UNIT 2 GUIDELINES AND SUGGESTIONS

Structure **Page Nos.**

2.0 INTRODUCTION

The purpose of this unit is to provide some guidelines and suggestion for the development of the project and the preparation of your final year project report. This unit covers the format and contents of the report, some rules for the layout and presentation, some suggestions on style and language that might be helpful and some recommendations for further reading. The project report in brief should start with a short introductory chapter to cover the background to the project, or state the problem, or possibly mention the motivation for your working on this particular project. Use the main body of the report to describe objectively what you have done in the project, to justify your design decisions, the problems you faced and what you achieved in solving them. The final chapter should sum up what you have achieved in the project and, possibly, outline the scope for future work.

2.1 OBJECTIVES

After going through this unit you should be able to:

- understand the key activities of the Mini Project,
- know your Roles and Responsibilities,
- understand how to select a project topic,
- understand how to start the project,
- know the guidelines for proposal and report preparation,
- know the Evaluation Scheme, and
- know the Assessment Guidelines.

2.2 KEY FEATURES OF THE PROJECT

While preparing the project students learn and practice different activities, which help them to develop the ability to solve real life problems related to software development.

There are different activities (including the details given in unit 1 and unit 2) in each phase of software development; however, some of the key activities of the project work are given below:

Analysis

- Framing the Systems Development Life Cycle (SDLC) Model for the related project,
- Understanding and evaluating the specific problem,
- Analysing and evaluating the systems requirements,
- Cost-benefit analysis,
- Performing technical feasibility, time feasibility and Operational feasibility for the project,
- Scheduling projects using both GANTT and PERT charts,
- Deciding the S/W requirement specifications and H/W requirement specifications, and
- Designing and constructing the entity-relationship (ER) diagram (for RDBMS related projects), data flow diagrams (level 0,1,2) (OR Object-oriented diagrams, System Flowcharts etc.) and data dictionary.

Design

- Plan the systems design phase and distinguish between logical and physical design requirements,
- Create the systems flow charts and state transition diagrams,
- Describe all the modules and the functionality of modules,
- Design and evaluate system inputs and outputs,
- Design and evaluate user interfaces for input, and validity checks for input data,
- Perform normalisation for the unnormalised tables for RDBMS related projects,
- Design various test cases for different testing techniques/strategies, and
- Decide various data structures.

Coding

- Performing coding according to the requirement and design document,
- Writing comments and description in coding,
- Using of naming convention of variable and functions,
- Explaining the exceptions handling and conditional checking, and
- Maintaining security.

Testing

- Performing various system testing techniques/strategies to include the different phases of testing,
- Identifying key problems with the software and re-implementation with logical justification, and
- Generating various test reports.

2.3 ROLES AND RESPONSIBILITIES

The key of making a group project successful is ensuring that each member of the team understands and accepts his or her roles and responsibilities within the team. Students may be given roles such as Team Coordinator, Auditor/Reviewer: Data Manager, Quality Manager or others according to the needs of the project. Each student should be involved in each and every phase of software development, however, the role is an additional responsibility of the students. The domain of these roles are as given below:

- **Team Coordinator:** Conducting meetings, coordinating the team, maintaining milestones and regulations related to the project work,
- **Auditor/Reviewer:** Inspecting and verifying whether the meetings and discussions are being held regularly. Also s/he will check if the project and management related documents are maintained properly and whether all team members are updated with latest information of the project.
- **Data Manager:** Maintaining records and information related to meetings and discussions related to the project, and
- **Quality Manager:** Maintaining records and information related to quality assurance in the project.

Clarifying this understanding explicitly at the beginning of the process, and reviewing it periodically throughout the duration of the project, can help avoid a great deal of confusion and frustration and increase the efficiency and effectiveness of the team. Students can select these projects in a group or individually according to their interest and the complexity of the project.

2.3.1 Counsellor

The MCS-044 Mini-project counsellor is the person who motivates and helps students during the development of the project. The counsellor should take responsibility for guiding and approving different project processes, including Analysis, Design, Coding, Testing, and also the editing of project reports. Moreover, the main responsibilities of a counsellor are:

- Dedicating adequate time to the student for providing effective supervision and encouragement,
- Making sure that the student chooses a manageable project topic,
- Providing critical comments on the student's work and progress,
- Ensuring the student has access to necessary data,
- Encouraging the student to proceed in the intended direction and to agreed time limits, and
- Making sure that the project is the student's own work.

2.3.2 Project Team / Student

The project team should be organised and determined towards the fulfilment of their projects' objectives and tasks. A maximum of four students should work on a project, however, an individual student can also undertake the project on his/her own. The main responsibilities of the project team/student are to:

- Ensure that an appropriate amount of time and effort is applied to the project,
- Ensure that they are responsive to the guidance of their counsellor,
- Acknowledge the text, material and ideas of others properly,
- Meet all milestones and regulations related to the work, and
- To communicate any problems that are likely to prejudice the quality or time lines of the work to the counsellor as and when such problems arise.

2.4 STEPS OF THE MINI PROJECT

We have listed here five general steps in your Mini Project, which may help you to determine the milestones and regulations related to project work.

- Selection of Topic Area,
- Project Report Planning,
- Project Proposal Report,
- Project Final Report, and
- Project Assessment

2.4.1 Selection of Topic Area

The choice of the topic for the project has great importance so it should be discussed with your counsellor in detail. The topic needs to integrate the interests of the student with the specialised expertise of the counsellor, and be of the appropriate level of difficulty. Students are encouraged to think about the areas of their interest in which they would like to undertake a project, and in consultation with a counsellor, an initial topic can be identified.

2.4.2 Project Report Planning

You should provide an overall aim for your project, which is a declaration of what you would like to achieve at the end of the project. This should be followed by a number of objectives, which act as clearly defined stages that make up your project.

Project Plan

A project plan should be included which provides an estimate of the time that you think you will require in order to work and meet each of your objectives. In your project plan avoid scheduling tasks linearly, try to overlap and tackle more than one task at any point of time.

You should begin planning your report from the day you begin your Mini-project. The report is one of the products of your work, in the same way as a program is a product. You should discuss with your counsellor the way in which your work will be reported. You can produce an outline plan of your report after your first meeting with your counsellor. This plan will not be detailed, but you can gradually increase the amount of detail in the plan until it forms the complete basis for writing the report.

The process of planning can help you sort out your ideas, make vague ideas precise and sequential. One common mistake students make is, to believe that a plan cannot be changed or that it is a sign of weakness to change a plan. A plan is another tool to be used to get work completed according to a satisfactory standard. It needs to be treated with as much respect as any other tool. At first, the plan might be in the list of chapter analyse headings. Next, one or more of the chapters can be broken down into sections, then the sections into subsections, and so on until a whole chapter is ready to be written. You may decide to split a chapter into two or more chapters or to merge two or more chapters into one. This means that you can use your plan to decide when to strengthen your report with some extra work, or when to move on to some new work.

A less common mistake that students make is to think that their report has to be written in order, from the first page to the last. It is wise not to begin writing until you have some level of plan for the whole report, but you can write parts as you go along. For instance, when you have the material for your review of previous work, you can write that chapter. It is quite usual to write the inner chapters before the last chapter and then to write the introductory chapter as the last part you write.

2.4.3 Project Proposal Report

Project proposal should be presented to, reviewed by and agreed upon in consultation with the project counsellor to provide constructive feedback on the proposal and planned programme of the project work. Further, in this section, you can present details regarding the preparation of the project proposal. The preparation of the Project proposal report may be taken to be an opportunity for students to practice their report writing skills. It is expected that this report will contain an overall structure for the project analysis along with a substantial part of the survey of technologies. The survey of technologies, and associated list of cited references, would be complete at this stage. The project proposal should contribute to some of the content of the final report. It also provides the counsellor with an opportunity to make constructive comments on the written work completed at this stage.

2.4.4 Project Final Report

The final report will contribute to the assessment and your marks. The format of this report will follow the format, guidelines and suggestions given in this block, but details should also be discussed with your counsellor. The final reports of students doing the project in a group should not be identical. Each student should emphasise on his/her role and responsibilities in the project work.

2.4.5 Project Assessment

The project presentation and viva voce also contribute to the final assessment. The presentation will provide an opportunity for the student to set the work done into context and to identify the main features of the work. Student should have good understanding and knowledge of each and every phase of software development either it's a group or individual project. In addition, the student will be expected to defend successfully the conclusions put forward in the report. The examiners will be looking for clear evidence that the student has a depth of understanding of the subject areas.

2.5 GUIDELINES FOR THE PROJECT PROPOSAL

These guidelines on report preparation gives simple and practical recommendation on the problems of getting started, getting organised, dividing the vast task into less difficult pieces and working on those pieces. It includes a suggested structure and a guide to what should go in each section of the project proposal and the project report.

Project Proposal

As we have discussed earlier the project proposal should be prepared in consultation with your counsellor during the counselling sessions. The project proposal should clearly state the objectives of the project. The project work should compulsorily include the analysis phase of the software development.

Front page

The front page of the proposal should contain the project title, followed by your name and your counsellor's name. The contents of this proposal report should contain the following:

Structure

1. INTRODUCTION
   - 1.1 Background
   - 1.2 Objectives
   - 1.3 Purpose and Scope
     - 1.3.1 Purpose
     - 1.3.2 Scope

2. SURVEY OF TECHNOLOGIES

3. REQUIREMENTS AND ANALYSIS

   - Problem Definition
   - Requirements Specification
   - Planning and Scheduling
   - Software and Hardware Requirements
   - Preliminary Product Description
   - Conceptual Models.

4. REFERENCES

The description of these topics are already explained in the previous unit, however, the references at this stage of the project proposal may be different from the references of the project report, so you should provide here a list of reference which is related to your project topic: literary and the review, survey of technologies that acts as a good reference to your work. This will demonstrate that your project is current and it is supported by articles, papers or books, which are accessible. (Refer to the reference in further sections). After finalising the proposal report, students should submit the project proposal report along with the proforma.

2.6 GUIDELINES FOR THE PROJECT REPORT

When you are about to begin writing the project report, it seems a lengthy, complicated job. It will seem less discouraging if you write continuously and prepare the documentation of each phase from the start of the project. However, in this case, towards the conclusion, you will even find, an enjoyment, satisfaction in the sense of achievement and pleasure in the enhancement of your technical writing. Let us look at how you should make a start.

Before writing your project report, first write the report outlines containing chapter headings, sub-headings, some figure titles and perhaps some other details, notes and comments. The report should contain a full and coherent account of your work. Although there will be an opportunity to present your work verbally, and demonstrate any software, the major part of the assessment will be based on the written material in your project report.

Project Report Format

The project report documentation should contain 80 to 100 pages for analysis, design, and testing phases, however, the size of complete report may vary depending upon the size of coding /implementation and appendices. The project documentation details should not be too generic in nature. To be more specific, whatever theory in respect of these topics is available in reference books should be avoided as far as possible. The project documentation should be in respect of your project only. You should make sensible use of appendices. For example, software user instructions, detailed code listings, correspondence may be relegated to appendices. Note that spiral bindings are not suitable for handing in the project report.

Project Report Layout

Project report should contain all the details and text should be short and concise, lengthy reports may not be qualitative, and care should be taken to edit the material sensibly. The project report should normally be printed with single line spacing on A4 paper (one side only). Figures should be clearly drawn and all material should be reproducible by normal photocopy. All pages, tables and figures must be numbered and figures should have titles. Detailed information about the layout for the project proposal and report are also listed below:

Font size and margin

1. The report is to be bound with a clear front cover.
2. The text is in 12-point Times New Roman font.
3. The pages are of A4 size, with margins as given below, except for the front cover, which has a specific format given in unit 1. Margins of pages should follow the following specifications.

   a. Left margin - 2 inch. from edge of paper.
   b. Right margin - 1 inch. from edge of paper.
   c. Top margin - 1 inch. from edge of paper.
   d. Bottom margin - 1 inch. from edge of paper.

4. The above margins shall be observed on charts, graphs, tables, and drawings. Folded papers or large size paper will not be accepted unless there is absolutely no other way for the material to be presented.

Heading

1. Headings used in the project report should follow the following convention:
2. Main Headings or Chapter Headings

   a. Times Roman, 16 Font size (1,2,3 etc.) numerals.
   b. Capital and Bold.
   c. Must begin a new page and be centered.
   d. Main headings are to be titled names that reflect content of the text that follows. Main headings are not to be identified as chapters.
   e. The number of the headings shall be followed by a period and two spaces.
   f. Must precede the following text material by second heading by three spaces.

3. Second Headings

   a. Times Roman, 14 Font size, Bold, 2.1, 2.2, 2.3, etc.
   b. Must be centered and be typed in capital and lower case (sentence case) letters; i.e., the first letter of each word except conjunctions, prepositions, and articles must be a capital letter. Omit period at the end of the heading.
   c. The letter designation of the heading shall be followed by a period and two spaces.
   d. Must be four spaces below preceding text and three spaces ahead of succeeding text.

4. First sub-headings

   a. Times Roman, 12 Font size, Bold, 2.2.1, 2.2.2, etc.

   b. Must be typed on separate lines beginning at the left margin line of the text, but need not begin on a new page.
   c. Must be typed in capitals and lower case letters except conjunctions, prepositions, and articles.
   d. The number designation of the heading shall be followed by a period and two spaces. Omit period at the end of the heading.
   e. Must be separated from the succeeding text by three spaces.

5. Second sub-headings (second sub-headings should be avoided if possible).

   a. Times Roman, 12 Font size, Bold.
   b. Must be typed on the same line as the text it introduces beginning at the left margin line of the text.

c. Must be typed in sentence case.
d. Must be followed by a period at the end of the heading and must be underscored by a line.
e. The letter designation shall be followed by a period and two spaces.

