TEL 309/10

Electronics Project

Course Guide

wawasan open UNIVERSITY
the people's university

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Course Guide

1.0 Introduction

TEL 309/10 Electronics Project is a 10 credit course to be taken after you have completed at least 90 credits or the equivalent, including any credit transfer or advance standing status that you have been granted. Unlike most other courses that you have taken, this course does not consist of the usual five study units. You need to plan your schedule carefully so that you can complete your project over the two semesters as allocated.

This course is a level 300 course in the programme and is to be taken in the final year of your undergraduate study. In this course, you will learn to apply your skills and knowledge on a real problem, or to make an in-depth investigation of a technical issue.

This course guide will guide you on how to go about the various stages of the project. The information will include how your project will be assessed. In each semester, the topics offered in the project course cover a very wide scope. This course guide and members of your course team can only provide general guidance on how to go about the project work. You need to carry out independent study and research work. The amount of effort you put in will determine the successful outcome of your project.

The project runs like the full time university study where final year students work closely with his/her supervisor. You will be assigned a Project Supervisor who can also be a WOU tutor or any other person deemed suitable by the School. A WOU academic staff member will be assigned as the Internal Examiner (IE) of your project. You will meet them face to face during your project meetings. We hope that the personal guidance provided will help you in completing your project.

This final year project report will probably be the first publication of your research work which you can proudly display on your bookshelf. Indeed you can be proud to have earned your Bachelor of Technology in Electronics degree through your ability and hard work.

2.0 Course Objectives and Learning Outcomes

Course objectives

This course aims to give you the opportunity to:

1. Conduct independent study and work in electronics technology.
2. Acquire practical experience in completing a project related to electronics technology.
3. Apply the knowledge gained in electronics courses.
4. Acquire an in-depth knowledge of a topic of current interest.
5. Gain experience in writing a formal report.

Course outcomes

By the end of this course, you should be able to:

1. Demonstrate in-depth knowledge on a specific topic in electronic.
2. Design system specifications to produce electronic devices.
3. Integrate knowledge and skills learnt in other electronics courses.
4. Present a well-structured written account of the techniques, methods and findings from an independent study.
5. Apply knowledge gained to a real life problem.

3.0 Timetable

Milestones for this project are given in the next section on the study programme. You are expected to draw up a timetable to plan your work accordingly.

The milestones in the timetable include meetings and deadlines to assist you in pacing your work, and to enable your Project Supervisor to monitor your progress throughout the two semesters of your project. You must submit the Initial, Interim and Final Reports on time, and to attend all project meetings and presentations.

You must adhere to the schedules of the TMAs comprising two reports and the oral presentation. It is particularly important that you meet the deadline of the submission of the Final Report. The Final Report has to be assessed by your supervisor and moderated by the internal examiner (IE). From the assessment result, the IE may require you to attend an oral examination.

4.0 Study Programme

You are expected to schedule an appointment with your Project supervisor in the **first week** of the semester in which your project course commences. In this first meeting, the project proposal will be discussed and your supervisor will provide suggestions on how it will be carried out. The project topic may be your own idea or one offered by the university. Your supervisor will help you establish an outline strategy; assess realistically the level of difficulty of the project and the time and resources available for completion. One important outcome of this meeting is to agree on the source of information for a literature survey and reading list. Most projects will include a reasonably comprehensive review of existing literature and a design-build-test or implementation part.

You must also agree on when future discussions should be and whether it should be done by telephone, email or discussion board through the LMS. It will be convenient if both you and your supervisor can contact each other via Internet Skype.

By the **3rd week**, you should have confirmed the topic of your project and be well under way with the literature survey. On the **8th week**, you are required to submit an Initial Report which consists of the project outline describing the work, including surveys and experiments with a schedule. After marking your Initial Report, your supervisor will hold a project meeting to discuss the main part of the project based on your report.

