measure of the degree of _____ between them.

(xiii) Boundary value analysis belongs to _____.

(xiv) The testing have been stopped when _____.

(xv) _____ is related to the overall functionality of the delivered software.

Group - B

2. (a) Suppose you are leading a team of software engineers which has been entrusted with the task of developing the software for the navigation system of an unmanned moon rover. The rover is designed to be active on the moon only for a specific duration, after which it will be abandoned. Should the Waterfall model or the Agile model be used in developing the software for the navigation system of this rover? Justify your answer in no less than six sentences. *[(CO2)(Evaluate/HOCQ)]*

(b) Among the activities in the software development life cycle (SDLC), which one is the most difficult to automate, and which one is the least difficult to automate? Justify each choice in no less than three sentences for each case. *[(CO1)(Apply/IOCQ)]*

(c) In the context of iterative and incremental software development, what is meant by an "iteration" and what is meant by an "increment"? Explain each concept with a suitable example. *[(CO2)(Apply/IOCQ)]*

4 + (2 + 2) + (2 + 2) = 12

3. (a) Which of the following artifacts is most useful for identifying analysis classes: user stories, use cases, or use case diagrams? How are analysis classes identified from that particular artifact? *[(CO1)(Understand/LOCQ)]*

(b) Explain for which type of software development Agile is the worst choice. *[(CO1)(Evaluate/HOCQ)]*

(c) Why Spiral Model is also called a Meta model? When Spiral model is the worst choice? *[(CO1)(Understand/LOCQ)]*

4 + 4 + (2 + 2) = 12

Group - C

4. (a) What do you mean by Cohesion? Briefly explain any two types of Cohesion with example(s). *[(CO2)(Understand/LOCQ)]*

(b) Identify a UML diagram that represents a static view of the system, and give an example. Identify a UML diagram that represents a dynamic view of the system, and give an example. *[(CO2)(Remember/LOCQ)]*

(c) "Use case descriptions and use case diagrams represent the same information in two different forms." Is this a true statement? Justify your answer with examples. *[(CO2)(Analyse/IOCQ)]*

(2 + 2) + (2 + 2) + 4 = 12

5. (a) Let us assume that you are given the task of writing a program to add, subtract, multiply, and divide two complex numbers. As user inputs, the program should be able to accept the two complex numbers, and the specific operation to be performed with the inputs. As output, the program should be able to present the result of the operation performed. Draw a functional decomposition diagram for this program and explain different components of the diagram. *[(CO2)(Apply/IOCQ)]*

(b) Analyse the following description of a system's functionality and identify the probable code components and their methods/functions. Describe the approach you used in the analysis process. *[(CO2)(Evaluate/HOCQ)]*

Administrator shall access the transaction information for a particular account on a periodic basis from the existing backend database. Administrator shall record the transaction information for a particular account accessed from the backend database in the system. Only successful transactions need to be available in the system for viewing within 48 hours after they have been initiated by the user. Users will be notified of failed transactions through procedures outside the scope of system's current release.

(c) With suitable example explain the differences between aggregation and composition. *[(CO2)(Apply/IOCQ)]*

4 + 6 + 2 = 12

Group - D

6. (a) With an example show how equivalence class partitioning helps us to have a good test suite. *[(CO3)(Understand/LOCQ)]*

(b) With an example explain how boundary value analysis is done. *[(CO3)(Apply/IOCQ)]*

(c) With an example compare and contrast between branch coverage and path coverage. *[(CO4)(Understand/LOCQ)]*

(d) Define the notion of a linearly independent path. *[(CO2)(Remember/LOCQ)]*

3 + 3 + 4 + 2 = 12

7. (a) Between lines of code (LOC) and function points (FP), which one do you think is a more effective metric for estimating a system's size? Justify your answer with examples. *[(CO3)(Analyse/HOCQ)]*

(b) Design a White Box Test suite for the following code:
(Construct the control flow graph and determine the basis set of linearly independent paths). *[(CO3)(Create/HOCQ)]*

```
#include <stdio.h>
int main()
{
   int n1, n2, i, gcd;

   printf("Enter two integers: ");
   scanf("%d %d", &n1, &n2);

   for(i=1; i <= n1 && i <= n2; ++i)
   {
      // Checks if i is factor of both integers
        if(n1%i==0 && n2%i==0)
                gcd = i;
   }

   printf("G.C.D of %d and %d is %d", n1, n2, gcd);

   return 0;
}
```