- Appendices re-start the section numbering, using capital letters as section labels and Arabic numerals as sub-section labels (i.e., A.1, A.2,); appendix headers are in decreasing-sized fonts.
- If a section is divided into sub-sections, it has at least two subsections. Similarly for subsections divided into sub sub-sections, and so on.
- The font matter, Conclusions, Recommendations, Glossary, Acknowledgements, and References sections are not divided into sub-sections. (Include in Main Heading or Chapter Heading).

Figure and Tables

- Each figure has a number and a caption below the figure. As given in the example of a *Figure.*

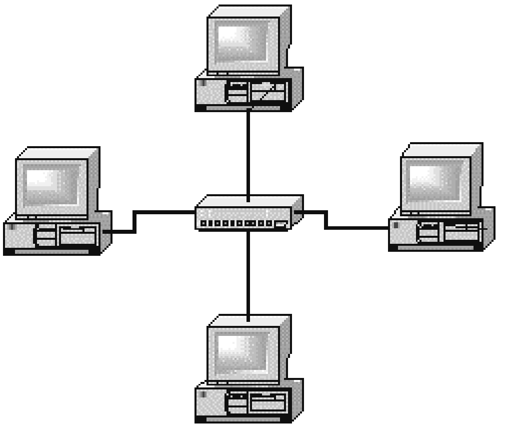


Figure 1: A typical computer network

- Each table has a number and a title above the table. As given in the example of a *Table.*

Table 1: Comparison of various data structures

Operation	Sequential List	Linked List	AVL-Tree
Search	O(log n)	O(n)	O(log n)
Delete	O(n)	O(1)	O(log n)
Insert	O(n)	O(1)	O(log n)

- Figure and table numbering restarts at the beginning of each appendix, using a combination of the appendix label and figure/table number within the appendix (e.g., A-1, A-2).
- Each figure and table is cited (referred to by number) in the report text, either on the same page as the figure/table or on the preceding page.
- Figures and tables are legible.

Paragraphs

Paragraph indentations must be uniformly eight letter spaces long. Series of paragraph items which are to be listed without headings under any of the regular headings may, for clarity be designated as follows: (A), (B), (C). No period is necessary between the parenthesis and the first sentence. Series of items listed in the interior of a paragraph may be designated as follows: (a), (b), (c). A period must not follow the parenthesis. Each item must begin with a lower case letter and must end with a semi-colon, unless it is a complete sentence. A new paragraph must not begin at the bottom of a page if there is not sufficient space for at least two lines.

Footnotes

Footnotes should be used only if absolutely necessary.

- Footnote references shall be indicated in the text by an Arabic number placed superior to the text and immediately following the word phrase or sentence, on which the footnote is to be appended.
- Footnotes shall be sequential for each page and for the entire report.
- Footnotes shall be placed at the bottom of the page on which they are indicated. They shall be indented from the margin line of the text by eight spaces and placed under a broken line made of 15 dashes.
- Footnotes shall be single spaced typing.

Pagination

Each page in the report is expected to bear a number. Only one side of the paper may be used. The following plan should be used exclusively:

a. The preliminary section, including the title page; copyright page, if any; foreword, preface, or acknowledgements; table of contents; etc., should be numbered, using lower case Roman Numerals, e.g., i, ii, iii, etc. The title page counts as Page i, but the number does not appear. The sequence of the preliminary section is as follows:

Introduction	Page i - number does not appear
Survey of Technologies……………………	Page ii, iii, as necessary
Requirements and Analysis	Page iii, iv, as necessary
References ....………	Page v, vi, as necessary

For the remainder of the report Times numbers are used. Each page must be numbered. Page numbers are to be placed two centimeters from the top and right hand margins on the pages. Include all pages for illustrations, tables, appendices, bibliography, etc. The numbering in the main body of the report should begin with Page 1 and run consecutively to the last page. No punctuation, such as dash or a period, should accompany the page number.

- Page numbering restarts at the main body of the report: pages in the main body and back matter, including appendices, are numbered using Arabic numerals, with the first page of the Introduction as page one.

- Page numbers are centered at the bottom of the page.

Specially Designated Expressions

(1) Specially designated expressions usually mean equations, formulas, etc.

(2) Specially designated expressions shall be centered on the page shall be set below the preceding text and before the succeeding text by three line spaces.

(3) The expressions shall be identified by an arabic number in parenthesis placed opposite the expression and in line with the right margin of the text. They should be numbered in each chapter in the order of their appearance together with the chapter number, e.g., (6.14).

References

The numerical reference of the material shall be indicated in the text by an arabic numeral in square brackets (e.g., [12]) placed in the text immediately following the name, word, phrase, or sentence which the reference concerns (in most cases this will be the author's name). The number in parenthesis should indicate the order of appearance of the reference in the text. The listing of references in the references shall be in the order in which they are used in the text and shall bear the same number as was used in the reference in the text.

It is very important that you acknowledge any of the work of others that you use or adapt in your own work, or that provides the essential background or context to your project. The use of references is the standard way to do this. Please follow the given standard for the references of books, journals, and online materials.

The list of cited references is placed between the main text and the appendices. This section should start on a new page, and should not have a chapter or section number, just the heading "References". Each reference should be as complete as possible. However, some schemes for writing references are given below:

- **A Journal Paper**

  name(s) of author(s), year of publication, title of paper, name of journal, volume number issue number (optional), page numbers.

- **A Conference Paper**

  name(s) of author(s), year of conference, title of paper, name(s) of editor(s), name of conference, place of conference (optional), publisher of proceedings, place of publication, page numbers.

- **A Book**

  name(s) of author(s), year of publication, chapters (if only part of the book is relevant), title of book, name of publishers, place of publication (optional), page numbers.

- **A Web Page**

  name(s) of author(s), year of publication, title of paper, url, date last accessed.

Appendices

These should contain detailed information not required on a first reading of the main text, but necessary for closer study of the project and in particular its continuation or replication. The Appendices should also include a program disk/cd when appropriate.

Coding style

In general during coding, most of your development time is spent in debugging, troubleshooting, and practicing general maintenance, especially on larger projects. Even when you work on small projects, a significant amount of time is usually spent analysing and fixing code. The readability of your code is important for your benefit and the benefit of your team members. When following conventions, you increase readability, which increases workflow and helps find and fix any errors in your code, and all programmers follow a standardised way of writing code, which improves the project in many ways. For C, this involves things like brace placement, indentation, and the way parentheses are used but the coding conventions and style varies from language to language hence, you should follow the coding conventions of the language, which you have used in your project implementation.

Style of English

The report should be written in an objective style, in the third person impersonal tense: e.g., “The following software was developed....”not “I developed the following software....”. An impersonal style keeps the technical factors and ideas to the forefront of the discussion and you in the background. Try to be objective and quantitative in your conclusions. For example, it is not enough to say vaguely “because the compiler was unreliable the code produced was not adequate”. It would be much better to say “because the A compiler produced code which ran 2-3 times slower than a fast enough scheduler could not be written using this algorithm”. The second statement is more precise, clear and informative and gives an impression that the student knows the project and subject very well.

Submission of the Project Report

You have to submit your project report by the given date. One copy of the original project report is to be submitted to the Study Centre concerned. A photocopy of the same project report must be retained by the student, which should be produced before the evaluation.

2.7 EVALUATION SCHEME

The project will be assessed by a written report and a combined presentation and viva voce (viva voce). To help the students we have given some guidelines about evaluation and assessment in the next section. If, the examiner finds that the project is lacking in any key areas then, the student will be asked to re-submit the project. If the student is re-submitting the project report then the students needs to repeat the entire process beginning with the approval of the project proposal.

Project Synopsis/Proposal

Students can discuss their project topic and proposal with counsellors at study centres during counselling, however, each student must send their complete project proposal to the counsellor with the proforma of the project proposal given in appendix 2. Further, counsellors will give suggestion on the project proposal/synopsis; students should modify the project work according to the suggestions given in the proforma of the project proposal.

Assignment/Continuous Evaluation

25% of total marks are allotted to continuous evaluation.

Final Evaluation

75% of total marks are evaluated in the final evaluation. These 75 marks will be given, based on the evaluation of project report. The weightage will be given to analysis, design, coding/implementation, testing and viva-voce.

2.8 ASSESSMENT GUIDELINES

In this section we have given a few general parameters as checkpoints for the assessment of any software development project. You can note these points and emphasise them during the project report preparation and examination. Basically, assessment will be based on the quality of your report, the technical merit of the project and the project execution. Technical merit attempts to assess the quality and depth of the intellectual effort you have put into the project. Project execution is concerned with assessing how much work you have put in.

Analysis

In Project planning include cost estimation and project scheduling. The Cost and efforts estimation is to be done with the help of functional point analysis or other similar methods. The project scheduling is identified with:

(i) Pert chart: Proper decomposition of stages, and
(ii) Gantt chart: Time, line structure and validity of chart.

You may know that the software requirement specification (SRS) document is one of the important documents of your project. The indicators for SRS document is whether you have used some standardisation like IEEE standards or any other international standard, or whether your SRS has a proper structure based on sound software engineering concepts as given in unit 3 or it is given in a running text. Project analysis for DBMS/Application development projects should contain the ER diagram, Data Flow Diagram and Data Dictionary, so you should include these with the following requirements. However for other categories of project you should prepare class diagrams, behavior model and /or state transition diagram and details of various data structures used.

- The Entity Relationship diagram (ER Diagram) should have:
    - Proper symbol of attributes, entities and relationship, and
    - Relationship of ER diagram to SRS with strong association

- Data Flow Diagram (DFD) should have:
    - All Data flow should be levelled and should have proper input and output.
    - Relationship of data flow to data dictionary Context Diagram, Level 1 and Level 2.

- **Data Dictionary:** It should explain each entity and relationship in ER diagram and data flow in DFD.

Design

Project design should include the desired features and operations in detail, including user interface design, program structure, schema design and normalised tables and data integrity and constraints. You should include them with the requirements given below:

- **Program Structure:** It should have the proper modularisations of software and specification of each module.
- **Schema Design and Normalised Tables:** Normalise the table to minimum 3NF. If any demand of Demoralisations clearly explain the reasons.
- **Data Integrity and Constraints:** Explain the referential diagram. Define entity integrity, which should include keys, alternate keys and other keys, value constraints and ranges.

- **Procedural Design:** Explain using Flowchart / Pseudo code / PDL.
- **User Interface Design:** Coherence with dataflow and processor; Consistency of interface and naming convention.
- **Architecture:** Program architecture and explanation on suitability of data structure used.

Coding

Coding phase of software development includes different activities like refining the algorithms for individual components, transferring the algorithms into a programming language (coding), translating the logical data model into a physical one and compiling and checking the syntactical correctness of the algorithm with these activities. You should include the comments and description in code, use the standardisation in coding, use the methodology for error handling and security implementation. These parameters ensure software quality and reliability. You should include them with the requirements given below:

- **Comments and Description:** Should have comments with functional description which include the input, output, total function calls to/from other functions, function parameters, description of main variables, Data type, logic description, etc.
- **Standardisation of Coding:** Use of naming convention of variable and functions, nested depth, naming constant, use of data structure and style.
- **Error Handling:** Explain exceptions handling and conditional checking.
- Parameter passing and calling: Check the technique used for this purpose, how it optimises the coding.
- **Security:** Maintain confidentiality, integrity and authorisation according to the requirement and needs of the system. Also maintain database level security, use of Views, use of revoke and grant, user and access rights and ensure steps taken against hacking of the system.

Testing

Testing is a process of devising a set of inputs to a given piece of software that will cause the software to exercise some portion of its code. The developer of the software can then check if the results produced by the software are in accordance with his or her expectations. It includes, number of activities such as correcting syntactically and semantically erroneous system components, detecting as many errors as possible in the software system, and assuring that the system implementation fulfills system specification.

It ensures the quality, efficiency and reliability of the software, which is measured by the testing methodology and techniques used for unit, integrated and system testing. You should give all the reports and results of test cases for unit, integrated and system testing. How debugged your code is and what actions you have taken too improve the code, must, be explained. Good testing can be measured by criteria such as correctness, reliability, user friendliness, maintainability, efficiency and portability of software.

Organisation of report

Report organisation improves the professional attitude of writing reports. You should emphasise on the proper binding of the project report, the cover page, page numbering, organisation of content, and proper printout of text and images.

Viva Voce

Student may be asked to write code for problem during viva to demonstrate his coding capabilities and s/he may be asked to write any segment of coding given in project report.

2.9 PITFALLS AND SOME TIPS

The main purpose of this course is to gain experience with the help of the concepts and methods learned from the previous courses particularly, in knowing the practical situation/problem in software development. We have explained most of the components of the project in detail, however you may need some tips that may be helpful and are generally required by students.

In recent years, we have noticed, that projects suffer from the lack of proper analysis and later any review, failure to implement an engineering approach and lack of critical element. A proper analysis and literary review is necessary for you to show that you can place your work in the wider context of computing. An engineering approach is one where you follow some appropriate process or methodology that leads from requirements to design to implementation and testing. By adopting such a process, it is much less likely that, you will fail to take some crucial factor into consideration, which is an important aspect of software engineering.

The critical element involves showing what you independently believe to be good and bad about what you've read, what you have been taught, what you have been asked to do, what you have done, what you have not done and the consequences thereof. It does not involve blindly accepting as fact everything that you have been told or read. However, we have listed a few points that generally are found to be lacking in the projects submitted by our students. These observations may be used by students as valuable feedback.

Sometimes students opt for the wrong project problem/topic without, understanding the depth of the requirements, and their own limitations in that area.

- Few students are over enthusiastic and they don't freeze the requirement or expectations till, the coding and implementation leads to low quality and less reliable software product.
- Most of the students assume that the coding is the only work they have to do and they neglect the importance of other software engineering processes that result in improper knowledge gain of project development and poor results/grades.
- Generally students lack critical work. They assume whatever is given in books or taught to them in software development is correct.
- Most of the students do not use the software engineering approach and methodologies for software development.
- Most of the students do not use standardisation in different phases of software development.
- Some students do not prepare documents such as the SRS, SDD, and Test Cases etc. in different phases of software development.
- Some students never consider the importance of notes and documentation, which creates problems for them during report writing.
- Generally students don't give proper acknowledgement of material used in the reference however, few are not aware of material which should be acknowledged in the reference. You must include the following material in the reference.