The main part of your project is carried out between the **8th week and 38th week**. During this 8 months period, you may contact your supervisor for advice or other support depending on your requirement. You will be required to submit an Interim Report on the **25th week**. This report is assessed and is usually followed by another meeting to discuss the direction for the final part of the project. You are required to give an oral presentation on the **26th week**. The *Interim Report* should show that you have completed a substantial part of the work, so that your supervisor can offer advice before you begin to write the *Final Report* which is due for submission by the **40th week**. Details of the requirements for each report are given in sections 8 and 9 later. Some students may be required to attend an oral examination after submission of the Final Report. The oral examination will take place on the **46th week**.

The year long project offers you an opportunity to develop the habit of keeping a *project diary* with entries at weekly intervals. You will find this practice valuable later when you are working on larger projects or higher level research. Supervisors may monitor the progress of students by requiring them to submit a monthly work summary extracted from the diary. This diary becomes very useful when you write your Interim and Final reports. It will also help you in the oral examination as you know the problems encountered at various stages of your project and how you overcome them. The diary is of value only when an accurate account of the project work is being recorded.

5.0 Level, Scope and Commitment

Level: While the project must be of a level worthy of an honours degree, starting with an over ambitious aim quite often causes a student to end with either uncompleted portions or to rush through with shallow treatment of the project objective.

The project is at level 300 of the programme which is equivalent to the final year in full time study. You are expected to have acquired the level of knowledge required for carrying out the project. You will have to apply that level of concepts, principles and analysis to the problem. You will need to go further in developing new or more advanced skills necessary to execute the project. These may include writing computer programs, using special software or handling laboratory equipment. Background reading and literature search play an important role here.

Remember that the project is not for a postgraduate research degree, and so you are not expected to make a discovery or an original contribution to the knowledge of the field. The project placed more importance on training students in following the procedure methodically and independently implementing the year long project from the beginning to its successful conclusion.

Scope: When defining the scope of your project with your supervisor, try not to aim far too wide in terms of coverage. On the other hand, an in-depth investigation on a particular topic may need you to be focused on a narrow area. In the latter case, you will need to assess whether you have enough knowledge in that specialist field to do that. You should adjust your aims to the level expected and according to the time and resources available.

You are not expected to define your project with precision at the beginning. Very often, the project is only loosely defined within a general direction to start off initially. You will need to adjust and redefine your aims and objectives in the light of issues that crop up as you go along. Your Initial and Interim reports will give you the opportunity to justify any change of scope.

Commitment: The study time you are expected to commit to completion of the project is 400 hours. Due to the intermittent nature, invariably a student will take more than this. Individuals work at different pace at different points of the project. When interesting discovery surfaces, some individuals may forego meals and sleep to work on the project. While a student at this phase needs no encouragement, he/she may need to know when to leave things aside to rejuvenate the mind especially when encountering dead ends in the work. Ups and downs are part of study and working life that you will have to learn to handle. When things do not work out, it's time that you seek your supervisor's advice.

A way for you to take your project seriously is to find a topic that interests you deeply enough. Otherwise, poor performance will bring disappointment to yourself and your supervisor. This is an Honours level final year course and should be treated as such.

6.0 Learning Support

Unlike all other regular courses, this Project course has no course study units and very little supplementary material. Nevertheless, you may still need to consult your Course Coordinator about any difficulties that emerge from your reading of this Course Guide or about problems with your supervisor.

The Project course aims to inculcate independent study and work. The programme of study is largely in your own hands. The University endeavours to give you the best possible support, and to see that your work is properly assessed. As assessment is intertwined with the provision of support, your supervisor and the University are responsible to provide both.

A supervisor will normally supervise several students at one time. You should contact him/her on academic problems. However, the supervisor may call in the Internal Examiner (IE) who is usually the Course Coordinator to help with finding solutions. Based on your Initial and Interim Reports, your Project supervisor then reports to the IE who will be alerted to issues such as lack of facilities or other problems.

The Project supervisor assesses your Final Report. The IE will moderate selected final reports and may provide comments to your supervisor. Your supervisor will then communicate those comments to you. The IE will call you for an oral examination if required.

The result given by your supervisor and the IE will be considered and approved by the Award Committee. The Award Committee is responsible for deciding each student's final status.

