



# OṢUN STATE UNIVERSITY

ÒṢOGBO, NIGERIA

COLLEGE OF SCIENCE, ENGINEERING AND TECHNOLOGY

FACULTY OF BASIC AND APPLIED SCIENCES

INFORMATION AND COMMUNICATION TECHNOLOGY  
DEPARTMENT

COURSE DESCRIPTION AND PRELIMINARY NOTES

CSC 497: Research Methodology/Seminar.

1 Units [0-0-3]

2022/23 Academic Session

**THIS DOCUMENT IS NOT FOR SALE !!**

Odétunjí Àjàdí ODÉJQBÍ

## Contents

<b>1</b>	<b>Preamble</b>	<b>2</b>
1.1	About the undergraduate project . . . . .	2
1.2	Course Objective . . . . .	2
1.3	Selecting a project . . . . .	3
1.4	Project title . . . . .	4
1.5	Project aim . . . . .	5
1.6	Project Objectives . . . . .	5
<b>2</b>	<b>Project Methodology</b>	<b>6</b>
2.1	Specification methods . . . . .	6
2.2	Formulation methods . . . . .	7
2.3	Design methods . . . . .	7
2.3.1	Design in Software project . . . . .	7
2.3.2	Design in Artificial Intelligence (AI) project . . . . .	7
2.3.3	Data design method . . . . .	8
2.3.4	Design in Hardware project . . . . .	8
2.4	Implementation methods . . . . .	8
2.4.1	Implementation in Software project . . . . .	8
2.4.2	Implementation in Hardware project . . . . .	9
2.4.3	Implementation in AI project . . . . .	9
2.5	Evaluation methods . . . . .	9
<b>3</b>	<b>Important aspects of the project</b>	<b>10</b>
3.1	Use of language . . . . .	10
3.2	Literature review . . . . .	11
3.3	Data . . . . .	11
3.4	Algorithms, heuristic, procedure . . . . .	11
3.5	Project note . . . . .	12
3.6	Project plan . . . . .	12

4 Course Support Resource 12

4.1 Course webpage . . . . . 12

5 Textbooks 13

NOVEMBER, 2022



# 1 Preamble

Graduating students in the Department of Information and Communication Technology are required to undertake a project. This document describes the procedure to guide your project activities. This is a general guidance to provide students with working experiences in the conduct, execution and documentation of a project activity. Students should please consult with their individual supervisors for further clarifications and specific directives on their projects.

## 1.1 About the undergraduate project

This is one(1) unit an Harmattan Semester course reckoned as a practical course [L-T-P] = [0-0-3]. In that wise you are expected to expend three(9) hours a week on the course throughout the duration of the course. The instruction in the course content should guide your activities in CSC499: Research Project, which is a Sessional course.

During your project you will be required to select a topic of your interest in the Information and Communication Technology area of the field of computing. Using this topic, you are to deploy what you have learnt, up to the moment, in your undergraduate degree programme. Therefore, the contents of the courses in which you have partaken in, or read about, from your Part I to the present should be reflected in the execution of your project. In addition, you are required to document the project activities following the standard best practices in computing science and engineering. At various stages during your project, you will be required to defend your work through oral presentations and interviews.

Specifically, the ability to give expression to the skills you have acquired during your training in this University will stand you in good stead. Also, your ability to communicate in the technical language of computing by using the appropriate vocabulary terms, acronyms, and symbols will be accessed.

This document aims to provide you a general guidance on how to efficiently conduct and effectively communicate your project activities.

## 1.2 Course Objective

The terms “project” and “research” are often used interchangeably and together (that is “Research project”). Here we will use the term “project” to refer to:

The description, formulation, execution and communication of the activities involved in the solution of a well-define information communication technology-based problem.

The intent of the course is for the students to gain familiarity with the language of expression, and acquittance with the technicalities involved, in conducting an investigation into well-stated problem and the development of an information and commu-

nication technology solution to it. After the completion of this course, the student will be better able to independently select an information communication technology-based problem and carry out the activities required for its solution.

Specifically, at the end of the project, candidates should have acquired information and skills manifesting in the ability to:

- (a.) Select a project topic and state a project title;
- (b.) Technically express a statement of the project problem in the context of the subject-matter of ICT;
- (c.) Identify a project aim;
- (d.) Set and state objectives to achieve the aim;
- (e.) Conduct a review of the literature on the subject-matter of the project problem;
- (f.) Identify the method for realising each of the objectives as well as the methodology to achieve the aim;
- (g.) Organise and execute the project activities;
- (h.) Document the project activities;
- (i.) Make oral presentation about the project conduct.