  - Written, printed, or published (electronic or paper both) material.
  - The algorithms, models, hypotheses and paradigms that are used.
  - The software, which you used, including the development environment, compilers, libraries, etc. you should given the web reference of the website so that other student can collect information about it.
- Most of the students are interested in developing website projects or some system development project, but very few student are involved in research oriented work.
- A few students are too dependent on the counsellor. Remember you are responsible for coding and documentation of your project.
- A few students also copy the projects from some sources. This practice creates a major problem, as it does not encourage the student's own creativity/ knowledge/potential.
- There is no need to write a detail history of Java or visual basic etc. On the other hand, it is important to mention what you have used in the project and to explain anything that might be unusual to the reader. For example, five years ago it was important to introduce the reader to Java, but now it is not required.
- Students may think, "So what if it's wrong as long as the meaning is clear". But poor spellings leave a negative impression (of carelessness) and sometimes cause confusion.

Report Format and Layout

In the previous sections, we have explained the specification of project report format and layout however, it is also important to discuss additional tips for the preparation of the report. That's why we have given you a few tips and points as given below:

- Use proper spelling and capitalisation of the programming languages, tools and other proprietary software that you have used. For example, some students write Unix and some writes UNIX, but which one of the two is correct?
- Similarly, do not leave a space before a full stop or other punctuation mark.
- Also, do not leave a space after an open bracket or before a closed bracket. You should do it (like this).
- Use round brackets only for parentheses. Keep square brackets for references.
- Commas and full stops should be placed inside quotation marks. Even at the end of sentences like "this."
- It is a good practice to leave two spaces after a full stop.
- Spell out numbers (from one to nine) in text, i.e., write "two" not "2" except where you are numbering bullet points. For number 10 and above, use numerals. Remember numbers should be spelled out when they begin a sentence.
- Spell out per cent; do not use %, and write per cent as two words without a period.
- Do not use the pronoun "I", always use "We", better use passive voice.

2.10 SCHEDULE OF PRACTICAL SESSIONS

Students can discuss their topic with the counsellors at study centres and the counsellors will give suggestions on project specification at the study centre during the practical sessions. There are total 10 practical sessions, as given below:

Name of the Topic	**No. of Practical Sessions (3 hrs each)**
Project specification	1
Coding / Implementation	5
Testing	2
Documentation	2

2.11 SUMMARY

In this unit, we have tried to cover most of the areas of concern in writing a project report. We have tried to encourage you to put some effort into the project report and laid down some guidelines to be followed for layout and format. The given guidelines and suggestions are gradually becoming the 'standard' for project reports preparation and will be amended and improved in the light of new/fresh experience.

2.12 FURTHER READINGS

1. IEEE 1063: Software user Documentation.

2. ISO/IEC 12207: *Software Life Cycle Process (http://www.software.org/quagmire/descriptions/iso-iec12207.asp).*

3. ISO/IEC: 18019: *Guidelines for the Design and Preparation of User Documentation for Application Software.*

4. http://en.tldp.org/HOWTO/Software-Release-Practice-HOWTO/documentation.html.

5. http://www.sei.cmu.edu/cmm/

UNIT 3 SOFTWARE ENGINEERING CONCEPTS AND STANDARDS

Structure **Page Nos.**

3.0 INTRODUCTION

Software Engineering deals with the development of software. Hence, understanding the basic concepts of software is essential. Before beginning the development of the project, it is essential to you to refresh your concepts about software development and engineering. During your first and third semester (in courses MCS-021 and MCS-034), you have already studied different approaches of software development. This, will be a complete refresher for you, however, for details you can also refer to these courses. As you know the field of software engineering is related to the development of software. Large software needs systematic development unlike simple programs, which can be developed in isolation, and there may not be any systematic approach being followed. There is a difference between programming and Software Engineering. Software Engineering includes activities like cost estimation, time estimation, designing, coding, documentation, maintenance, quality assurance, testing of software etc. whereas programming includes only the coding part.

The important task in software development is developing and maintaining documentation. Documentation is a process that helps users of software and other people to use and interact with the system. Effective and accurate documentation is very necessary for the success of any system. Documentation becomes a part of each step of system development throughout the process of system development even before the documentation starts officially. During the process of system development, study reports and other necessary information are documented to help people involved in system development understand the process.

There are many kinds of documentation namely, analysis documentation, design documentation, interface documentation, internal program documentation and user-oriented documentation. We will learn how to develop these documents in this unit. In most of your lab manuals and practical exercises you have developed different programs/softwares according to the given problem, however in this course: Mini-Project we will not only develop program but also learn the real time challenges/problems in software development and engineering.

3.1 OBJECTIVES

After going through this unit, you should be able to:

5 learn about the various phases of software development life cycle;

6 understand software development models;

7 understand the importance and concept of documentation;

8 learn about various documents and process of documentation;

9 understand application of various standards of documentation processes;

10 differentiate between various documentation processes;

11 understand the relation between documentation and quality of software, and

12 understand the good practices for documentation process.

3.2 SOFTWARE DEVELOPMENT APPROACHES

The software industry considers software development as a process. According to Booch and Rumbaugh, “A process defines who is doing what, when and how to reach a certain goal”? Software engineering is a field, which combines process, methods and tools for the development of software. The concept of process is the main step in software engineering approach. Thus, a software process is a set of activities. The various steps (called phases) which are adopted in the development of this process are collectively termed as Software Development Life Cycle (SDLC). The various phases of SDLC are discussed below. Normally, these phases are performed lineally or circularly, but it can be changed according to the project as well. The software is also considered as a product and its development as a process. Thus, these phases can be termed as Software Process Technology. In general, different phases of SDLC are defined as the following:

13 Analysis

14 Design

15 Coding

16 Testing.

As you have already learnt about different software development models (in the course MCS-034), in details, here, briefly, we provide the description of linear and spiral approach to software development which will be useful to you in your Mini- project. The following are some of the models adopted to develop software:

3.2.1 Waterfall Model

It is the simplest, oldest and most widely used process model. In this model, each phase of the life cycle is completed before the start of a new phase. It is actually the first engineering approach of software development. *Figure 1* depicts the Water Fall Model.

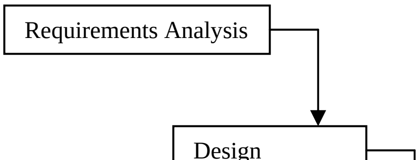


Figure 1: Waterfall model

The functions of various phases are discussed in software process technology.

The waterfall model provides a systematic and sequential approach to software development and is better than the build and fix approach. But, in this model, complete requirements should be available at the time of commencement of the project, but in actual practice, the requirements keep on originating during different phases. The waterfall model can accommodate new requirements only in the maintenance phase. Moreover, it does not incorporate any kind of risk assessment. In the waterfall model, a working model of software is not available. Thus, there is no way of judging the problems of the software in-between different phases.

A slight modification of the waterfall model is a model with feedback. Once software is developed and is operational, then the feedback to various phases may be provided.

3.2.2 Spiral Model

This model can be considered as the model, which combines the strengths of various other models. Conventional software development processes do not take uncertainties into account. Important software projects have failed because of unforeseen risks. The other models view the software process as a linear activity whereas this model considers it as a spiral process. This is made by representing the iterative development cycle as an expanding spiral.

The following are the primary activities in this model:

Finalising Objective: The objectives are set for the particular phase of the project.

Risk Analysis: The risks are identified to the extent possible. They are analysed and necessary steps are taken.

Development: Based on the risks that are identified, an SDLC model is selected and followed.

Planning: At this point, the work done till this time is reviewed. Based on the review, a decision regarding whether to go through the loop of spiral again or not will be decided. If there is need to do so, then planning is done accordingly.

In the spiral model, these phases are followed iteratively. *Figure 2* depicts the Boehm's Spiral Model (IEEE, 1988).

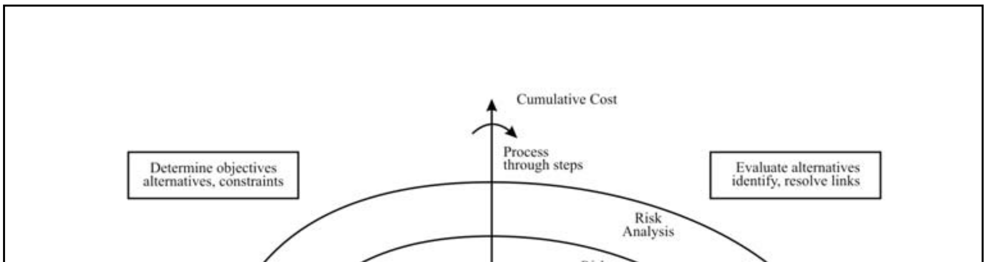

Cumulative Cost
Process through steps
Determine objectives alternatives, constraints
Evaluate alternatives identify, resolve links
Risk Analysis

Figure 1.6: Spiral model

Figure 2: Boehm's spiral model (IEEE, 1988)

In this model, Software development starts with lesser requirements specification, lesser risk analysis, etc. The radical dimension this model represents cumulative cost. The angular dimension represents progress made in completing the cycle.

The inner cycles of the spiral model represent early phases of requirements analysis and after prototyping of software, the requirements are refined.

In the spiral model, after each phase a review is performed regarding all products developed upto that point and plans are devised for the next cycle. This model is a realistic approach to the development of large scale software. It suggests a systematic approach according to classical life cycle, but incorporates it into iterative framework. It gives a direct consideration to technical risks. Thus, for high risk projects, this model is very useful. The risk analysis and validation steps eliminate errors in early phases of development.

3.2.3 Selection of Approach

"Which development process is best" or "Which development process is best for my project?" In search of these questions we can debate the advantage and disadvantages of one development process over another until we get fed up, but we will never reach the conclusion,Why? Because different processes have different strengths and weaknesses.

Each development process is viable and useful, but each one works better in some situations than it does in others.

If you're working on a somewhat traditional project for example, a school management system, where the features are defined a priori and it's possible to freeze the specification, the waterfall process is best in that case. If you're working on a project whose nature and scope are vague or unpredictable (for example, a project where you cannot determine your next steps until you have reached a certain plateau), consider either a spiral or feedback waterfall process. These two processes are very similar in that both involve a series of many frequent iterations of the design-implementation-integration-test cycle seen in the waterfall process.

3.3 ANALYSIS

Analysis describes the "What" of a system. The objectives that are to be achieved in Software process development, are the requirements. In the requirements analysis phase, the requirements are properly defined and noted down. The output of this phase is SRS (Software Requirements Specification) document written in the natural language. According to IEEE, requirements analysis may be defined as (1) the process of studying user's needs to arrive at a definition of system hardware and software requirements (2) the process of studying and refining system hardware or software requirements.

The main activities in the analysis phase are cost estimation, project planning and scheduling, feasibility report preparation, and the development of SRS (software requirement specifications) document of the project.

Feasibility Report

You may include the following contents in the feasibility report given in the *Table* shown below:

Topic	Some of the contents of the topic
Introduction	Include the project background and report layout here.
Terms of Reference	Define the expectations of the project, the Time Frame and Available Resources
Existing System	Define here the results of Fact Finding, working of the Current System and the problems in the Current System
System Requirements	Give the system requirements here, after discussion with the System User
Proposed System	Define the outline of the Proposed System, key Input and Output to and from the system
Development Plan, Cost Feasibility and other feasibilities	You can include the Gantt Chart, Pert Chart, cost estimation, etc.

Cost Estimation

Cost estimates are made to discover the cost to the developer, the cost of producing a software system. It is an important activity in the real time project management, however, this course may not require you to calculate cost estimation but it is important for you to understand different methods of cost estimation for future use. There are different cost estimation methods available like LOC, COCOMO, Putnams, Statistical method and functional point methods, you can refer your MCS-034 course material for further details.

Project Planning and Scheduling

Scheduling of a software project can be correlated to prioritising various tasks (jobs) with respect to their cost, time and duration. Scheduling can be done with resource constraint or time constraint in mind. Depending upon the project, scheduling methods can be static or dynamic in implementation.

Scheduling Techniques

The following are the various types of scheduling techniques in software engineering:

Work Breakdown Structure: The project is scheduled in various phases following a bottom-up or top-down approach. A tree-like structure is followed without any loops. At each phase or step, milestone and deliverables are mentioned with respect to requirements. The work breakdown structure shows the overall breakup flow of the project and does not indicate any parallel flow. *Figure 3* depicts an example of a work breakdown structure.