7.0 Assessment

The assessment of the project will be based on the following components and weightings:

1. TMA 1 (compulsory): Initial report (10%)
2. TMA 2 (compulsory): Interim report and oral presentation (20% + 10%)
3. Exam (compulsory): Final project report (60%)
4. Oral examination (at the discretion of the School).

The responsibility for the assessment of these components will be:

1. Initial and Interim reports: Project supervisor, with IE monitoring selected copies.
2. Oral Presentation: Project supervisor.
3. Final project report: Project supervisor, with the IE monitoring selected copies.
4. Oral Exam (at the discretion of the School): IE, 1 academic member and Dean of School or his representative.

To gain at least a pass, you will have to:

1. Obtain at least 40% overall.
2. Obtain at least 40% (i.e., 24/60 of overall) for the Final Report.
3. Obtain at least 40% (i.e., 16/40 of overall) for the cumulative score of Initial and Interim reports, and Oral Presentation.
4. Attend the oral examination (at the discretion of the School).

8.0 Progress Reports

The project is an academic exercise. It is different from a business or technical report that you write in your working life. It is about learning, making choices and decisions based on your judgment, analysing the data, looking for trends and evidence, and backing your conclusions based on scientific principles.

Marks are given only for what is contained in your reports, and not for work that you may have done but which is not included in the reports. Your reports must reflect a high level of learning and scholarship appropriate to an honours degree. You should have shown evidence of good understanding of the principles involved and that your arguments are on strong ground. Originality in the presentation will be highly regarded.

General guidelines on the content and style are given below. However, different approach may be used for other specific projects such as systems and design. When in doubt, discuss with your supervisor before writing your reports. Whatever approach you may adopt must show the same level of achievement.

Initial report (due on the 8th week)

The report should be about 1,500 words long. Your supervisor will provide comments on the report which will be discussed and elaborated in the subsequent project meeting.

In grading your report, your supervisor will look for the following:

1. References used in your study, with comments as to their relevance.
2. Evidence of your understanding of the principles underlying the project.
3. Identification of a definite topic and relation to existing similar work.
4. Specification of the goals of the project.
5. Outline of a strategy for achieving these goals.

Throughout the report, your supervisor will look for "critical and analytical approach" to the problem being investigated. Be careful that in your enthusiasm, you do not lose sight of the aims and the objectives of your project. In your report, you must stick to your direction of focus and not let your line of thought sway out of the way.

It is important that you include as much detail as possible in your Initial Report. This is to enable your supervisor to give you guidance and advice. After reviewing your Initial Report, it may be necessary to revise the aims and methodology of your project. It is crucial to consider your supervisor's advice before proceeding into the next stage.

The percentage figure given alongside each section indicates the approximate weighting of marks given. Your Initial Report may be in note form and will usually be presented with three main headings:

1. *Project Definition (20%)*

   This part should include:

   a. *Project objective* (the 'what' of the project): a statement of what is to be achieved, the expected outcome and possible use or value of the project. In experimental studies, this could be represented by the hypothesis that is to be tested.

   b. *Overall objective* (the 'why' of the project): why you consider it important and worthwhile. The reason can be simply "because it's there," or "to collect the data which is useful in some way," something that confound your predictions.

   c. *Proposed approach and method* (the 'how' of the project): a statement of how the objective is to be achieved; conducting experiment, writing software, survey and analysis of data, etc.

2. *Literature Review (60%)*

   This section carries the most marks. The materials you put into this section will also be an important aspect in your Final Report. This section is a critical appraisal of the literature based on which you formulate and develop your project. You should describe how the literature and any existing work reported in this area are related to your project. It is important to show where appropriate, how you apply the concepts and principles you have learnt in other courses of this programme to your project.

3. *Project Plan (20%)*

   This should include a chart or schedule covering the whole duration of the project. Break down the activities into as much detail as possible. Each task is to be shown with the time allocated and also how each is related to the others in the sequence of execution. Under the chart, you should describe the resources required for successful completion of the project (e.g., information or data, access to equipment and facilities). Give details on arrangements that have been reached about the use of facilities, equipment, software, etc.