4 + (3 + 2 + 3) = 12

Group - E

8. (a) Write three limitations of LOC (Lines of Code) metric of project size estimation. *[(CO4)(Remember/LOCQ)]*

(b) Assume that the size of an organic type software product has been estimated to be 32K lines of source code. Assume that the average salary of software engineers be Rs. 30,000/- per month. Determine the effort required to develop the software product, the nominal development time and cost required to develop the product. The constants for each category of software products are given below: *[(CO5)(Evaluate/HOCQ)]*

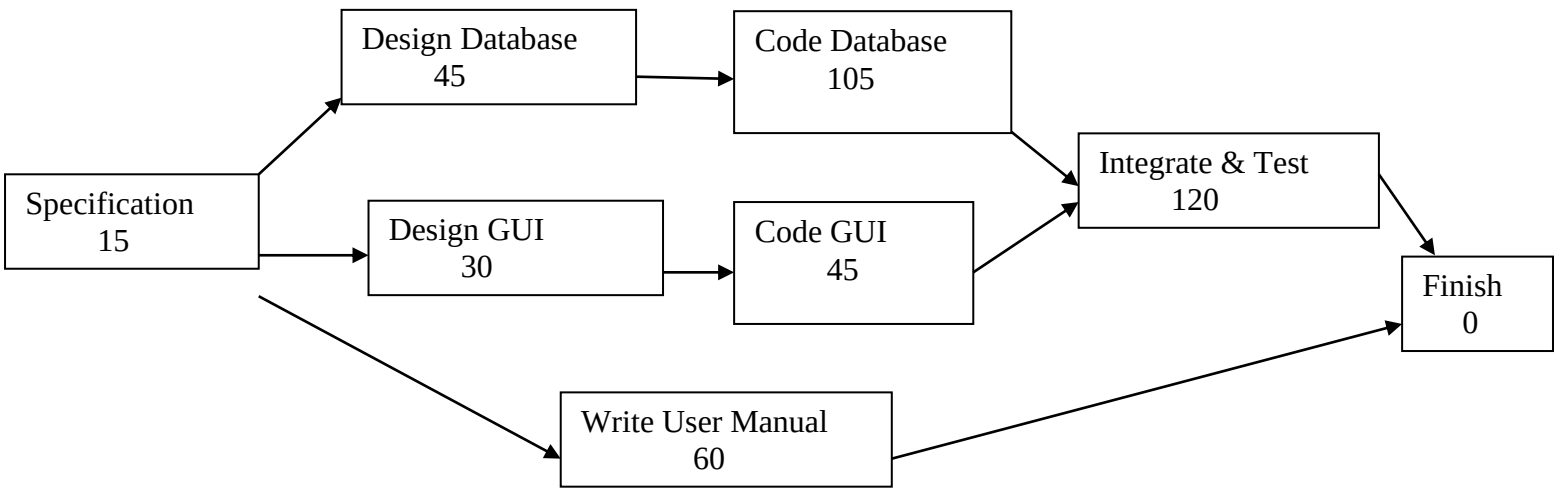
Project	a1	a2	b1	b2
Organic	2.4	1.05	2.5	0.38
Semidetached	3.0	1.12	2.5	0.35
Embedded	3.6	1.20	2.5	0.32

(c) With examples compare and contrast between corrective and adaptive maintenance. *[(CO4)(Analyze/IOCQ)]*

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

9. (a) In the context of software development, what is change control? What is a change request? What do the "check-in" and "check-out" processes accomplish? *[(CO6)(Analyse/IOCQ)]*

(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.



[(CO6)(Evaluate/HOCQ)]

4 + (4 + 4) = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	29.16	30.2	40.6

Course Outcome:
After completion of the course, students will be able to:

CO1: Propose a software life cycle model for the given requirements and compile software requirement specifications as per IEEE guidelines.
CO2: Develop function-oriented design and/or object-oriented design for software systems using industry standard techniques.
CO3: Apply the knowledge of different coding standards and/or guidelines and propose test cases for sample software system modules in different testing methods.
CO4: Compare and contrast among different types of software maintenance and to decide on the maintenance models to be employed depending on the situation.
CO5: Apply different project management strategies for project planning such as to estimate the project size, duration and cost.
CO6: Apply the ideas of different project monitoring and control techniques such as WBS, Activity Network, PERT chart, Critical path etc. to efficiently monitor and control the project. They will be able to identify different software project risks and determine their mitigation approaches.