SOFTWARE ENGINEERING
(CSEN 3201)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and <u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> from each group.

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

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) Decision table is preferred
(a) when the number of conditions is small
(b) when order of decision is a critical issue
(c) when the number of conditions is large
(d) none of the above.

(ii) 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.

(iii) Which diagram is used to model object interactions arranged in chronological order
(a) Sequence diagram (b) Use-case diagram
(c) Context diagram (d) Activity diagram.

(iv) Consider the following pseudo-code

```
If (A > B) and (C > D)
then A = A + 1
B = B + 1
End if
```

The cyclomatic complexity of the pseudo-code is
(a) 2 (b) 3 (c) 4 (d) 5.

(v) From functional strength point of view the best type of cohesion is
(a) coincidental (b) logical
(c) functional (d) sequential.

(vi) Two modules are said to be highly coupled when they have
(a) control coupling (b) content coupling
(c) data coupling (d) stamp coupling.

(vii) The SRS is said to be *consistent* if and only if
(a) its structure and style are such that any changes to the requirements can be made easily while retaining the style and structure
(b) every requirement stated therein is one that the software shall meet
(c) every requirement stated therein is verifiable
(d) no subset of individual requirements described in it conflict with each other.

(viii) Consider the following Statement: "The data set will contain an end of file character." What characteristic of SRS is being depicted here?
(a) Consistent (b) Non-verifiable
(c) Correct (d) Ambiguous.

(ix) Equivalence class partitioning is followed during the
(a) white box testing (b) black box testing
(c) verification (d) none of these.

(x) 'Balancing of DFD' is means
(a) conservation of inputs and outputs at various levels
(b) Sub dividing a process into smaller sub processes
(c) Labeling of all data items
(d) Allowing data flows to take place only to or from processes.

Group- B

2. (a) Why is the SRS document also known as the black box specification of a system? Explain. [(CO1)(Remember/LOCQ)]

(b) A Library Membership Software (LMS) should support the following three options : (i) New member
(ii) Renewal
(iii) Cancel membership.

When the new member option is selected, the software should ask for the member's name, address and phone number. If proper information is entered, the software should create a membership record for the new member with membership id and print a bill for the annual membership charge and the security deposit payable. If the renewal option is chosen, the LMS should ask for the membership id. If the membership id is valid, then the membership expiry date in the membership record should be updated and the annual membership charge payable by the member should be printed. If the membership id is not valid, an error message will be displayed. If the cancel membership option is selected, the system should ask for the membership id again. If the membership id is valid, then the membership cancellation process can be executed and a cheque for the balance amount due to the member is printed and membership record will be deleted.

Draw Decision Tree and also implement Decision Table for the system. [(CO1)(Analyze/IOCQ)]

2 + (5 + 5) = 12

3. Answer the following:
   (i) Explain for which type of software development spiral model is suitable? [(CO1)(Evaluate/HOCQ)]
   (ii) Discuss the benefits of adopting Agile. [(CO1)(Evaluate/HOCQ)]
   (iii) Explain the key features of Scrum? [(CO1)(Understand/LOCQ)]

(4 + 4 + 4) = 12

Group - C

4. With respect to Software Design:
   (i) State the most desirable combination of Cohesion and Coupling for good design. [(CO2)(Understand/LOCQ)]
   (ii) Briefly explain any two types of Cohesion with example(s). [(CO2)(Understand/LOCQ)]
   (iii) Briefly explain any two types of Coupling with example(s). [(CO2)(Understand/LOCQ)]
   (iv) Rank the different types of Coupling, in order of most to least desirable. [(CO2)(Understand/LOCQ)]

(2 + 4 + 4 + 2) = 12

5. (a) The main function of a vending machine is to allow a customer to buy product(s) from the machine (candy, chocolate, soda, juice, etc.). When the customer wants to buy some of the products offered by the vending machine, he/she inserts money into the machine, selects one or more products, and the machine dispenses the selected product(s) to the customer. Should the products cost less than the amount of money the customer put in the machine, the vending machine shall dispense change. Also, the vending machine needs to be restocked when it runs out of certain products. In addition, there must be a provision for a person (say, a collector) to collect money from the vending machine.
   (i) Identify the potential actors for such a vending system and draw a use-case diagram that clearly depicts the actors, the system boundary, and the use-cases with which the actors interact.
   (ii) Define two possible scenarios for two of your use cases. Capture the typical scenarios; do not worry about abnormal cases at this point.
   Mention two of exception-cases that we might need to handle in the vending machine system. [(CO2)(Analyze/IOCQ)]