Interim Report (due on the 25th week)

The Interim Report should be about 1,500 words long and presented in three main headings:

1. *Progress since the Initial Report (25%)*

   This section should contain a brief statement of the following:

   a. A restatement of the project objective: has the objective changed, modified or been developed further since the Initial Report? If this has not undergone change or further development, state why.

   b. Your progress: a statement of what has been achieved since the Initial Report.

   c. Problems and successes: comment on the successes of the project so far and/or any practical problems that have arisen and how they were tackled.

   d. A critical assessment of any further literature you may have read, or a reinterpretation of some of the material you presented in the first report which comes about in the light of experience.

   e. Project plan: a diagram and/or summary of tasks to be completed in the remaining time.

2. *Draft chapter on literature review and methodology (50%)*

   This part of the report will be used as the basis for a chapter in the main text section in your Final Report. Read the notes on style and presentation in sections 9, 10 and 11.

   The draft chapter should include the theoretical background to the project and the methodology of investigation you are using. You should start with a brief discussion on the ways you have originally intended to use. If appropriate, this should be followed by a description of the strategy you have subsequently decided to adopt, and the reasons why this later course was chosen. Finally, you should interpret any preliminary findings at this interim stage of your project, in the light of the literature you have studied. You should compare your findings with what you have expected or against what has been reported in the literature.

3. *Final Report structure (25%)*

   This section should include a proposed list of chapter headings for your Final Report, with a brief synopsis outlining the likely content of each section. You should also include an approximate word or page count for each chapter.

Oral presentation (on the 26th week)

The oral presentation will form part of TMA 2 of the course and will serve two purposes:

1. For students to learn the techniques of, as well as to experience presenting a project to an audience of experts in 15 – 20 minutes.

2. The presentation will provide an avenue of feedback for the students. Comments will be given by the Project supervisor during the presentation.

The distribution of marks for the oral presentation is summarised below:

1.	Oral presentation	20%
2.	Background knowledge	30%
3.	Project methodology	30%
4.	Discussion, Q and A	20%
Total		**100%**

Note: If you are unable to attend the oral presentation, please inform your Project supervisor immediately.

Report submission

The Initial and Interim Reports are allocated assignment numbers of the course:

Initial Report	TEL 309/TMA 1
Interim Report	TEL 309/TMA 2

The cut-off dates for submission of these reports are shown on a separate timetable.

Completing your reports

Please submit all your reports in hard copy. Use A4 size paper and put your name, your student number and the appropriate assignment number at the top of every sheet.

Submitting your reports

When you have completed each report, please fill in the Report Submission form, taking particular care to enter your student number and the assignment number correctly.

It is recommended that you send each completed report, together with its Report Submission form, to the Regional Office by hand. If you decide to mail your report, please write your name and address at the back of the envelope.

Report submission policy

You are required to submit all your project reports in accordance with the deadlines given. Please submit your reports early and keep a copy of each report you submit.

If your report is posted to the Regional Office, you need to check that your report has been received by your supervisor (for instance, confirmation through telephone or email). Applications for extension without supporting documents on the grounds of postal loss will not be accepted. WOU cannot accept any responsibility for reports that are not received by your supervisor due to problems with the postal service. As a precaution, you are advised to keep a copy of each report you submit and obtain a certificate of posting from the post office when you post your report.

Submission extension application

You may apply via the Online Assignment Submission (OAS) system for a submission extension on the grounds of illness, accident, disability, bereavement or other compassionate circumstances. To submit your extension application, you have to log on to: https://assignment.wou.edu.my/onlineExtension.asp

Applications for extensions of up to seven days should be applied through the OAS system to the supervisor who will consider valid and unexpected emergencies on an individual basis. The supervisor will also decide and advise you of the revised date for submission.

For extensions of *over seven days*, **you should note the following**:

1. If you require an extension of more than seven days on the grounds of illness, accident, disability, bereavement or other compassionate circumstances, you are required to apply for the extension via the OAS system. Your Course Coordinator or the Dean will consider valid and unexpected emergencies on an individual basis. The Course Coordinator or the Dean will also decide and advise you of the revised date for submission.

