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
<u>any 4 (four)</u> from Group B to E, taking <u>one</u> 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 is NOT a non-functional requirement?
(a) Efficiency   (b) Reliability   (c) Product features   (d) Stability.

(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) On which of the following is Agile Software Development based?
(a) Linear Development   (b) Incremental development
(c) Iterative Development   (d) Both Incremental and Iterative Development.

(iv) 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;
}
(a) 2   (b) 3   (c) 4   (d) 5

(v) Black-box testing attempts to find errors in which of the following categories?
(a) Incorrect or missing functions   (b) Interface errors
(c) Performance errors   (d) All the above.

(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) Which type of coupling is considered to be the lowest?
(a) Stamp   (b) Data   (c) Control   (d) Common.

(viii) The approach used in top-down analysis and design is
(a) to identify the top level functions by combining many smaller components into a single entity
(b) to prepare flow charts after programming has been completed
(c) to identify a top level function an d then create a hierarchy of lower-level modules and components.
(d) all of the above.

(ix) What does COCOMO acronym stand for?
(a) Collective Cost Estimation Model   (b) Complete Cost Estimation Model
(c) Constructive Cost Estimation Model   (d) Common Cost Estimation Model.

(x) Estimation of software development effort for organic software in basic COCOMO is
(a) $E=2.0(KLOC)^{1.05}$ Per Month   (b) $E=3.4(KLOC)^{1.06}$ Per Month
(c) $E=2.4(KLOC)^{1.05}$ Per Month   (d) $E=2.4(KLOC)^{1.07}$ Per Month.

Fill in the blanks with the correct word

(xi) If data-items EMP-DOB, EMP-SEX and TOT-EARN from module CALC-EARN are passed on to module CALC-ITAX, then these two modules are said to have _____ coupling.

(xii) A company needs to develop digital signal processing software for one of its newest inventions. The software is expected to have 20000 LOC. The company needs to determine the effort in person-month needed to develop this software using basic COCOMO model. The multiplicative factor for this model is given as 2.2 for the software development on embedded systems, while the exponentiation factor is given as 1.50. The estimated effort is _____ person-month.

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

(xiv) Quality Management is known as _____.

(xv) _____ threatens the quality and timeliness of the produced software.

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)(Remeber/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) For which type of software development, spiral model is suitable? — Explain. *[(CO1)(Apply/IOCQ)]*

   (b) Smart Stock Enterprises (SSE), one Pune-based start-up organization, specializing in customer services for stock-trading, has decided to engage Heritage Software Services (HSS), a promising software services company based at Kolkata, as the vendor for fresh development of IndiSmartTrader (IST), SSE's online stock trading application system. The development must start from 01-Oct-2017 and the developed IST has to go-live at SSE's Mumbai data centre from 01-Apr-2018 but its User Acceptance Test (UAT) at SSE's Pune corporate centre must commence from 01-Mar-2018
   HSS has formed a team of system analysts and you are a part of it. This team, in its first team meeting, is debating on which SDLC model to use: (A) 'Iterative Waterfall', or (B) 'Rapid Prototyping'. A couple of team members are even suggesting adoption of some 'Agile' model. Are you in favor of or against using Agile model here? Mention four points on the pros and cons of using 'Iterative Waterfall' model or 'Rapid Prototyping' model (but not for both). *[(CO1)(Analyze/HOCQ)]*

   (c) Draw DFD (level-0, level-1) for Hotel Management System. *[(CO1)(Remember/LOCQ)]*

   3 + 5 + (2 + 2) = 12

Group - C

4. (a) Name any three types of cohesion that modules can have in software design. Grade these three in terms of from 'High' to 'Low'. *[(CO2)(Understand/LOCQ)]*

   (b) Name any three types of coupling that modules can have in software design. Grade these three in terms of from 'Low' to High'. *[(CO2)(Understand/LOCQ)]*

   (c) 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. *[(CO2)(Analyze/HOCQ)]*

   3 + 3 + 6 = 12

5. (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

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) {
        f (m > n)
        then m = m – b;
        else n = n – m;
    }
      return m;
}
```
[(CO3)(Analyze/HOCQ)]

4 + 3 + (3 + 2) = 12

7. (a) A program named QES (Quadratic Equation Solver) is developed to find the roots of a quadratic equation: $ax^2 + bx + c = 0$, where a, b, c are assumed to be user inputs, and each of these are considered as single-digit integers ranging between –9 to +9, including 0. Identify the Test Cases for Boundary Value Analysis for QES. *[(CO3)(Analyse/HOCQ)]*

(b) 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. *[(CO3)(Remember/LOCQ)]*

(c) Why Mixed integration testing is mostly preferred and commonly used for integration testing approach over top-down and bottom-up approaches? *[(CO3)(Apply/IOCQ)]*

4 + 4 + 4 = 12

Group - E

8. 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. *[(CO5)(Apply/HOCQ)]*

(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. *[(CO5)(Analyze/IOCQ)]*

(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)(Remember/LOCQ)]*

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

9. (a) Explain in detail the basic COCOMO model. Why COCOMO model preferred over other available models. *[(CO5)(Understand/LOCQ)]*

(b) Consider the following information.

Task	Activity Effort	Person-Month
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, LS, LF for every task.

(iii) Determine the critical path.

(iv) Develop the Gantt chart representation for the project. *[(CO6)(Analyze/HOCQ)]*

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

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	28.13	25	46.87