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 any 5 (five) from Group B to E, taking at least one 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) Various notations that are commonly used are ……., data-flow diagrams, structure charts, decision table, and program design language.
(a) Circles (b) Flowcharts
(c) Gantt charts (d) Rayleigh curves.

(ii) As a design notation, structure charts show the ……. and …….. flow between modules.
(a) control and information (b) circular and data
(c) control and data (d) regular and irregular.

(iii) Program design language is a language that is used to specify the system design using natural language (English) along with the constructs of a …….
(a) Hindi language (b) Binary language
(c) Programming language (d) Both (b) and (c).

(iv) A module is said to have *logical cohesion*, if
(a) it performs a set of tasks that relate to each other very loosely.
(b) all the functions of the module are executed within the same time span.
(c) all elements of the module perform similar operations, e.g., error handling, data input, data output etc.
(d) None of the above.

(v) High coupling among modules makes it
(a) difficult to understand and maintain the product
(b) difficult to implement and debug
(c) expensive to develop the product as the modules having high coupling cannot be developed independently
(d) all of the above.

(vi) The cyclomatic complexity of the following program fragment is:

```
int gcd (int x, int y) {
   while (x != y) {
      if (x > y) then
         x = x – y;
      else   x = y – x;
    }
    return x;
}
```

(a) 2 (b) 3 (c) 4 (d) 5

(vii) 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.

(viii) Component testing is also known as:
(a) Alpha testing (b) Unit testing
(c) Ad hoc testing (d) Beta testing.

(ix) Which of the following is not a step of debugging?
(a) Defect analysis (b) Testing
(c) Defect resolution (d) Defect Identification

(x) As a software manager, when you will decide the number of people required for a software project?
(a) Before the scope is determined.
(b) Before an estimate of the development effort is made.
(c) After an estimate of the development effort is made.
(d) None of the above.

Group – B

2. (a) What is meant by "Non-functional Requirement" in a Software Requirements Specification (SRS)? Mention <u>three</u> typical non-functional requirements in an SRS.

(b) Provide examples of <u>four</u> important *functional* and *non-functional* requirements for an *internet-based banking system* which will allow bonafide 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.

(1 + 3) + (4 + 4) = 12

3. (a) Briefly discuss two most popular reasons of adopting Agile model.

(b) Briefly describe one situation when Agile is <u>not</u> the best choice of development?

(c) What is "Scrum Sprint"?

(d) What do you understand by "Daily Stand-Up" (or "Daily Scrum")?

(e) What is the difference between Waterfall and Agile models?

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

Group – C

4. (a) "If modules X and Y operate on the same input and output data, then the cohesion is Communicational" – Justify the assertion.

(b) Do you agree with the statement -- "A design solution that is difficult to understand would lead to increased development and maintenance cost?" Give reasoning's for your answer.

(c) What do you mean by the terms cohesion and coupling in the context of software design? How are these concepts useful in arriving at a good design of a system?

(d) Is it true that whenever you increase the cohesion of your design, coupling in the design would automatically decrease? Justify your answer by using suitable examples.

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

5. (a) Name any three types of cohesion that modules can have in software design. Grade these three in terms of from 'High' to 'Low'.

(b) Name any three types of coupling that modules can have in software design. Grade these three in terms of from 'Low' to High'.

(c) How is control coupling between two modules represented in a Structure Chart (SC)?

(d) Identify and create use cases and actors for the problem statement stated below:
The CSE students and Faculty use the Library System. The Library contains Books and Journals. Books can be issued to both the Students and Faculty. Journals can only be issued to the Faculty. The Librarian can only issue books and Journals. The deputy-Librarian is In-charge of receiving the Returned Books and Journals. Each student is provided with three Library cards for using the facilities of the Library. Students can be issued only three books on their available cards at a time. On the issue of the books the Librarian specifies a date on which the students are expected to return the book. In case they are unable to do so, they will be charged with a fine of Rs 2 per day. The Accountant is responsible for receiving the fine for over-due books. Each Faculty is provided with a Library member ID. Faculties can be issued a maximum of five books at a time. The issue of Journals and Books to the Faculties is also performed in the same manner. Faculties are not charged with any fine.

3 + 3 + 2 + 4 = 12

Group – D

6. (a) What is the relation between error, fault and failure?

(b) Distinguish between alpha, beta and acceptance testing. How are the test cases designed for these tests?

(c) The following program is written to print the value of c that is considered as user input, ranging between -138 to +117, including 0.

```
int main() {
  char c;
  printf("Enter a number:"); scanf("%d",&c);
  c+=10;
  printf("%d",c); return 0;
}
```

(i) Design the Equivalence Classes of Test Cases for testing the above program.
(ii) Identify the Test Cases for Boundary Value Analysis of the said program.

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

7. (a) What is meant by a Stub? What is a Driver?

(b) With some suitable examples, explain statement coverage, branch coverage and path coverage criteria.

(c) Design a white box suite for the following piece of C code:

```
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 0;
}
```

The suite should include Control Flow Graph, Independent Path and Cyclomatic Complexity (using two different techniques).

(1 + 1) + 4 + (2 + 2 + 2) = 12

Group – E

8. (a) Define the meaning of software quality and detail the factors which affect the quality and not the productivity of a software product.

(b) Adding more people to a **late software project** leads to more delay. Do you agree? Can there be situations when this statement is false? Give reasons in both the cases whether you agree.

(c) An organization assumes that no risks will occur during software development and neglects identifying and managing risks. Is the assumption of the organization correct? Why or why not.

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

9. (a) A project size of 200 KLOC is to be developed. S/W development team has average experience on similar type of projects. The project schedule is not very tight. Calculate the effort and development time of the project. The constants for each category of software products are given below:

Project	a_1	a_2	b_1	b_2
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

(b) The following table indicates the various tasks involved in completing a software project, the corresponding activities, and the estimated effort for each task in person-months.

Notation	*Activity*	*Effort in person-months*
T_1	Requirements Specification	1
T_2	Design	2
T_3	Code actuator interface module	2
T_4	Code sensor interface module	5
T_5	Code user interface part	3
T_6	Code control processing part	1
T_7	Integrate and Test	6
T_8	Write user manual	3

The precedence relation $T_i \leq \{T_j, T_K\}$ implies that the task T_i must complete before either task T_i or T_k can start. The following precedence relation is known to hold among different tasks: $T_1 \leq T_2 \leq \{T_3, T_4, T_5, T_6\} \leq T_7$. Draw the **Activity network** and the **Gantt chart** representations for the project. Find out the **critical path**.

(1.5 + 1.5) + (4 + 3 + 2) = 12

Department & Section	Submission Link
CSE Sec A	https://classroom.google.com/c/Mjk4ODQ2MjQxMDY3/a/MzY0NTMwOTMxODkx/details
CSE Sec B	https://classroom.google.com/c/Mjk1NjM2ODE1NTQ1/a/MzY0MzE2NzYwOTQw/details
CSE Sec C	https://classroom.google.com/c/Mjk5MzI1NDE2NjYx/a/MzY0NTI2OTQ1Nzg3/details