   (b) Distinguish between a data flow diagram and a flow chart. [(CO2)(Remember/LOCQ)]

10 + 2 = 12

Group - D

6. (a) Identify three equivalence classes for testing of a program module that computes the square root of an input integer that can assume values in the range of 100 to 900, both included. [(CO1)(Remember/LOCQ)]

   (b) Consider the following C function named sort.

```
/* sort takes an integer array and sorts it in ascending order */
void sort ()
        {
        int i, j;
                for (i=0; i <n-1; i++)
        for (j=i+1; j<n; j++)
        if (a[i] > a[j])
         { temp=a[i];
                a[i]=a[j];
        a[j]=temp;
        }
}
```

Determine the cyclomatic complexity of the *sort* function. Design a test suite for the function *sort* using the following white-box testing strategies (Show the important steps in your test suite design method).

(i) Statement coverage
(ii) Branch coverage
(iii) Condition coverage
(iv) Path coverage. [(CO3)(Understand/HOCQ)]

3 + (3 + 6) = 12

7. (a) Briefly explain the role of 'Stub' and 'Driver' for Unit Testing of modules.
[(CO3)(Remember/LOCQ)]

(b) What is the difference between verification and validation?
[(CO3)(Understand/LOCQ)]

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

```
int binary_search(int num)
        {
                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);
        }
```

(d) Why mixed integration testing is mostly preferred and commonly used integration testing approach over top-down and bottom-up approaches?
[(CO3)(Analyze/IOCQ)]

2 + 2 + 5 + 3 = 12

Group - E

8. In the context of Software Maintenance:

(i) What are the different types of maintenance that a software product / system / application might need? Explain, in brief, with suitable example(s).
[(CO4)(Remember/LOCQ)]

(ii) Mention any <u>three</u> factors on which software maintenance activities depend.
[(CO4)(Understand/LOCQ)]

(iii) List the typical activities needed to fix some programming defects in a Payroll system that produces incorrect Monthly Pay-slips for employees having Overtime Hours during that month. [(CO4)(Apply/IOCQ)]

(6 + 3 + 3) = 12

9. (a) Following are the

Notation	Activity Effort	person-months
T1	Requirements specification	1
T2	Design	2
T3	Code actuator interface module	2
T4	Code sensor interface module	5
T5	Code user interface part	3
T6	Code control processing part	1
T7	Integrate and test	6
T8	Write user manual	3

The precedence relation Ti ≤ {Tj, Tk} implies that the task Ti must complete before either task Tj or Tk can start. The following precedence relation is known to hold among different tasks: T1 ≤ T2 ≤ {T3, T4, T5,
T6} ≤ T7.,T1<T8

(i) Draw the Activity network representation of the tasks.
(ii) Determine ES, EF and LS, LF for every task.
(iii) Determine the critical path.
(iv) Develop the Gantt chart representations for the project.
[(CO5)(Understand/IOCQ)]

(b) Explain in detail about Delphi Estimation technique.
[(CO3)(Understand/LOCQ)]

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

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	39.58	37.5	22.92

Course Outcome (CO):

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

1. CO1: Propose a software life cycle model for the given requirements and compile software requirement specifications as per IEEE guidelines.

2. CO2: Develop function-oriented design and/or object-oriented design for software systems using industry standard techniques.
3. CO3: Apply the knowledge of different coding standards and/or guidelines and propose test cases for sample software system modules in different testing methods.
4. CO4: Compare and contrast among different types of software maintenance and to decide on the maintenance models to be employed depending on the situation.
5. CO5: Apply different project management strategies for project planning such as to estimate the project size, duration and cost.
6. 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.

*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question