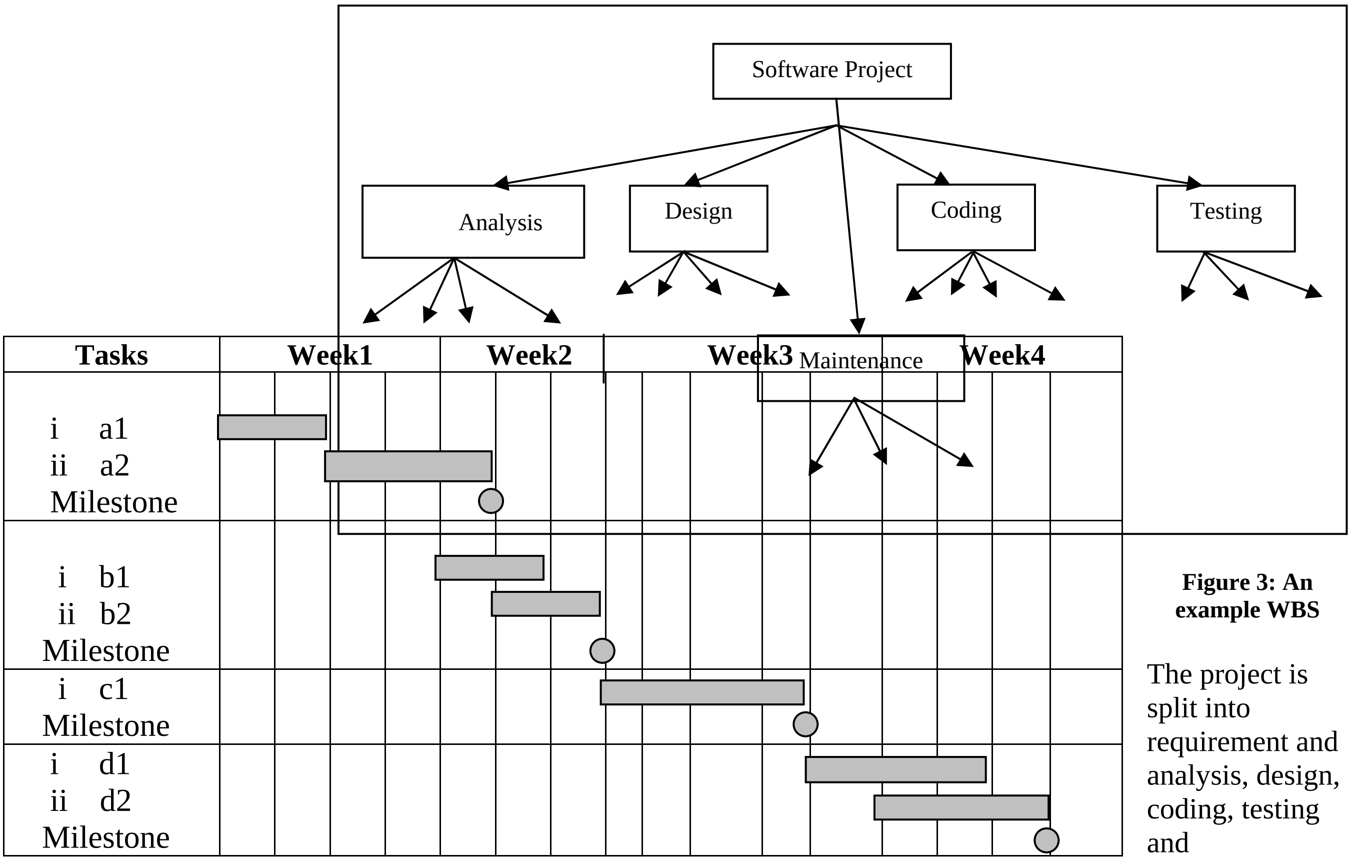


Figure 3: An example WBS

The project is split into requirement and analysis, design, coding, testing and maintenance phase. Further, requirement and analysis is divided into R1,R2, .. Rn; design is divided into D1,D2..Dn; coding is divided into C1,C2..Cn; testing is divided into T1,T2.. Tn; and maintenance is divided into M1, M2.. Mn. If the project is complex, then further sub-division is done. Upon the completion of each stage, integration is done.

Flow Graph: Various modules are represented as nodes with edges connecting nodes. Dependency between nodes is shown by flow of data between nodes. Nodes indicate milestones and deliverables with the corresponding module implemented. Cycles are not allowed in the graph. Start and end nodes indicate the source and terminating nodes of the flow. *Figure 4* depicts a flow graph.

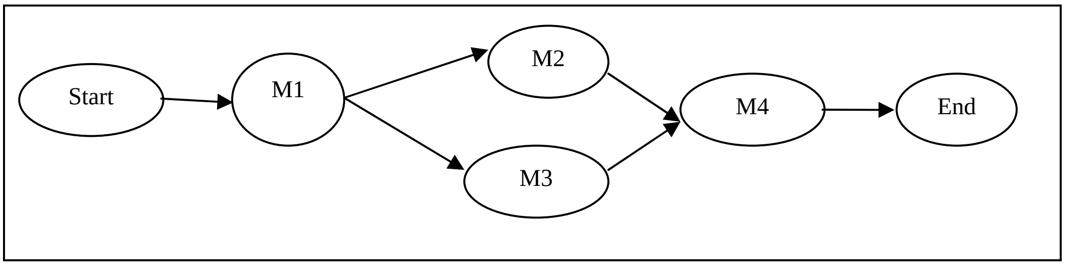


Figure 4: Flow graph

M1 is the starting module and the data flows to M2 and M3. The combined data from M2 and M3 flow to M4 and finally the project terminates. In certain projects, time schedule is also associated with each module. The arrows indicate the flow of information between modules.

Gantt Chart or Time Line Charts: A Gantt chart can be developed for the entire project or a separate chart can be developed for each function. A tabular form is maintained where rows indicate the tasks with milestones and columns indicate duration (weeks/months) . The horizontal bars that spans across columns indicate duration of the task. *Figure 5* depicts a Gantt Chart. The circles indicate the milestones.

Program Evaluation Review Technique (PERT): Mainly used for high-risk projects with various estimation parameters. For each module in a project, duration is estimated as follows:

Figure 5: Gantt chart

1) Time taken to complete a project or module under normal conditions, *tnormal.*

2) Time taken to complete a project or module with minimum time (all resources available), *tmin.*

3) Time taken to complete a project or module with maximum time (resource constraints), *tmax.*

4) Time taken to complete a project from previous related history, *Thistory*.

An average of tnormal, tmin, tmax and thistory is taken depending upon the project. Sometimes, various weights are added as 4*tnormal, 5*tmin, 0.9*tmax and 2*thistory to estimate the time for a project or module. The Project manager fixes the parameters.

The software project management tools support project planning and scheduling. Some of the sample information that you can produce using these tools are:

A Sample Partial Project Plan

Overall Goal of the Project

The proposed software system should be able to:

- *read the structured data available in the Excel files and store it in a Database system,*
- *validate data of the database on the basis of predefined business rules,*
- *prepare reports on data that is found to be in error during validation, and*
- *prepare MIS reports from the validated data.*

The Primary Data

The Primary data in the system is the employee data of the participant companies.

Delivery Deadlines

6 months from the date of Approval.

PROJECT PLAN

1. OBJECTIVES

The objective of the system can be defined here as:

- *The proposed system should be able to read the data from Excel files and store validated data in the Database.*

- *……………………………………….*

2. SPECIFIC PRODUCTS TO BE DELIVERED

The products that will be delivered (You need not include all for an actual system):

The tested system and Network

Clint Workstations

A robust Database Management Server

Any other third party software.

3. ACTIVITIES AND MILESTONES

The activities in the system, after including the provisions for security, are:

- *Verification of the Users.*
- *Migration of the Excel data.*
- *Validation of the migrated data.*
- *……………………………….*

The milestones in the system are:

- *Start of the Project : 1st June, 2006*
- *SRS Completion : 28th June, 2006*
- *Requirements finalisation : 1st July, 2006*
- *……………………………………………………*

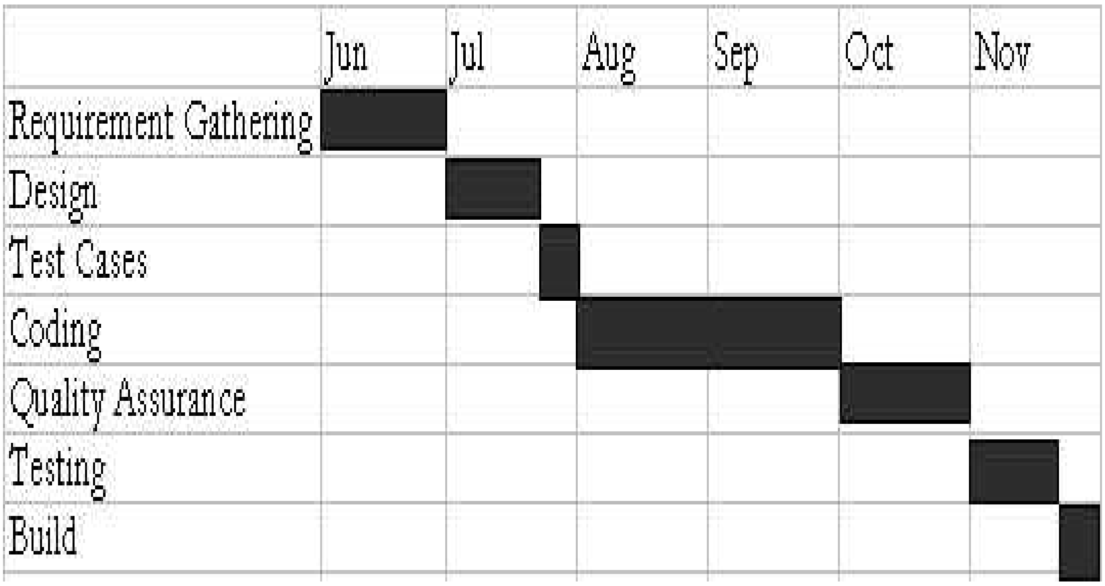
4. RESOURCE REQUIREMENT

The Hardware, Software, and Tools are required for the three different environments, viz., Development environment, Quality Control environment, Deployment environment. These resources may be documented accordingly.

5. SCHEDULING

GANTT Chart

A very elementary Gantt or Timeline Chart for the development plan is given below. The plan explains the tasks versus the time they will take to complete.



PERT Chart

A suitable PERT Chart for the development plan can be given here.

6. BUDGETARY ESTIMATES

The whole budgetary estimates may be divided into resource procurement and software development costs. The software development efforts and cost may be estimated with the help of COCOMO or any other model used by the organisation.

Software Requirement Specification

This document is generated as output of requirement analysis. The requirement analysis involves obtaining a clear and thorough understanding of the product to be developed. Thus, SRS should be a consistent, correct, unambiguous and complete, document. The developer of the system can prepare SRS after detailed communication with the customer. An SRS clearly defines the following:

- **External Interfaces of the system:** They identify the information which is to flow '*from and to'* to the system.
- Functional and non-functional requirements of the system. They stand for the finding of run time requirements.
- Design constraints:

Normally IEEE standard is followed. A typical format of SRS is as follows:

TABLE OF CONTENTS

Introduction

- Purpose
- Scope
- Definition
- Product and its function
- Benefits and Goals
- Overview.

Overall Description

- Product Description
- Product Functioning
- Functions of Project
- Users of Project
- Assumptions made.

Specific Requirements

- Interface Requirements
- User Requirements
- Hardware Requirements
- Software Requirements
- Logical Database Requirements.

Basic Processing Actions of the System
Appendices

- Input/Output Formats
- Instruction for Security
- Results of Fact Finding
- Data Model
- Functional Model
- Process Specification.

A sample portion of SRS is given below:

INTRODUCTION

Purpose

SRS contains details of the proposed software system, sufficient enough for the designers to design the system. Thus, SRS is a means of communicating the findings of the analysis stage to the design stage. The SRS includes:

5 Interface,

6 Logical Database,

7 Hardware, and

8 Performance and other constraints.

It also contains the assumptions made by the analyst and any systemic dependency.

Scope

The scope of SRS contains all the areas related to the project. The scope of SRS includes:

- Proposed software description,
- Users of the proposed software,
- Functional requirements of the software,
- Assumptions and dependencies in the system, and
- Constraints.

Definition

……………………..

Product and its function

………………………..

Benefits and Goals

………………………..

Overview

..………………………

Overall Description

Product Description

The Client should be able to upload the raw data in Excel files into the Database. The raw data is then validated using ………

Product Functioning

- The Raw data from the Clients is put into the database.

………………………………………………..

Functions in the Project

There are five functions of the system.

- User Verification

The User is asked to enter the Username and Password. The system checks the validity of Username and Password, otherwise the User is asked to do so again. A maximum of three valid attempts are given to the user.

- Upload Raw Data

……………………….

- Validate Data

……………………….

- Put the Validated Data

……………………….

- Generating Reports

…………………………..

Users of the Product

………………………

Assumptions

……………………

SPECIFIC REQUIREMENTS

Interface Requirements

The Interface requirements include:

- Easy to follow Interface,
- Very few graphics,
- No hidden buttons, and
- Relevant error messages.

……………………………….

User Requirements

After a careful study of the requirements of the Client, analysts have come up with a set of requirements.

…………………………………..

Hardware and Software Requirements

There are three environments that have been created for the project, viz.,

- Development environment,
- Quality Control environment, and
- Production environment.

The hardware requirements for all the platforms may be indicated here.

Logical Database Requirements

The following information is to be stored in the database.

- The Clients Raw data,
- The Clients Validated data, and
- Username and Password.

BASIC PROCESSING ACTIONS OF THE SYSTEM

The basic processing actions of the system are.

- Verification of the User

………………………………..

- Upload Data

APPENDICES

APPENDIX A

INPUT / OUTPUT FORMATS

The input formats for the system contains the following screens.
The convention used while making the input formats are.

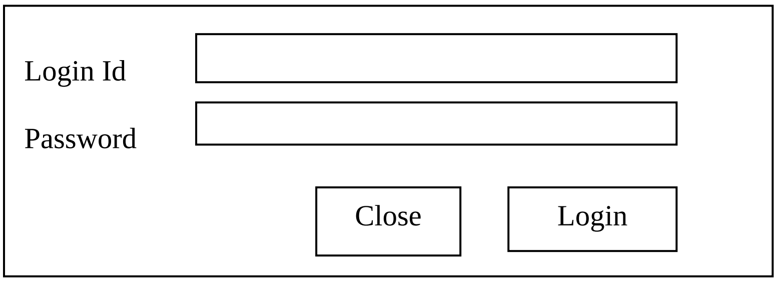
□ Square box is used for user input

▢

Rounded Square box is used for system display

Login Screen

The following screen that inputs the Username and Password from the User for authentication of the User to the system is:



APPENDIX B

Instructions For Security

Security is an integral part of any system. Clients send their confidential data with trust and it is our foremost duty to protect the security and privacy of the data of the Clients.