### **1.3 Selecting a project**

The project you wish to conduct should be carefully selected to fit your peculiar situation, skills and academic interests. Note that you will be engaged with this project for about the next six(6) months. Therefore, you need to select a topic that will hold your interest for that period or more. The project you selected can arise from:

- (a.) ICT oriented problem identified during your Industrial Training (IT);
- (b.) ICT oriented problem identified during your private study;
- (c.) An ICT based problem proposed to you by your supervisor;
- (d.) Part of an ongoing ICT base project, e.g. in the Department;
- (e.) Continuation of previous ICT project;
- (f.) An ICT-based problem that you have observed in your immediate environment.

**Irrespective of how you selected your area of interest and topic, the project should:**

- (1.) Address a problem in an area of Information Communication Technology aspects of computing science and engineering;
- (2.) Concisely state what you hope to accomplish;

- (3.) Within the ambit of your undergraduate learning;
- (4.) Must be achievable within the resources and time available to you;

**Criteria for selecting a project include:**

- (1.) Your strength (academic, programming, mathematical, language, etc.);
- (2.) Your major (Computer Science/Engineering/Maths/etc);
- (3.) Your interest/motivation;
- (4.) Financial situation;
- (5.) Time constraint.

## 1.4 Project title

Your project title must give expression to what you wish to accomplish: what you want to do. This will be determined by the “verb” term in the title. Example of the “verbs” that can appear in your project titles are as listed in Table 1.

Table 1: “Verbs” in project title

Ser. No.	Verb	Description
1.	Develop	Produce a complete working system.
2.	Design	Technically express the structure of a system.
3.	Simulate	Demonstrate the working of a system.
4.	Model	Formally express the structure of a system.
5.	Implement	Transform a design into a working system.
6.	Optimise	Improve the efficiency of a working system.
7.	Illustrate	Explain with example the capability of a system.
8.	Formulate	Express a model using the language of symbols.

Your project title must also contain the object of the study. This will be determined by the “noun” term in the title. Example of the “nouns” that can appear in your project titles are as listed in Table 2 and 3.

Listed below are examples project titles.

- 1. Development of a Number Tutoring System for *Yorùbá* Language.
- 2. Development of an Alphabet Tutoring System for Selected African language
- 3. Design and Simulation of a Text Control Robot Arm System
- 4. Development of a Mobile Application Recommender System for Soup making
- 5. Design and Implementation of a Mobile Application Information System for Osun state.

Table 2: “Noun” in project title

Ser. No.	Noun	Description
1.	Robot	A machine that gives expression to well-defined actions and process.
2.	Tutor	A system to support learning.
3.	Model	Formal expression of a concept.
4.	System	An entity with an identity which its maintains through interaction with its environment.
5.	Device	An artefact for a well-specified function.
6.	Process	A sequence of procedure to accomplish a well-defined tasks.
7.	Procedures	A subset or component of a process.
8.	Translator	A system that generate a sentence in language $L1$ corresponding to that of another language $L2$ .

Table 3: “Noun” in project title

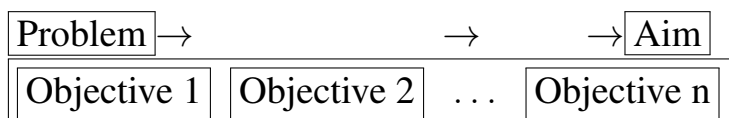
Ser. No.	Noun	Description
9.	Language	Instrument for giving expression to concepts.
10.	Decision	Selecting one of a number of alternative actions
11.	Application	System to support the accomplishment of a well-defined task
12.	Resource	Various data and objects for supporting the development of a system
13.	Digital	Binary formulated computing data and objects
14.	Information	String of symbols that encode logic
15.	Recommender	Presenting one of a number of alternative actions.

## 1.5 Project aim

The aim is the statement that summarises the final outcome of your project. A project must have **one aim**. The aim of your project should answer the question “What will be delivered after this project is concluded?” “What will be produce at the end of this project?” “What problem would have been solved at the end of this project?”. In order to construct a good aim, you must be able to identify the problem at hand what can be used to remove the problem. That which removes the problem is the aim.