2. An electronic copy of supporting documents must be submitted with the application for extension of over seven (7) days to justify the claim.

3. Applications for extension should be lodged **before** or **on** the due date.

4. Applications are considered by:

   - The Course Coordinator for **extension** of 8 to 14 days.

   - The Dean for **extension** beyond 14 days.

5. Applications for extension without supporting documents will not be accepted.

According to WOU policy, there is no extension of the deadline for the Final Report submission.

9.0 Final Report and Oral Examination

This assessment is in two parts:

1. Your Final Report is marked by the Project supervisor and moderated by the IE.

2. The oral examination (if required) will be conducted by the IE, one academic member of the School, and the Dean or his representative.

General requirements

The Final Report is the most important element in the course and accounts for 60% of the total marks. Your supervisor will mark your report, but you will not receive any feedback before the oral examination (if you are being called).

The marking scheme below is recommended, however internal examiners are allowed to vary as appropriate to suit the nature of different projects.

	Report Content	**Marks**
1	A critical analysis and explanation of the project and clarification of its aims.	20%
2	Integration of technological understanding in achieving the aims of the project.	25%
3	Independent reading and study, and critical use of literature in discussing the findings of the project.	25%
4	Organisation of work and of component activities of the project.	10%
5	Clarity of presentation of the report.	20%
	Total	100%

Flexibility is allowed on the length of the Final Report. However the average length of a normal Final Report would be between 7,500 and 8,500 words. Discuss with your supervisor if you think your report will exceed this by a large margin. It may be that you are including unnecessary material or could organise the structure in a better way.

It is important that as well as your successes, you record your failures; that is, the dead ends or false starts. Explain the reasons for the failures and why they were not foreseen. One of the aims of the course is to teach you how to do a project. Some students may not reach a "successful" outcome, such as getting a solution to the problem or building a working model. They may nevertheless have learnt just as much as, if not more than those who do. Unless you record the whole process of your project, the examiners will not be able to tell what you have learnt.

Confidential material

The Award Committee cannot accept a Final Report that contains confidential material. The reason for this is that all Final Reports will be kept in the university and will be available to any user. This is normal for undergraduate and graduate project reports in all universities. To avoid any complication, ensure that your sources of information are not confidential. If you are in any doubt, please consult your supervisor.

Acknowledgements

You are required to specify and acknowledge any support you may have received from all sources in your project work. If the assistance in any source, in particular from your employers is substantial, you should include a detailed description in the Appendix.

At the beginning of your Final Report, you should also acknowledge help or assistance from any other source.

Report title page and declarations

Your Final Report should be typed on A4 size plain paper. Follow the format and style of the title page given in the Appendix for your report. The title page contains your name, student number and project title.

You are to reproduce the copyright declaration and the originality declaration in the Appendix and bind them at the front of your report following the title page.

Submission of report

Submit two ring bound copies of your Final Report; one each for your supervisor and the Internal Examiner. You will need to keep a copy of the report yourself for reference and prepare for the oral examination, if necessary.

After the report has been marked and the oral examination (if you are called), an original print copy of the Final Report is to be bound in soft covers for submission to the university. The sample of the cover paper type and colour will be informed by the ROs of the university at a later date. A copy of your report in CDROM is also required to be submitted with the final bound copy or report. Allow plenty of time for typing, so that you have time to make corrections and final amendments after your oral examination.

Submit all your reports by hand to the ROs to arrive by the cut-off date shown on the timetable. No reports can be accepted after the cut-off date.

Structure of the final report

The structure below is given for your guidance to write your Final Report. This structure follows the commonly accepted practice of dividing a report into sections under headings similar to these. However, you are allowed to use your own way of writing the report:

1. Title page
2. Abstract
3. Contents page
4. Introduction
5. Aims
6. Main text and discussion
7. Conclusions and recommendations
8. Acknowledgements
9. References
10. Appendices

The Abstract

Your report must include an abstract, sometimes called the Summary. The Abstract may be as brief as 200 – 250 words and should never be more than one side of A4 page. It should fulfil two purposes:

1. To someone who has not read the report, the general picture obtained from reading the abstract may make him/her decide to read the whole report.
2. The Abstract should help someone who has read the report previously to recall an overview of issues addressed by the report.