………………………

APPENDIX C

RESULTS OF FACT FINDING

Working of the Current System and its Problems

APPENDIX D

DATA MODEL

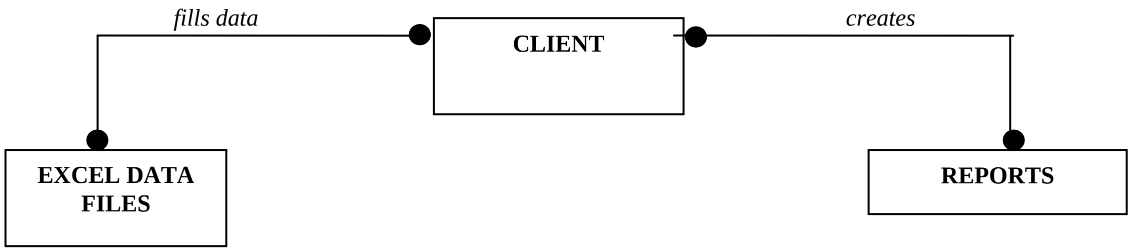
Classes involved in the Project

- Clients
- Excel Data Files
- Reports

Association between the classes

- Clients fill data in the Excel Data Files (M .. M)
- Clients generate Reports (M … M)

E-R/Object Diagram for the System



Attributes of the Entities are:

Object Classes	Attribute
Clients	number name address

	phone number fax email
Excel data Files	excel file number client number
Reports	report number report name client number

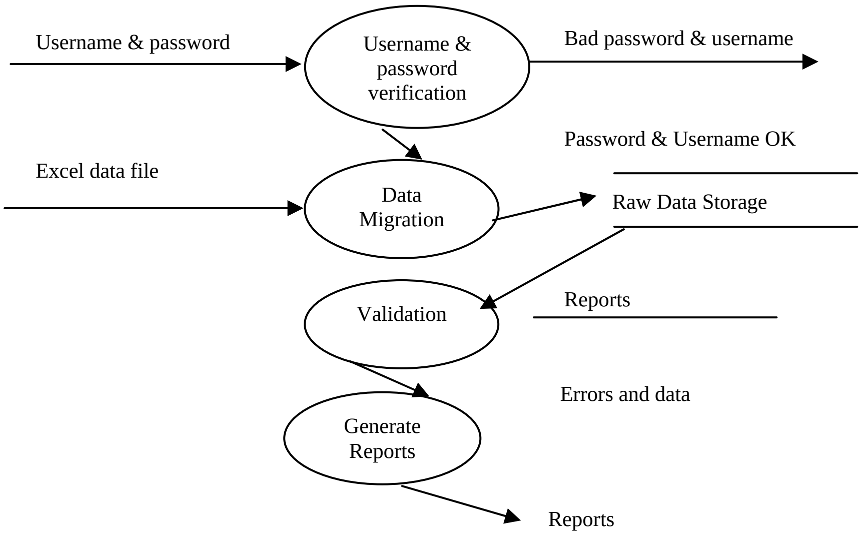
APPENDIX E

FUNCTIONAL MODEL

One sample DFD at level 1 contains the following processes:

- Verification of username and Password
- Data Migration,
- Validation of Migrated data, and
- Generating Reports.

You can make various levels of DFDs



Process Specification

Let us give one sample process verification.

Process: Username and Password Verification

Input: Username & Password

Output: Access granted or denied message

Processing

The Client enters the Username and Password and clicks the Login button.

The system connects with the DBMS and verifies them in the related database. If both are valid: allow user to enter the system with the allowed access rights for that user. Otherwise prompt wrong Username-Password message and take the user to the screen where s/he can re-enter the Username-Password.

Interface Description

The interface contains the text boxes where the user can enter Username and Password. It also contains a Login button for login and a Close button on closing the application.

Internal Data Structure

The process uses the encrypted username and password table that also contains information on access permission.

3.4 DESIGN

Software design is all about developing the blue print for designing workable software. The goal of a software designer is to develop models that can be translated into software. Unlike design in civil and mechanical engineering, software design is a new and evolving discipline contrary to classical building design etc. In early days, software development mostly concentrated on writing codes. Software design is central to the software engineering process. Various design models are developed during the design phase. The design models are further refined to develop detailed design models, which are closely related to the program.

Software Design Process

Software design is the process of applying various software engineering techniques for developing models in order to define a software system, which provides sufficient details for the actual realisation of the software. The goal of software design is to translate user requirements into an implementable program.

Software design is the only way through which we can translate user requirements to workable software. In contrary to designing, a building software design is not a fully developed and mature process. Nevertheless the techniques available provides us with tools for a systematic approach to the design of software. *Figure 6* depicts the process of software design.

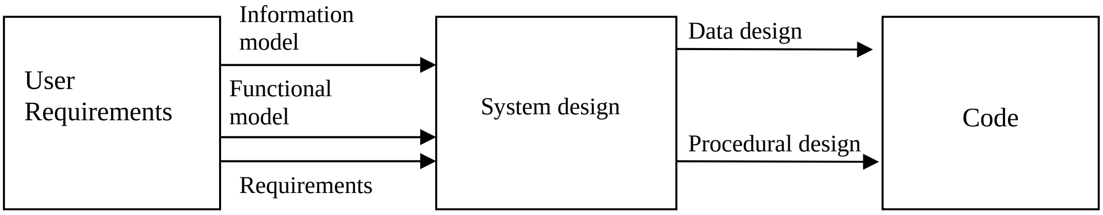


Figure 6: Process of software Design

During the process of software design, the information model is translated in to data design. Functional model and behavioural model are translated to architectural design, which defines major component of the software. Keeping in view the importance of design, it should be given due weightage before rushing to the coding of software.

Software design forms the foundation for implementation of a software system and helps in the maintenance of software in the future too. Software quality and software design process are highly interrelated. Quality is built into the software during the design phase.

High level design gives a holistic view of the software to be built, whereas low level refinements of the design are very closely related to the final source code. A good design can make the work of programmer easy and hardly allows the programmer to forget required details. Sufficient time should be devoted to the design process to ensure good quality software.

The following are some of the fundamentals of design:

9 The design should follow a hierarchical organisation,

10 Design should be modular or logically partitioned into modules, which are relatively independent and perform independent task,

11 Design leading to interface that facilitates interaction with the external environment,

12 Step-wise refinement to more detailed design, which provides necessary details for the developer of the code, and

13 Modularity is encouraged to facilitate parallel development, but, at the same time, too many modules lead to the increase of effort involved in integrating the modules.

System Design Specification

The system design specification or software design specification as referred to, has a primary audience, the system implementer or coder. It is also an important source of information the system verification and testing. The system design specification gives a complete understanding of the details of each component of the system, and its associated algorithms, etc.

The system design specification documents the requirements of the system be implemented. It consists of the final steps of describing the system in detail before coding begins.

The system design specification is developed in a two stage process. In the first step, design specification generally describes the overall architecture of the system at a higher level. The second step provides the technical details of low-level design, which will guide the implementer. It describes exactly what the software must perform to meet the requirements of the system.

Tools for Describing Design

Various tools are used to describe the higher level and lower level aspects of system design. The following are some of the tools that can be used in the System Design Specification to describe various aspects of the design.

Data Dictionary

Definition of all the data and control elements used in the software product or sub-system. Complete definition of each data item and its synonyms are included in the data dictionary. A data dictionary may consist of description of data elements and definitions of tables.

Description of Data Element:

14 Name and aliases of data item (its formal name).

15 Uses (which processes or modules use the data item; how and when the data item is used).

16 Format (standard format for representing the data item).

17 Additional information such as default values, initial value(s), limitations and constraints that are associated with the data elements.

Table Definitions

- Table name and Aliases.
- Table owner or database name.

- Key order for all the tables, possible keys including primary key and foreign key.
- Information about indexes that exist on the table.

Database Schema: Database schema is a graphical presentation of the whole database. Data retrieval is made possible by connecting various tables through keys. Schema can be viewed as a logical unit from the programmer's point of view.

E-R Model: Entity-relationship model is database analysis and design tool. It lists real-life application entities and defines the relationship between real life entities that are to be mapped to the database. E-R model forms the basis for database design.

Security Model: The database security model associates users, groups of users or applications with database access rights.

Trade-off Matrix

A matrix that is used to describe decision criteria and relative importance of each decision criterion. This allows comparison of each alternative in a quantifiable term.

Decision Table

A decision table shows the way the system handles input conditions and subsequent actions on the event. A decision table is composed of rows and columns, separated into four separate quadrants.

Input Conditions	Condition Alternatives
Actions	Subsequent Action Entries

Timing Diagram

Describes the timing relationships among various functions and behaviours of each component. They are used to explore the behaviours of one or more objects throughout a given period of time. This diagram is specifically useful to describe logic circuits.

State Machine Diagram

State machine diagrams are good at exploring the detailed transitions between states as the result of events. A state machine diagram is shown in *Figure 7.*

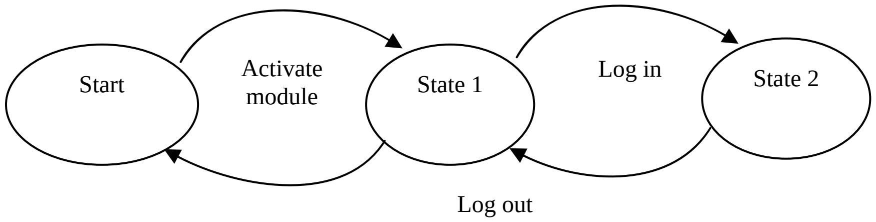
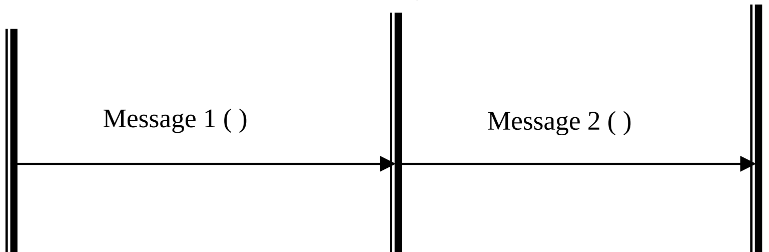


Figure 7: A state machine diagram

Object Interaction Diagram

It illustrates the interaction between various objects of an object-oriented system. Please refer to *Figure 8.* This diagram consists of directed lines between clients and servers. Each box contains the name of the object. This diagram also shows conditions for messages to be sent to other objects. The vertical distance is used to show the life of an object.



Object: class1
Object:class2
Object:class2

Figure 8: An object interaction diagram

A Flow chart shows the flow of processing control as the program executes. Please refer to *Figure 9*.

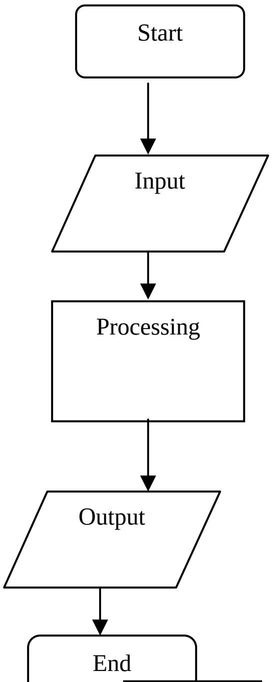


Figure 9: Flow chart

Inheritance Diagram

It is a de[illegible]work product that primarily doc[illegible]eritance relationships between classes and interfaces in object-oriented modeling. The standard notation consists of one box for each class. The boxes are arranged in a hierarchical tree according to their inheritance characteristics. Each class box includes the class name, its attributes, and its operations. *Figure 10* shows a typical inheritance diagram.

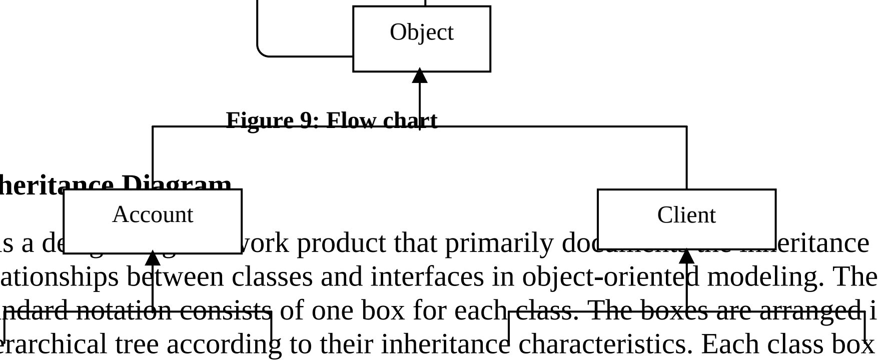


Figure 10: A typical inheritance diagram

Aggregation Diagram

The E-R model cannot express relationships among relationships. An aggregation diagram shows relationships among objects. When a class is formed as a collection of other classes, it is called an aggregation relationship between these classes. Each module will be represented by its name. The relationship will be indicated by a directed line from container to container. The directed line is labelled with the cardinality of the relationship. It describes "has a" relationship. *Figure 11* shows an aggregation between two classes (circle *has a* shape).

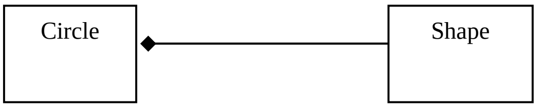


Figure 11: Aggregation

Structure Chart

A structure chart is a tree of sub-routines in a program (Refer to *Figure 12*). It indicates the interconnections between the sub-routines. The sub-routines should be labelled with the same name used in the pseudo code.