## 1.6 Project Objectives

The objectives divides your aim into smaller sequence of tasks or activities which when carried out will accomplish the aim. Each task will achieve a goal.

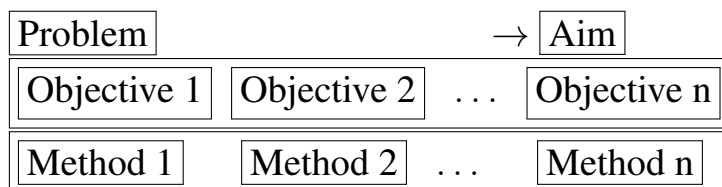


Objectives in ICT projects will normally include some of the following:

1. Specification
2. Formulation
3. Design
4. Implementation
5. Evaluation
6. Documentation

## 2 Project Methodology

The project methodology comprises the list of methods. Each method must correspond to an item in your list of objectives. It also include the procedure you will use to integrate or synthesis the methods during the project execution.



The following are the methods for achieving objectives of an ICT-based project. Each method has a set of specific tools for its realisation.

### 2.1 Specification methods

A detail and precise description of a problem precedes the specification of its solution. The purpose of the specification is to explicitly present the requirements that must be satisfied by the outcome of your project. The specification will state the character of **the input** and **the output** of the system that implements the solution to be presented by your project in the context of the user and implementation environment. Appropriate assumption must be stated and the limit of the target system must be clearly expressed. The following tools are used in specification method:

1. Use case diagram
2. Entity Relation ER diagram
3. Mock up digram
4. Activity Transcripts

There are also a number of software framework and tools available and used in modern software and hardware systems specification.

## **2.2 Formulation methods**

Mathematical equations, functions and models are used for model formulation. Standard mathematical models can be adopted or adapted to generate a formulae that suit a problem-solving process. This include:

1. Equations: Linear non-linear (e.g. quadratic);
2. Standard mathematical model: Decay model, Predator-Prey, Zero-sum game, etc.
3. Formal Grammar (alphabet, constant, variables, expression)
4. Petri-Nets

## **2.3 Design methods**

There are various design tools that you are expected to use during your project depending on the type of project and the aspect of your project solution specialisation.

### **2.3.1 Design in Software project**

1. Algorithm flowchart/pseudo-code
2. UML class diagram, transition diagram, sequence diagram;
3. Finite State Automata tools;
4. Truth tables;
5. Interface design diagram.

### **2.3.2 Design in Artificial Intelligence (AI) project**

1. Frame
2. Semantic networks
3. ANN structure
4. Fuzzy logic structure/architecture
5. Grammar specification
6. Tree and Graph
7. Heuristics
8. Script
9. Rules
10. Predicate calculus



### **2.3.3 Data design method**

1. Variables and constants format design
2. Input-Output Sample/Examples data design
3. Questionnaire design
4. Observation process design
5. Data measurement/collection design
6. Data storage format and structure design
7. Data pre-processing design
8. Data documentation design

### **2.3.4 Design in Hardware project**

1. Hardware circuit diagram
2. System Timing Diagram
3. Real-time that record design
4. Finite State Automata tools
5. Truth tables/ K-map
6. Signal/clock diagram

## **2.4 Implementation methods**

This will comprise the hardware and software instrument for realising the design. The details of the development environment should be stated. The documentation of the implementation of your project should include the following:

### **2.4.1 Implementation in Software project**

The following are issues that should be discussed in software project implementation:

1. The running program
2. The programming language (why you chose it)
3. Programming environment(IDE/OS)
4. Stages in software coding
5. The Editor software
6. Program compilation activities
7. Program Linking activities

8. JFlap (For automata models simulation)
9. NS3 (For Computer network simulation)
10. Andriod Studio (General simulation)
11. Andriod Software Stack (General simulation)
12. WEKA/Matlab/Maple/Octave (For mathematical model simulation)
13. R (For Statistical model simulation)

#### **2.4.2 Implementation in Hardware project**

In addition to the software issues above, the following are issues the should to be discussed in hardware project implementation:

1. System components: e.g. IC, transistor, Resistor, Relay, Switches, PROM, etc.
2. The circuit hosting media: Breadboard, Ferroboard
3. Arduino; DWSIM; FreeFem++; Freemat; Gekko; SageMath, Scilab; SymPy; RobotLogix.
4. Complete hardware construction

For AI application you will document

#### **2.4.3 Implementation in AI project**

In addition to the hardware issues above, the following are issues the should to be discussed in AI project implementation:

1. ESTA
2. Pycham
3. Flash or Pencil (Animation)
4. Octave or Matlab (Pattern Recognition)
5. JFlap (Automata and Grammar modelling)

The cost of implementation and possible cost of deployment should be stated.

