Q1. (a) Explain the following terms:
   (i) Software engineering
   (ii) Software process model [4 Marks]

   (b) Briefly explain the four fundamental activities which are common to all software processes. [4 Marks]

   (c) What are the major causes of software project failure identified by the Standish group in the CHAOS report? [3 Marks]

   (d) Use a diagram to illustrate the waterfall software process. [3 Marks]

   (e) Briefly explain the advantages the iterative/incremental approach has over the traditional waterfall model of the software process. [2 Marks]

   (f) Identify the advantages/disadvantages of prototyping. [2 Marks]

   (g) Explain what is meant by the following terms when applied to software process:
       (i) Agility
       (ii) Iteration [4 Marks]

   (h) Rewrite the following (vague) requirements so that they may be objectively validated:
       (i) The system should have a good response time.
       (ii) The system must be reliable
       (iii) The system must be operated with minimum training. [3 Marks]
Q2. (a) Explain what is meant by the term requirements engineering? [2 Marks]

(b) What is the purpose of document sampling technique as a fact-finding technique? [2 Marks]

(c) Differentiate between the following types of requirements when developing a software system:
   (i) Functional Requirements
   (ii) Non Functional Requirements [2 Marks]

(d) Using the following diagram to illustrate your answers explain what is meant by the following terms as used in relation to use case diagrams:
   (i) Actor
   (ii) Extends dependency relationship
   (iii) Includes/uses dependency relationship
   (iv) Association relationship
   (v) Extension point
   (vi) Scenario
   (vii) Generalization relationship
   (viii) Flow of events [8 Marks]

Order Processing system

(e) Use cases are an increasingly popular requirements modelling technique. However, hunting down every possible user or system behaviour is not simple; it requires lateral thinking and venturing out of the box. Frequently, practitioners give up too easily and simply let use cases terminate. Give an overview of a technique that could be used to help identify use case scenarios. [4 Marks]

(f) Give an overview of the different types of use cases. [5 Marks]

(g) Differentiate between software analysis and software design. [2 Marks]
Q3. (a) What is the purpose of modelling software? [2 Marks]

(b) Give an overview of each of four main reasons for using UML. [4 Marks]

(c) The vocabulary of the UML encompasses three kinds of building blocks: What are these? [3 Marks]

(d) Describe the three properties of objects. [3 Marks]

(e) Draw an object diagram representing the objects and relationships implied by the following description.

The Cork city library holds the following books among many others: ‘History of World War 2’, ‘The adventures of Robin Hood’ and two copies of ‘Harry Potter and the philosophers stone’. Joe and Martina are registered users of the library. Joe currently has the ‘Adventures of Robin Hood’ out on loan, and Martina has borrowed the ‘History of World War 2’ and one copy of ‘Harry Potter and the philosopher’s stone’. Your model should represent the date by which a borrowed book should be returned. Consider carefully which object should store this piece of data. [7 Marks]

(f) Explain the following terms when used with objects:

(i) Encapsulation

(ii) Polymorphism

(iii) Generalization/ specialization [6 Marks]
Q4. (a) Give a brief description of the following properties of associations Use examples to illustrate your answer:

(i) Association name
(ii) Self association
(iii) Multiplicity
(iv) Role name
(v) Navigation

(b) Differentiate between the following and illustrate how each is modelled in UML.

(i) Class and object
(ii) Abstract class and Concrete class
(iii) Class scoped attribute and instance scoped attribute
(iv) Link and association
(v) Class and Interface

(c) Draw a class diagram for the following specification for a hospital system. Include classes, relationships, multiplicity, navigability, and attributes.

Document any assumptions you make.

Most patients are assigned to a ward on admittance and each ward may contain many patients. However, consultants (Senior surgeons) at the hospital may have private patients who are assigned to private rooms. The information to be recorded about a patient includes a medical number, name address, etc. A nurse is assigned to a ward. S/He cannot be assigned to more than one ward. A ward may have any number of nurses assigned to it. Nurses are identified by their staff number and each ward has a unique number. A patient may have a number of operations. The information to be recorded about an operation includes the type of operation, the patient, the surgeons, date time, and location.

Only one surgeon may perform an operation., any other surgeons present being considered as assisting at the operation. Surgeons come under the direction of consultants who also perform or assist at operations. Information recorded on surgeons include name, address, phone number, etc.

An operation can be performed in only one theatre but a given theatre may be the location of many operations. Each theatre has an identifying number. A nurse may be assigned to a theatre and S/He cannot be assigned to more than one theatre. A theatre may have many nurses assigned. There are several categories of nurses including staff nurse, junior nurse and trainee nurse.
Q5. (a) Differentiate between the following types of classes and show how they can be modeled in UML.
   (i) Entity Class
   (ii) Boundary class
   (iii) Control Class [6 Marks]

(b) What is the purpose of interaction diagrams? [2 Marks]

(c) Differentiate between sequence diagrams and collaboration diagrams. [2 Marks]

(d) Use the following diagram to explain the following terms that are used with sequence diagrams:
   (i) Message
   (ii) Activation
   (iii) Lifeline
   (iv) Object
   (v) Self Delegation [5 Marks]

(e) How is the creation and destruction of an object shown on a sequence diagram? [2 Marks]

(f) A computer network has four workstations attached to it, numbered from 1 to 4. There are three registered users of the network, A, B, C. A is currently logged onto workstations 1 and 3, and C is logged onto workstation 4.
   (i) Draw an object diagram representing the objects and relationships implied in this description.
   (ii) Add to the diagram messages that might be sent in response to a request to the network to determine the number of currently unused workstations
   (iii) Add to the diagram messages that might be sent in response to the request to determine if a particular user is logged on. [8 Marks]
Q6. (a) Differentiate between the following:
   (i)  Software verification and software validation
   (ii) Static verification and dynamic verification
   (iii) Testing and Debugging  [6 Marks]

   (b) What are the primary advantages of software inspections?  [2 Marks]

   (c) What is meant by software testability?  [2 Marks]

   (d) Use a model to illustrate the defect testing process.  [4 Marks]

   (e) One approach to defect testing is Black-box. Give an overview of this approach and identify the type of defects that can be found.  [4 Marks]

   (f) What distinguishes software management from other types of management?  [3 Marks]

   (g) Give an overview of the major activities involved in a software risk management process.  [4 Marks]