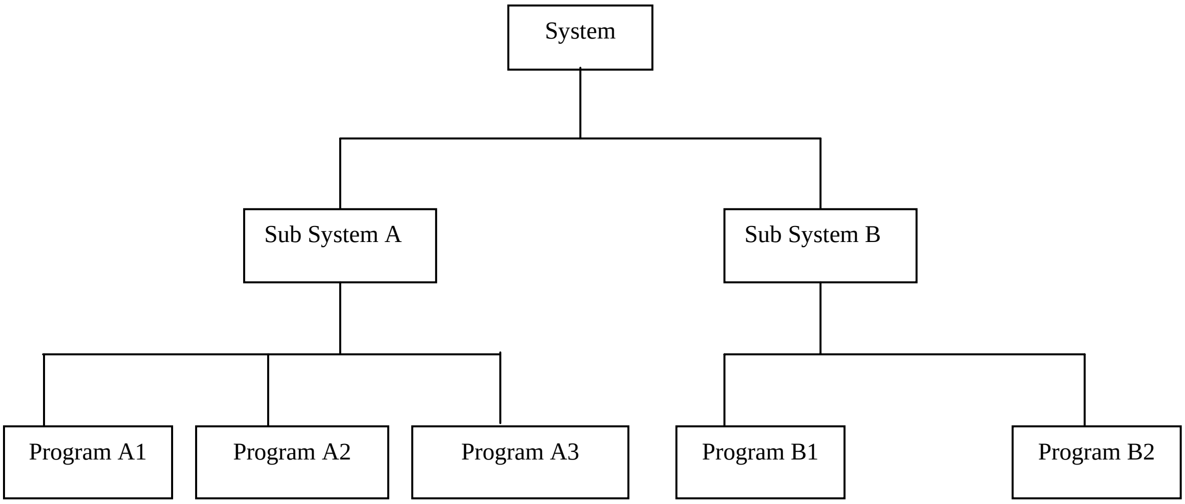
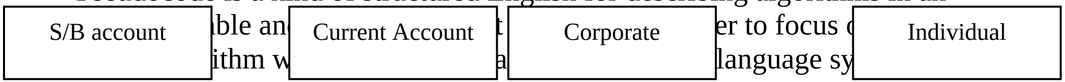


Figure 12: A structures chart

Pseudocode

Pseudocode is a kind of structured English for describing algorithms in an ble an t er to focus ithm w a language sy which the code is going to be written. The pseudocode needs to be complete. It describes the entire logic of the algorithm so that implementation becomes a routine mechanical task of translating line by line into the source code of the target language. Thus, it must include flow of control.



This helps in describing how the system will solve the given problem. "Pseudocode" does not refer to a precise form of expression. It refers to the simple use of Standard English. Pseudocode must use a restricted subset of English in such a way that it resembles a good high level programming language. *Figure 13* shows an example of pseudo code.

```
IF HoursWorked > MaxWorkHour THEN
Display overtime message
ELSE
```

Figure 13: Example of a pseudocode

Contents of a Typical System Design Specification Document

1. Introduction

    1.1 Purpose and scope of this document:
    Full description of the main objectives and scope of the SDS document is specified.

    1.2 Definitions, acronyms, abbreviations and references
    Definitions and abbreviations used are narrated in alphabetic order. This section will include technical books and documents related to design issues. It must refer to the SRS as one of the reference book.

2. System architecture description

    2.1 Overview of modules, components of the system and sub-systems
    Structure and relationships. Interrelationships and dependencies among various components are described. Here, the use of structure charts can
be
    useful.

3. Detailed description of components

17.2.1.1.1.1 3.1 Name of the component
17.2.1.1.1.2 3.2 Purpose and function
17.2.1.1.1.3 3.3 Sub-routine and constituents of the component
17.2.1.1.1.4 3.4 Dependencies, processing logic including pseudocode
17.2.1.1.1.5 3.5 Data elements used in the component.

4. Appendices.

3.5 SAMPLE DESIGN DOCUMENT

SCOPE

Define the System's Objectives here

……………………

Architecture Design

Give the architecture of the system based on the analysis and flow models.

DATA DESIGN

Refine the E-R diagram if needed and make one table for each entry and data store and table for all M.M relationships.

For example, the Client table may be:

COLUMN HEADING *CONSTRAINTS*

client_no	Primary Key
client_number	Not Null
client_addr	Not Null

…….

INTERFACE DESIGN

Human-Machine Interface Design Rules

Follow the basis rules for the interface design. These can be classified into three main types:

- External Interface design
- Interface to the External Data
- Interface to the external system or devices

External Interface Design

18 Easy to follow Interface

19 Zero or very less graphics (as not being used commercially)

20 No hidden buttons

21 Proper error messages

…………………………………….

Interface to the External Data

The system has to use proper external data. The system makes a connection with the DBMS to do so. The rules that have to be followed while interfacing with the external data are:

- You must do the type checking.
- Field overrun that is maximum size should be enough to accommodate the largest data of that type
- It is always better to encrypt the data and then store it in the database.

Interface to the External System or Device

…………………………………..

PROCEDURAL DESIGN

Verification of the User

Algorithm

Input: ………..

Output: …………….

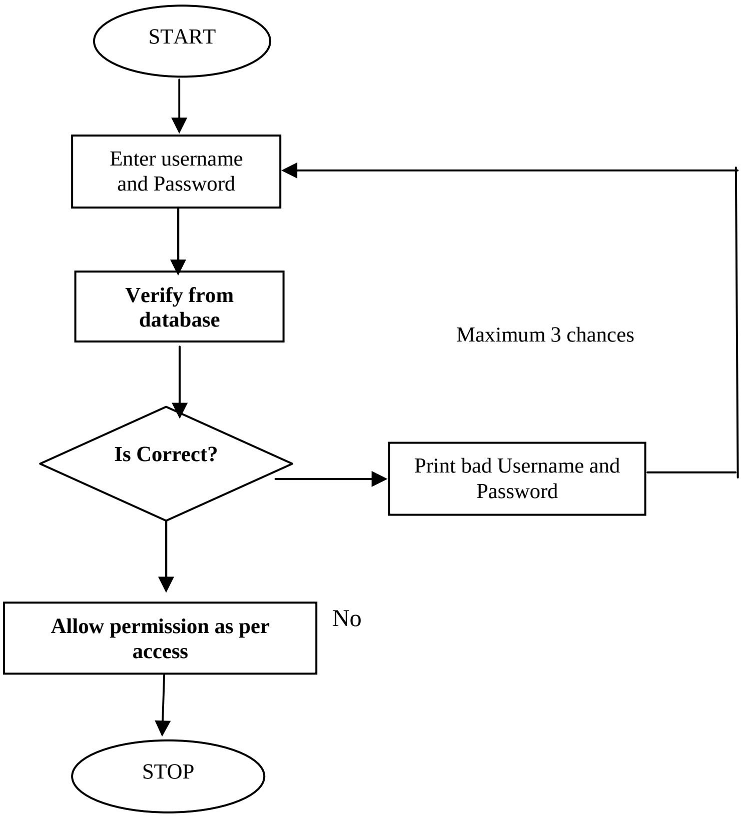
STEPS

Ask the Client to enter Username-Password.

Check Username and Password combination in the encrypted database.

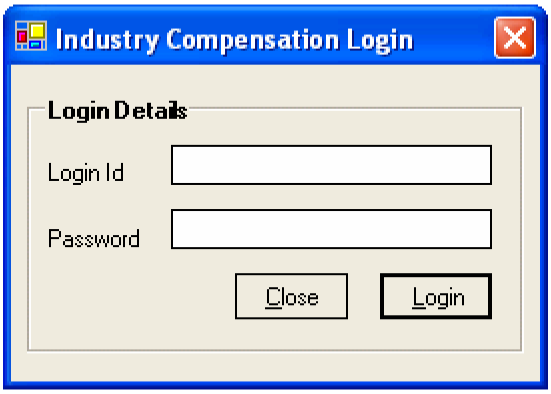
If the Username and Password is correct then give permission with allowed access rights.

Else, access is denied and the enter Username and Password screen is shown again. This cycle may be repeated for a maximum of three times.
Flow Chart


START
Enter username and Password
Verify from database
Maximum 3 chances
Is Correct?
Print bad Username and Password
Allow permission as per access
No
STOP

Interface Design

Login Screen



Output / Reports Design

Design your output reports

Data Security and Rights

Security is the integral part of any system. You can use encryption and authentication or any other security mechanism as the need may be.

3.6 CODING

The input to the coding phase is the SDD document. In this phase, the design document is coded according to the module specification. This phase transforms the SDD document into a high-level language code. Currently, major software companies adhere to some well-specified and standard style of coding called coding standards. Good coding standards improve the understanding of the code. Once a module is developed, a check is carried out to ensure that coding standards are followed. Coding standards generally give guidelines on the following:

i) Name of the module
ii) Internal and External documentation of source code
iii) Modification history
iv) Uniform appearance of codes.

It must contain proper comments. The coding should be structured as per software architecture.

VALIDATION CHECKS

Verification of the User

Both User Id and Password are mandatory
The size of User Id must be 10 characters long

ERROR AND EXCEPTION HANDLING

A proper mechanism of Error Handling is necessary in any system.

COMMENTS

Comments are an integral part of any system. Like any properly developed and maintained system with high quality, this system too has sufficient comments and description of the processes, functions, classes, and data structures.

CODING STANDARDS

The defined coding standards of software developers may be followed. A sample clause in coding standard may be: “A consistent naming pattern is one of the most important elements of predictability and discoverability in a managed code. For each type, you must follow the defined capitalisation styles, case sensitivity and word choice”.

3.7 TESTING

Testing

Testing is the process of running the software on manually created inputs with the intention to detect errors. In the process of testing, an attempt is made to detect errors, to correct the errors in order to develop error free software. Testing is performed keeping the user’s requirements in mind and before the software is actually launched on a real system, it is tested.

Normally, while developing the code, a software developer also carries out some testing. This is known as debugging. This unearths the defects that must be removed from the program. Testing and debugging are different processes. Testing is meant for finding the existence of defects while debugging stands for locating the place of errors and correcting the errors during the process of testing. The following are some guidelines for testing:

i) Test the modules thoroughly, cover all the access paths, generate enough data to cover all the access paths arising from conditions.
ii) Test the modules by deliberately processing/entering wrong data.
iii) Specifically create data for conditional statements. Enter data in test file, which will satisfy the conditions and test the script again.
iv) Test for locking by invoking multiple concurrent processes.

The following objectives are to be kept in mind while performing testing:

i) It should be done with the intention of finding errors.
ii) Good test cases should be designed with a probability of detecting undiscovered errors.
iii) A successful test is one that uncovers yet undiscovered error(s).

The following are some of the principles of testing:

i) All tests should be performed according to user requirements.
ii) Planning of tests should be done long before testing.
iii) Starting with a small test, it should proceed towards large tests.

The following are different levels of testing:

Large systems are built out of subsystems, subsystems are made up of modules, of procedures and functions. Thus, in large systems, testing is performed at various levels, like unit level testing, module level testing, subsystem level, and system level testing.

In all levels, testing is performed to check interface integrity, information content, and performance.

The following are some of the strategies for testing: This involves design of test cases. Test case is a set of designed data for which the system is tested. Two testing strategies are present.

i) **Code Testing:** The code testing strategy examines the logic of the system. In this, the analyst develops test cases for every instruction in the code. All the paths in the program are tested. This test does not guarantee against software failures. Also, it does not indicate whether the code is according to requirements or not.

ii) **Specification Testing:** In this, testing with specific cases is performed. The test cases are developed for each condition or combination of conditions and submitted for processing.

The objective of testing is to design test cases that systematically uncover different classes of errors and do so with the minimum amount of time and effort. Testing cannot show the absence of errors. It can only find the presence of errors. The test case design is as challenging as software development. Still, however effective the design is, it cannot remove 100% errors. Even, the best quality software are not 100 % error free. The reliability of software is closely dependent on testing.

Some testing techniques are the black box and the white box methods.

White Box Testing: This method, also known as glass box testing, is performed early in the testing process. Using this, the software engineer can derive tests that guarantees exercises of all independent paths within the module at least once. It has the following features:

i) Exercises all logical decisions on their true and false sides.

ii) Executes all loops at their boundaries and within their operational bounds.
iii) Exercises internal data structures to assure their validity.

Black Box Testing: This is applied during the later stage of testing. It enables the software developer to derive a set of input conditions that will fully exercise the functional requirements of a program. It enables him/her to detect errors like incorrect or missing functions, interface errors, data structures or external data base access errors and performance errors etc.

3.8 TEST DESIGN DOCUMENT

During system development, this document provides the information needed for adequate testing. It also lists approaches, procedures and standards to ensure that a quality product meets the requirement of the user. This document is generally supplemented by documents like schedules, assignments and results. A record of the final result of the testing should be kept externally.

This document provides valuable input for the maintenance phase.

The following IEEE standards describe the standard practices on software test and documentation:

829-1998 IEEE Standard for Software Test Documentation
1008-1987 (R1993) IEEE Standard for Software Unit Testing
1012-1998 IEEE Standard for Software Verification and Validation

The following is the typical content of the Test Design Document:

1. Introduction

Purpose

The purpose of this *document* and its intended audience are clearly stated.

Scope

Give an overview of testing process and major phases of the testing process. Specify what is not covered in the scope of the testing such as, supporting or not third party software.

Glossary

It defines technical terms used in this document.

References

Any references to other external documents stated in this document including references to related project documents. They usually refer to the System Requirement Specification and the System Design Specification documents.

Overview of Document

Describe the contents and organisation of the document.

Test Plan

A test plan is a document that describes the scope, approach, resources and schedule of intended testing activities. It identifies test items, the features to be tested, the testing tasks, and the person who will do each task, and any risks that require contingency planning.

Schedules and Resources

An overview of the testing schedule in phases along with resources required for testing is specified.

Recording of Tests

Specify the format to be used to record test results. It should very specifically name the item to be tested, the person who did the testing, reference of the test process/data and the results expected by that test, the data tested. If a test fails, the person responsible for correcting and re-testing is also documented. The filled out format would be kept with the specific testing schedule. A database could be used to keep track of testing.