### **2.5 Evaluation methods**

Evaluation is necessary to determine the extent to which the results of the solution you obtained satisfy the requirements specified for the problem you addressed in the project. Your evaluation should address the criterial you set in the requirements: both functional (what the system does) and non-functional (how the system does what it does). Your evaluation may also address issues relating to quality (how the system

feels). The evaluation may include criteria for the validity of: (i) The user interface, (ii) Data content, (iii) Process sequence, (iv) Response time, (v) Scalability and (vi) Cost efficiency.

In most conventional systems you will need to conduct  $\alpha$ - $\beta$  tests in software applications. The  $\beta$  aspect of the  $\alpha$ - $\beta$  test will often require that you use the software yourself or get some of your friends and colleagues that are familiar with the working of the system to use it. This will include: (i) Unit-testing and (ii) Integrated-testing. In Units-testing you test each and every components of the software individually and independently. When this has been done successfully, then the Integrated-testing commences. In Integrated-testing the entire system or a combination of two or more of its component are tested. When this has been done successfully, then the  $\beta$ -test commences. To do this, the software or system you developed will be given to potential users. A questionnaire is then used to collect user's opinion about the software performance. The accuracy and adequacy of output as well as quality and easy of user interface presentation will be the aim. If your program has a help menu, your questionnaire should also include questions about the usefulness of the help features.

In Non-conventional system such as Artificial Intelligence (AI) The mean opinion test (MOT) is used for evaluation. In the MOT evaluation, the aim is to determine human opinion about the extent to which a system mimics specific human ability. Therefore, the efficiency of the software, e.g. speed of operation, amount of memory and data but or processor time used by the system are inconsequential.

### **3 Important aspects of the project**

The following aspects are very important to the quality of the conduct of your project. The care and attention you give to them will reflect in the final outcome of your project work. These aspects are briefly discussed as follows.

#### **3.1 Use of language**

Your command of the language of communication in computing generally, and your area of specialisation in particular, is central to successful conduct of your project. Ensure that you understand each important terms used in the expression of concepts in your area of specialisation. To this end you will need a dictionary of computing (there a many such dictionary on the internet). So consult dictionary regularly to be sure of the meaning of the terms your are using. If a term has more than one meaning, be sure to indicate which of the meaning you are adopting, and why. Revisit the definition of some key terms such as (i) symbol, digit, letter, data, strings, algorithm, information, tutor, hardware, software, etc.

You must ve very familiar with the meaning of all the symbol and acronyms that you will be using in the explanation of your project activities.

### 3.2 Literature review

The review of the literature is to give you strong footing on the background information about the area of your project topic. Start your literature review by previewing the contexts of the literature reviews chapter (usually Chapter Two) in previous project submitted in your area of work. Pay particular attention to the content in terms of the presentation and how sentences and arguments are constructed. Also familiarise yourself with the acceptable citation and referencing of the your work documented in the literature.

Your ability to do a good literature review will help you to better understand the issues in your area of research. It will also guide in how the technical language of your area of work. It will also help you to appreciate how the language is used to give expression to concepts in your area of work.

You will need to construct a Literature Review Table comprising six(6) columns for important items of literature. The columns are: (i) Serial Number, (ii) Source (citation), (iii) Problem addressed, (iv) Methodology used, (v) Result obtained, (vi) Comment and remark. Details of the Literature review Table will be provided to you in the course of this project.

### 3.3 Data

You need to pay particular attention to the data you will be using in your project. You must describe clearly what every item of data is meant for, how you design the data, how you collected the data, how you pre-process and formatted the data, how you stored the data. Any likelihood of error, compromise, security breach, etc, that can affect the data must also be discussed. You need also to state the procedure you are putting in place to prevent or circumscribe possible failure.

For hardware related project, you will need to state the precaution taken during the collection of data if you use measuring instruments.

Note that if your data is faulted, every other aspect of your project has failed. This is because, your design, system implementation and result depends on the data.

### 3.4 Algorithms, heuristic, procedure

The algorithm, heuristics and procedure you use in your project must be clearly and precisely presented, explained and documented in your work. Use the standard symbols and diagrams only. If you are adopting or adopting any other symbol in your design, you need to state why the standard ones are inadequate for your purpose.

### 3.5 Project note

You will need an A4 size hard-cover note (60 pages minimum) for documenting your project activities. You should bring this note along with you during project meetings with your supervisor. The Project Note is your private document. So feel free to write anything you wish in respect of the project into it. It must however, contain the agenda and minutes of meetings with your supervisor. Important literature items, sketches of models as they come to you in your thinking, important data that you collect on the fly but not available in print or digital form, etc.

Your Project Note should be the diary for all activities related to your project work.

It is advised that you attach this document to the inner page of the back cover of your project note.

### 3.6 Project plan

You are expected to spend at least six(6) hours a week on the practical and theoretical aspects of your project throughout this course. This period must be spent fruitfully and productively. In order to do so, you need a project plan. The plan will document each stage of your project and the time you allotted to them. A Gantt Chart is a useful tool for creating such plan. The Chart will have the following columns: (i) Serial Number, (ii) Activity, (iii) Period Allocated, (iv) Progress so far, (v) Deliverable.

## 4 Course Support Resource

The technical resources and teaching aids that will be used to support this course are discussed in the following subsections.

### 4.1 Course webpage

Please be informed that there is an online Course Management System (CMS) to support this course on *Moodle*. Information on all aspects of this course will be made available to you through your course *Moodle* page. Visit the home page of the Computing and Intelligent Systems Research Group web-page site at <https://ifecisrg.org.ng/>. Click on **e-learning** tab and the system will take you to *Moodle*. You are required to create an account and enrol your participation in the course on the *Moodle* CMS. After you have created the account, navigate back to the *Moodle* site and locate **UniOsun-Course**. Click on the course you wish to enrol into. The course **enrolment key** will be provided to you during lecture. **Keep your username and password to the Moodle system in a safe place** as you will need them to access the CMS in the future. Also **you will be held responsible for all actions that takes place in your Moodle home page.**

The course homepage and materials can also be accessed through **Mobile Apps**. You can do that using the following steps:

- Step 1: Go to Google Play store;
- Step 2: Search for Moodle Classic;
- Step 3: Click, download and install;
- Step 4: Open the installed application, enter the site url - <https://ifecisrg.org.ng/elearning> and click on **connect**;
- Step 5: Enter your username and password after which you can access your profile and navigate through the provided links on the task bar.

## 5 Textbooks

Attempt will be made to provide all that you will require in the form of notes and handouts during this project. You are expected to visit the course webpage regularly, at least once a week, in order to download a copy of the course materials. **You are strongly advised not to sell, or repackage for sale, any material given to you during this course.** You will find the following textbooks and material useful if you can lay your hands on them.

1. Luger, G.F. and Strubblefield, W. A. (2003) Artificial Intelligence, structure and strategies for complex problem solving, Latest Edition, Addison-Wesley, ISBN: 0-805-31196-3,
2. Russell, S. and Norvig, P. (2003) Artificial Intelligence, a modern approach, Prentice-Hall, England, 2nd Edition, ISBN:0-13-080302-2, 2003
3. Oxford Dictionary of Computing, Sixth Edition, Oxford University Press.
4. Leed, P. D. and Ormrod, J. E. (2001) Practical Research: Planning and Design, Seventh Edition, Merrill Prentice Hall, Upper Saddle River, USA.
5. Odejobi, O. A. (2008) Computer Text-to-Speech Synthesis of African Languages, Modern Tools, Techniques and Technologies, VDM Verlag Müller, Germany ISBN:978-3-639-02330-5, pp.349
6. Jessop, M.(2005) Teaching, Learning and Research in Final Year Humanities Computing Student Projects , *Literary and Linguistic Computing*, Vol. 20, No. 3, pp. 295–311.
7. Floridi, L.(1999) Philosophy and Computing: An introduction, Routledge, USA
8. Oetiker, T.(2010) The Not So Short Introduction to L<sup>A</sup>T<sub>E</sub>X 2<sub>ε</sub>