Reporting Test Results

The summary of what has been tested successfully and the errors that still exist which are to be rectified is specified.

Verification Testing

Unit Testing

For each unit/component, there must be a test, which will enable the tester to know the accurate functioning of that unit.

Integration testing

Integration test is done on modules or sub-systems.

Validation Testing

System Testing

This is top level integration testing. At this level, requirements are validated as described in the SRS.

Acceptance and Beta Testing

List test plans for acceptance testing or beta testing. During this test, real data is used for testing by the development team (acceptance testing/alpha testing) or the customer (beta testing). It describes how the results of such testing will be reported and handled by the developers.

A sample test case may be:

Login Screen

S.No.	Test Case ID	Do	Expected Result
1.	QT1-001	Enter user id in the text box specified.	Successful login in to the system if the values

		User id must not be more than 510 characters and it should not contain any special characters and no spaces including in the start. Enter password in the text box specified. Password must not be more than 10 characters. Click on the Login button.	are found in the database.
…..			

Test Log

Function	**Purpose of Set of Test Cases per Area**	**Test Case ID(s)**	**No of Test Cases run**	**Number of Test Cases Successful**
Login	The verification of username and password	QT1-001	8	100%
……				

3.9 SUMMARY

Software engineering covers the entire range of activities used to develop software. The activities include requirements analysis, program development using some recognised approach like structured programming, testing techniques, quality assurance, management and implementation and maintenance. Further, software engineering expects to address problems, which are encountered during software development.

3.10 FURTHER READINGS

1. *Software Engineering, Sixth Edition, 2001*, Ian Sommerville; Pearson Education., New Delhi.

2. *Software Engineering – A Practitioner's Approach*, Roger S. Pressman; McGraw-Hill, New Delhi.

3. Jeffrey A. Hoffer, Joey F. George, Joseph S. Valacich; *Modern Systems Analysis and Design*; Pearson Education; Third Edition; 2002.

4. ISO/IEC: 18019: Guide lines for the design and preparation of user documentation for application software.

5. MCS-034 Course material of MCA (revised syllabus), IGNOU.

6. MCS-014 Course material of MCA (revised syllabus), IGNOU.

7. http://www.rspa.com

8. http://www.ieee.org

9. http://standards.ieee.org

10. http://www.sce.carleton.ca/squall

11. http://en.tldp.org/HOWTO/Software-Release-Practice-HOWTO/documentation.html

12. http://www.sei.cmu.edu/cmm/

UNIT 4 CATEGORY WISE PROBLEM DEFINITION

Structure **Page Nos.**

4.0 INTRODUCTION

The project is dedicated to investigating the potentials of advanced technologies in group learning, information exchange and network conferencing involving teachers and students. Project development is the student's opportunity to do a significant piece of work in an area of personal interest and to expand his or her understanding of computer science. The students are free to pursue any area of computer science that is of their interest e.g., web application development or network applications etc. This unit provides a description of project problems and ideas in different areas of computer science. However, students can elaborate the project definitions further after discussions with the counsellor. You should select project problems, that is challenging, but manageable within the resources and time available.

4.1 OBJECTIVES

After going through this unit, you should be able to:

- get an opportunity to investigate a chosen topic in considerable depth;
- know how to start a project;
- understand the given project problems;
- develop or critical awareness of current problems and/or new insights, in their field of study;
- know the application and tools for project development, and
- deal with project analysis issues both systematically and creatively.

4.2 PROJECT SELECTION

The selection of project area and problem is of crucial importance. The area needs to integrate the interests of the student with the specialisation of the counsellor, and be of a suitable level of difficulty. Students are encouraged to think about the subject areas of their interest in which they would like to undertake a project, and after discussion with the counsellor, or preliminary project problem can be selected. A counsellor is formally allocated to students, and in consultation with the counsellor, a project proposal is prepared. Selecting a project problem can be difficult from the given set of projects. You could do so, by answering some of the following questions.

Am I interested in this area or topic? This is a very important question. If your answer is no, choose another area or topic. What do I know about this subject or topic?

This would determine the amount of work and research you have to put in. What are some of the things that can be discussed about this subject or topic? This identifies the amount of sub-topics (scope) that can be discussed. It also helps determine how easy or difficult this subject would be. Who will benefit from this project? It will determine the importance of your project. At who am I targeting this project? This will help you in the presentation and your answer to this question should not be “only the examiner”.

The projects offered in this unit may vary substantially in breadth, depth and degree of difficulty. The most important thing is to shortlist a set of projects that are right for you. A number of students are better suited to well-defined and relatively secure projects that provide scope for representing expertise with a low risk of disappointment. Other students are better advised to undertake relatively difficult, insecure projects that require a high degree of innovative input and/or technical problem solving.

You can elaborate on project definitions after discussing it with your counsellor; so you may require different resources and references in order to understand and elaborate on the definition of these project areas. You can get detail understanding of these projects from your industrial placement employer or another similar software organisation or University (e.g., different department’s, teaching, research or administration) previous projects that need further work done similar to the project description given. You should start the project with a commonly known project problem, but with a novel solution, applying a well-known solution to a novel class of problems and evaluating several possible solutions to find the best one for solving a particular problem.

4.3 PROJECT CATEGORIES

We have divided different projects into four broad areas / categories of computer science as given below, so that you can select any of these category for your Mini project.

- Application development
- Networking project
- System software
- Website development.

An initial list of project definition will be given below in the following sections however, a student can elaborate project definitions after discussing with the counsellor.

Students should select projects from the given categories according to their interest, experience and knowledge in that area, students should evaluated themselves objectively and, then choose the project. Students may propose modification and suggestions in the given project specification and finalise it with the approval of the counsellor.

4.4 APPLICATION DEVELOPMENT PROJECTS

Here, we will focus on investigating new ideas in application development through different projects. A set of names of possible projects and their details will be presented. However, students are encouraged to be creative and develop their own ideas in the given project descriptions.

1) Project Name: Cricket Training Management System

Description

Design and develop a Cricket Training Management System to improve the quality of training. Assume there are many teams (according to their age and experience) and each of them need different training, different set of exercises, and different diet. With your system it should be possible to select a set of exercises and create a programme for each team according to their age and experience, and keep track of each team member and his/her performance. Also, it should include the attendance system to record, who did not turn up for a particular session. Your system should also prepare a diet chart for each and every member considering his or her age, height, weight, role, level etc.

2) **Project Name: Conference Room Booking**

Description

Build a software for online conference room booking on date and time basis, in order to better facilitate meetings and collaborative work for people connected the by local area network. This software helps any authorised person book a shared conference room from his/her desk itself and also shows the availability of a particular conference room at the chosen time and date. This software also handles various device booking such as an amplifier, video switch and projector etc. Also, this software can be improvised to send a confirmation mail to the user's id alongwith the booked timings and date.

4.5 NETWORKING PROJECTS

We will focus on investigating new ideas in networking research through different networking projects. A set of possible project topics, which will be presented. However, students are encouraged to be creative and develop their own ideas in the given project descriptions.

1) **Project Name: Advance Search Utility for Network**

Description

Develop a search utility for searching the different documents based on size (in bytes), type (e.g., html, doc, pdf etc), date-of-modification and contents (text written in document) from the different machines in a network. It will search the documents and indicate the source machine, file and other relevant information.

2) **Project Name: Simulator of Bus Network**

Description

Buses have been widely used in LANs (e.g., Ethernet) to inter-connect a moderate number of computers. This project develops a discrete-event simulator for a bus-based network with the intend of analyse system performance under different working conditions like:

- Performance on cable breakdown
- Performance on additional computers are added or
- Performance on heavy traffic
- Possibility of Data leakage
- Possibility of Virus infection
- Performance with Carrier Sense Multiple Access
- Performance with a bus master which controls access to the shared bus resource.

4.6 SYSTEM SOFTWARE DEVELOPMENT PROJECTS

Here we will focus on investigating new ideas in application development through different projects. A set of possible project name and their details will be presented. However, students are encouraged to be creative and develop their own ideas in the given project descriptions.

1) **Project Name: Advance Data Manager**

Description

The way we organise our information and files, in the same way, develop an application, which will classify and group the files according to the user requirements like size, type, date of modification, contents and other logical relationships. Your application should create the different folders automatically and place files into them. For example: I have 36 files in my folder say ABC, and I want them to put in 4 folders named as 2003, 2004, 2005, 2006, which should contain the files, created in the years 2003, 2004, 2005 and 2006 respectively. For this task simply I will select the files and ask my application to do this work for me.

2) **Project Name: Voice Password**

Description

Passwords are usually used to achieve secure authentication in a computer system. This project will require the student to come up with an alternative way of authenticating usage using a combination of voice words to authenticate users. The software should recognise the voice of each user uniquely and correctly.

4.7 WEB DEVELOPMENT PROJECTS

Here we will focus on investigating new ideas in application development through different projects. A set of possible project name and their details will be presented. However, students are encouraged to be creative and develop their own ideas in the given project descriptions.

1) **Project Name: On line election**

Description

Develop a website for “On line election”. The programmer should understand the constraints and real time issues faced during elections. For example: Let students of a college prepare for the elections president and other posts. Design a website which will show all the details of all the contesting candidates, their agenda, commitments etc. During the specific day students will securely contribute his/her vote. Voting should be secure; program should not disclose the identity of voter (e.g., who gave vote to whom should not disclose and should not be accessible any one). The voter should be able to vote only once. Voter authentication should be done properly.

2) **Project Name: On-line examination**

Description

Online examination for objective and subjective questions. For subjective questions avoid the copy and paste function on the web page, only the keyboard should work in the Box’s for descriptive questions. Timer should inform the student about the amount of time left. Questions should be generated one after another randomly; select the question from the database. User name and password for each student should be checked properly. Automatically checking of objective answers, and for descriptive answer manually checking should be done. Provide online declaration of results.

The idea is to set up an on-line cost effective Test Engine. The examination department, the academy will maintain a question bank. The Controller of examinations will have the authority to modify the criteria for examinations according to the academy’s rules.

The system will facilitate off-line evaluation of examinations and declaration of results. The system will allow experts to send in their questions to the question bank through this system. In general this system has the following objectives:

- To design an on-line cost effective examination and evaluation system.
- Fetch the questions randomly according to specific criteria from a large question database.
- Provide on-line evaluation and result declaration system.
- Use latest IT tools and Internet/Intranet technology to make a on-line Examination and evaluation system.
- To save the time of students engaged in learning advanced tools and technologies.
- To create a multi user application for conducting examinations and evaluating results on-line for intranet.
- Measure your skills.
- Certify your abilities.

4.8 LIST OF APPLICATION AND TOOLS

FRONT END / GUI Tools	Visual Basic, Power Builder, X-Windows (X/lib, X/motif, X/Intrinsic), Oracle Developer 2000,VC++, Jbuilder
RDBMS/BACK END	Oracle, Ingres, Sybase, Progress, SQL Plus, Versant, MY SQL, SQL Server, DB2
LANGUAGES	C, C++, Java, VC++, C#
NETWORK SIMULATORS	NS2, MIT’S, NETSIM, NIST, CPSIM, INSANE, NEST, REAL, OPNET, JAVA
SCRIPTING LANGUAGES	PERL, SHELL Scripts (Unix), TcL/TK
RDBMS/BACK END	Oracle, Ingres, Sybase, Progress, SQL Plus, Versant, MY SQL, SQL Server, DB2
.NET Platform	Dyalog APL, VB.Net, C#.Net, Visual C#.Net, Net, ASP.Net, Delphi
MIDDLE WARE (COMPONENT) TECHNOLOGIES	COM/DCOM, Active-X, EJB, WINCE, MSMQ, BEA, MessageQ, MTS, CICS
UNIX INTERNALS	Device Drivers, RPC, Threads, Socket programming
ARCHITECTURAL CONCEPTS	COBRA, TUXEDO, MQ SERIES
INTERNET TECHNOLOGIES	DHTML, Java script, VB Script, Perl & CGI script, HTML, Java, Active X, RMI, CORBA, SWING, JSP, ASP, XML, EJB, Java Beans, Servlets, Visual Age for

	JAVA, UML, VRML, WML, Vignette, EDA, Broadvision, Ariba, iPlanet, ATG, BigTalk, CSS, XSL, Oracle ASP server, AWT, J2EE, LDAP, ColdFusion, Haskell 98
WIRELESS TECHNOLOGIES	Blue Tooth, 3G, ISDN, EDGE
REALTIME OPERATING SYSTEM/ EMBEDDED SKILLS	QNX, LINUX, OSEK, DSP, VRTX, RTXC, Nucleus
OPERATING SYSTEMS	WINDOWS 2000/ME, WINDOWS NT, WINDOWS XP, UNIX, LINUX, IRIX, SUN SOLARIS, HP/UX, PSOS, VxWorks, AS400, AIX, DOS
APPLICATION AREAS	Financial / Insurance / Manufacturing / Multimedia / Computer Graphics / Instructional Design/ Database Management System/ Internet / Intranet / Computer Networking-Communication Software development/ E-Commerce/ ERP/ MRP/ TCP-IP programming / Routing protocols programming/ Socket programming.

4.9 SUMMARY

Projects also often form an important focus of discussion at interview with future employers as they provide a detailed example of what you can achieve. Projects typically involve adopting an engineering approach to the design and development of a software system that fulfils a practical need (including, for example, filling a perceived gap in the general software market). You can choose your project topic from the lists supplied in this unit. We encourage industry-related suggestions in our projects topics and novel applications within the sciences, education or government.

4.10 FURTHER READINGS

1. http://www.rspa.com

2. http://standards.ieee.org

3. http://www.sce.carleton.ca/squall

4. http://www.isi.edu/nsnam/ns/

5. http://www.inrialpes.fr/planete/People/ernst/Documents/Simulator.html.

UNIT 1 PROJECT STRUCTURE

Structure **Page Nos.**

1.0 INTRODUCTION

The project report should be documented with an engineering approach to the solution of the problem that you have sought to address. The project report should be prepared in order to solve the problem in a methodical and professional manner, making due references to appropriate techniques, technologies and professional standards. You should start the documentation process from the first step of software development so that you can easily identify the issues to be focused upon in the ultimate project report. You should also include the details from your project notebook, in which you would have recorded the progress of your project throughout the course. The project report should contain enough details to enable examiners to evaluate your work. The details, however, should not render your project report as boring and tedious. The important points should be highlighted in the body of the report, with details often relegated to appendices. This unit covers all the details on the structure of mini project report contents; it also contains detailed explanations on each of these contents.

1.1 OBJECTIVES

After going through this unit, you should be able to:

- demonstrate a systematic understanding of project contents;
- understand methodologies and professional way of documentation;
- know the meaning of different project contents, and
- understand established techniques of project report development.

1.2 IMPORTANCE OF THE MINI PROJECT

The Mini Project is not only a part of the coursework, but also a mechanism to demonstrate your abilities and specialisation. It provides the opportunity for you to demonstrate originality, teamwork, inspiration, planning and organisation in a software project, and to put into practice some of the techniques you have been taught throughout the previous courses. The Mini Project is important for a number of reasons. It provides students with:

- opportunity to specialise in specific areas of computer science;
- future employers will most likely ask you about your project at interview;
- opportunity to demonstrate a wide range of skills and knowledge learned, and
- encourages integration of knowledge gained in the previous course units.

The project report is an extremely important aspect of the project. It serves to show what you have achieved and should demonstrate that:

- You understand the wider context of computing by relating your choice of the project, and the approach you take, to existing products or research.
- You can apply the theoretical and practical techniques taught in the course to the problem you are addressing and that you understand their relevance to the wider world of computing.
- You are capable of objectively criticising your own work and making constructive suggestions for improvements or further work based on your experiences so far.
- You can explain your thinking and working processes clearly and concisely to others through your project report.

1.3 MINI PROJECT: TABLE OF CONTENTS

The project report should contain a full and coherent account of your work. Although there will be an opportunity to present your work verbally, and demonstrate the software, the major part of the assessment will be based on the written material in your project report. You can expect help and feedback from your MCS-044 course counsellor, but ultimately it's your own responsibility. The suggestive structure of a project report should be as given below; however, you should be guided by your counsellor in selecting the most appropriate format for your project.

Title Page

Original Copy of the Approved Proforma of the Project Proposal
Certificate of Authenticated work
Role and Responsibility Form

Abstract

Acknowledgement
Table of Contents
Table of Figures

CHAPTER 1: INTRODUCTION

1.1 Background
1.2 Objectives
1.3 Purpose, Scope, and Applicability
1.3.1 Purpose
1.3.2 Scope
1.3.3 Applicability
1.4 Achievements
1.5 Organisation of Report

CHAPTER 2: SURVEY OF TECHNOLOGIES

CHAPTER 3: REQUIREMENTS AND ANALYSIS

3.1 Problem Definition
3.2 Requirements Specification
3.3 Planning and Scheduling
3.4 Software and Hardware Requirements
3.5 Preliminary Product Description
3.6 Conceptual Models

CHAPTER 4: SYSTEM DESIGN

4.1 Basic Modules

- 4.2 Data Design
  - 4.2.1 Schema Design
  - 4.2.2 Data Integrity and Constraints
- 4.3 Procedural Design
  - 4.3.1 Logic Diagrams
  - 4.3.2 Data Structures
  - 4.3.3 Algorithms Design
- 4.4 User interface design
- 4.5 Security Issues
- 4.6 Test Cases Design

CHAPTER 5: IMPLEMENTATION AND TESTING

- 5.1 Implementation Approaches
- 5.2 Coding Details and Code Efficiency
  - 5.2.1 Code Efficiency
- 5.3 Testing Approach
  - 5.3.1 Unit Testing
  - 5.3.2 Integrated Testing
- 5.4 Modifications and Improvements

CHAPTER 6: RESULTS AND DISCUSSION

- 6.1 Test Reports
- 6.2 User Documentation

CHAPTER 7: CONCLUSIONS

- 7.1 Conclusion
- 7.2 Limitations of the System
- 7.3 Future Scope of the Project

REFERENCES
GLOSSARY
APPENDIX A
APPENDIX B

1.4 EXPLANATION OF CONTENTS

Title Page

Sample format of *Title page* is given in Appendix 1 of this block. Students should follow the given format.

Original Copy of the Approved Proforma of the Project Proposal

Sample *Proforma of Project Proposal* is given in Appendix 2 of this block. Students should follow the given format.

Certificate of Authenticated work

Sample format of *Certificate of Authenticated work* is given in Appendix 3 of this block. Students should follow the given format.

Role and Responsibility Form

Sample format for *Role and Responsibility Form* is given in Appendix 4 of this block. Students should follow the given format.

Abstract

This should be one/two short paragraphs (100-150 words total), summarising the project work. It is important that this is not just a re-statement of the original project outline. A suggested flow is background, project aims and main achievements. From the abstract, a reader should be able to ascertain if the project is of interest to them and, it should present results of which they may wish to know more details.

Acknowledgements

This should express your gratitude to those who have helped you in the preparation of your project.

Table of Contents: The table of contents gives the readers a view of the detailed structure of the report. You would need to provide section and subsection headings with associated pages. The formatting details of these sections and subsections you will find in unit 2 of this block.

Table of Figures: List of all Figures, Tables, Graphs, Charts etc. along with their page numbers in a table of figures.

Chapter 1: Introduction

The introduction has several parts as given below:

Background: A description of the background and context of the project and its relation to work already done in the area. Summarise existing work in the area concerned with your project work.

Objectives: Concise statement of the aims and objectives of the project. Define exactly what you are going to do in the project; the objectives should be about 30 /40 words.

Purpose, Scope and Applicability: The description of Purpose, Scope, and Applicability are given below:

- *Purpose:* Description of the topic of your project that answers questions on why you are doing this project. How your project could improve the system its significance and theoretical framework.

- *Scope:* A brief overview of the methodology, assumptions and limitations. You should answer the question: What are the main issues you are covering in your project? What are the main functions of your project?

- *Applicability:* You should explain the direct and indirect applications of your work. Briefly discuss how this project will serve the computer world and people.

Achievements: Explain what knowledge you achieved after the completion of your work. What contributions has your project made to the chosen area? Goals achieved - describes the degree to which the findings support the original objectives laid out by the project. The goals may be partially or fully achieved, or exceeded.

Organisation of Report: Summarising the remaining chapters of the project report, in effect, giving the reader an overview of what is to come in the project report.

Chapter 2: Survey of Technologies

In this chapter *Survey of Technologies* you should demonstrate your awareness and understanding of Available Technologies related to the topic of your project. You should give the detail of all the related technologies that are necessary to complete your project. You should describe the technologies available in your chosen area and present a comparative study of all those Available Technologies. Explain why you selected the one technology for the completion of the objectives of your project.

Chapter 3: Requirements and Analysis

Problem Definition: Define the problem on which you are working in the project. Provide details of the overall problem and then divide the problem in to sub-problems. Define each sub-problem clearly.

Requirements Specification: In this phase you should define the requirements of the system, independent of how these requirements will be accomplished. The Requirements Specification describes the things in the system and the actions that can be done on these things. Identify the operation and problems of the existing system.

Planning and Scheduling: Planning and scheduling is a complicated part of software development. Planning, for our purposes, can be thought of as determining all the small tasks that must be carried out in order to accomplish the goal. Planning also takes into account, rules, known as constraints, which, control when certain tasks can or cannot happen. Scheduling can be thought of as determining whether adequate resources are available to carry out the plan. You should show the Gantt chart and Program Evaluation Review Technique (PERT).

Software and Hardware Requirements: Define the details of all the software and hardware needed for the development and implementation of your project.

- *Hardware Requirement:* In this section, the equipment, graphics card, numeric co-processor, mouse, disk capacity, RAM capacity etc. necessary to run the software must be noted.

- *Software Requirements:* In this section, the operating system, the compiler, testing tools, linker, and the libraries etc. necessary to compile, link and install the software must be listed.

Preliminary Product Description: Identify the requirements and objectives of the new system. Define the functions and operation of the application/system you are developing as your project.

Conceptual Models: You should understand the problem domain and produce a model of the system, which describes operations that can be performed on the system, and the allowable sequences of those operations. Conceptual Models could consist of complete Data Flow Diagrams, ER diagrams, Object-oriented diagrams, System Flowcharts etc.

Chapter 4: System Design

Describes desired features and operations in detail, including screen layouts, business rules, process diagrams, pseudocode and other documentation.

Basic Modules: You should follow the divide and conquer theory, so divide the overall problem into more manageable parts and develop each part or module separately. When all modules are ready, you should integrate all the modules into one system. In this phase, you should briefly describe all the modules and the functionality of these modules.

Data Design: Data design will consist of how you organise, managing and manipulate the data.

- *Schema Design:* Define the structure and explanation of schemas used in your project.

- *Data Integrity and Constraints:* Define and explain all the validity checks and constraints you are providing to maintain data integrity.

Procedural Design: Procedural design is a systematic way for developing algorithms or procedurals.

- *Logic Diagrams:* Define the systematical flow of procedure that improves its comprehension and helps the programmer during implementation. e.g., Control Flow Chart, Process Diagrams etc.

- *Data Structures:* Create and define the data structure used in your procedures.

- *Algorithms Design:* With proper explanations of input data, output data, logic of processes, design and explain the working of algorithms.

User Interface Design: Define user, task, environment analysis and how you intend to map those requirements in order to develop a "User Interface". Describe the external and internal components and the architecture of your user interface. Show some rough pictorial views of the user interface and its components.

Security Issues: Discuss Real-time considerations and Security issues related to your project and explain how you intend avoiding those security problems. What are your security policy plans and architecture?

Test Cases Design: Define test cases, which will provide easy detection of errors and mistakes with in a minimum period of time and with the least effort. Explain the different conditions in which you wish to ensure the correct working of your software.

Chapter 5: Implementation and Testing

Implementation Approaches: Define the plan of implementation, and the standards you have used in the implementation.

Coding Details and Code Efficiency: Students not need include full source code, instead, include only the important codes (algorithms, applets code, forms code etc). The program code should contain comments needed for explaining the work a piece of code does. Comments may be needed to explain why it does it, or, why it does a particular way.

You can explain the function of the code with a shot of the output screen of that program code.

- *Code Efficiency:* You should explain how your code is efficient and how you have handled code optimisation.

Testing Approach: Testing should be according to the scheme presented in the system design chapter and should follow some suitable model – e.g., category partition, state machine-based. Both functional testing and user-acceptance testing are appropriate. Explain your approach of testing.

- *Unit Testing:* Unit testing deals with testing a unit or module as a whole. This would test the interaction of many functions but, do confine the test within one module.

- *Integrated Testing:* Brings all the modules together into a special testing environment, then checks for errors, bugs and interoperability. It deals with tests for the entire application. Application limits and features are tested here.

Modifications and Improvements: Once you finish the testing you are bound to be faced with bugs, errors and you will need to modify your source code to improve the system. Define what modification you implemented in the system and how it improved your system.

Chapter 6: Results and Discussion

Test Reports: Explain the test results and reports based on your test cases, which should show that your software is capable of facing any problematic situation and that it works fine in different conditions. Take the different sample inputs and show the outputs.

User Documentation: Define the working of the software; explain its different functions, components with screen shots. The user document should provide all the details of your product in such a way that any user reading the manual, is able to understand the working and functionality of the document.

Chapter 7: Conclusions

Conclusion: The conclusions can be summarised in a fairly short chapter (2 or 3 pages). This chapter brings together many of the points that you would have made in the other chapters.

Limitations of the System: Explain the limitations you encounterd during the testing of your software that you were not able to modify. List the criticisms you accepted during the demonstrations of your software.

Future Scope of the Project describes two things: firstly, new areas of investigation prompted by developments in this project, and secondly, parts of the current work that were not completed due to time constraints and/or problems encountered.

REFERENCES

It is very important that you acknowledge the work of others that you have used or adapted in your own work, or that provides the essential background or context to your project. The use of references is the standard way to do this. Please follow the given standard for the references for books, journals, and online material.

GLOSSARY

If you use any acronyms, abbreviations, symbols, or uncommon terms in the project report then their meaning should be explained where they first occur. If you go on to use any of them extensively then it is helpful to list them in this section and define the meaning.

APPENDICES

These may be provided to include further details of results, mathematical derivations, certain illustrative parts of the program code (e.g., class interfaces), user documentation etc.

In particular, if there are technical details of the work done that might be useful to others who wish to build on this work, but that are not sufficiently important to the project as a whole to justify being discussed in the main body of the project, then they should be included as appendices.

1.5 SUMMARY

Project development usually involves an engineering approach to the design and development of a software system that fulfils a practical need. Projects also often form an important focus for discussion at interviews with future employers as they provide a detailed example of what you are capable of achieving. In this course you can choose your project topic from the lists supplied in *Unit 4: Category-wise Problem Definition.* The next Unit *Guidelines and Suggestions* will provide you detailed guidelines and suggestions, which will be useful for you during project development and the preparation of the report.

1.6 FURTHER READINGS

1. *Modern Systems Analysis and Design*; Jeffrey A. Hoffer, Joey F. George, Joseph S. Valacich; Pearson Education; Third Edition; 2002.

2. ISO/IEC 12207: *Software Life Cycle Process (http://www.software.org/quagmire/descriptions/iso-iec12207.asp).*

3. IEEE 1063: *Software User Documentation (http://ieeexplore.ieee.org).*

4. ISO/IEC: 18019: *Guidelines for the Design and Preparation of User Documentation for Application Software.*

5. http://www.sce.carleton.ca/squall.

6. http://en.tldp.org/HOWTO/Software-Release-Practice-HOWTO/documentation.html.

7. http://www.sei.cmu.edu/cmm/