The wide range of projects available to students makes it impossible to be prescriptive about the content and style of an abstract. The Abstract needs to be written to serve the purpose according to the nature of the individual project. The following points are guidance on writing the abstract.

The Abstract should:

1. Briefly describe the project objectives and methodology.
2. Include any necessary background information.
3. State any findings or results.
4. Highlight any major conclusions.
5. Be a "stand-alone" document, giving enough information on what the project is all about.

The abstract must be concise, self-contained and self-explanatory.

Introduction and aims

The Introduction should describe the background of your project and what you expect to achieve. The description should place it in the context of how it relates to other relevant work in the field of study. A formal statement clearly stating the aims of your work is required in this section.

Main text

The main text consists of one or more sections covering the methodology or procedure, formulation or derivation of model, software simulation, experiment, data collection, analysis, and where applicable, an estimation of the accuracy and significance of the results.

In subdividing your sections into detail headings, there are two factors to consider:

1. The coherence and logic or flow of the argument for clarity.
2. Strategy to capture the reader's interest.

Conclusions and recommendations

The final conclusions and recommendations sum up not only your achievements, but also failures. It is always the case that a project will bring up more questions and open up more leads for investigation. A section should be written to point out possible future work for others to follow up. These may be useful for our future students.

Oral examination

This applies only to students who are called after their final reports have been assessed. The majority of those students being called in for oral examinations will take place during the 46th week. You will be told later in the year where and when your oral examination will take place.

Aims of the oral examination

1. When this is deemed necessary and if possible, to provide an opportunity for the student to demonstrate understanding of the Project by oral communication to compensate for a poor written report.

2. To provide an opportunity for the examiners to satisfy themselves about the level and amount of work done, by allowing the student an opportunity to give a detailed account of the project.

3. To provide the examiners more information to decide the award of a suitable grade for borderline cases, which in some cases may affect the honours classification.

The oral examination

The oral examination (if necessary) will be conducted by a panel comprising of the Internal Examiner, another member of the School's academic staff, and the Dean or his representative. The examiners will want to check your knowledge of the background and the underlying principles to the project. They will also look at some details on how you organised and managed your project. Arising from the findings in your project, the examiners will ask some further questions. Such questions are usually open-ended that will give you the opportunity to demonstrate your overall grasp of the topic. The examiners are not seeking to trap you or cause you embarrassment but are in general trying to give you an opportunity to demonstrate soundness of your conclusions from the project.

Examination policy

There is no written examination to attend for this course. However, you will need to attend the oral presentation, and if required an oral examination. You are required to attend all scheduled examinations that make up a final grade at the appointed time and place.

Students who are experiencing illness or a personal crisis and are unable to sit for any examination have to state [in writing] to the Registrar the reasons for their absence. Each submission must be supported by valid documents within seven (7) days from the date of the examination and will be considered by the University on its merits and on a case-by-case basis.

If you miss a scheduled examination without approval, you will be awarded zero marks for the examination.

10.0 Writing Style, Presentation and Handling of Data

This section is intended as a guide to help you write your Final Report. You must realise that the nature in a project can vary from a theoretical study, computer simulation, design and hardware implementation, measurement and data collection, etc. Each of these will need different ways in reporting effectively.

Individuality is reflected in the style of writing. Here, the guidelines are not meant to force everyone to adopt a certain writing style. These are merely to affirm that the attributes of a piece of good writing is easily recognisable in its clarity, conciseness and ordered presentation. Above all, remember that your report should be addressed to a general but informed reader. It should be written so that other students will have sufficient detail to continue with the work.

Visual presentation

Appearance is important.

1. Use A4 size paper and leave at least 40 mm for the left hand margin and about 25 mm for the right hand margin. Also leave about 40 mm at the top and 25 mm at the bottom of each sheet. These generous margins will help photocopying.

2. You are advised to work in SI units. Use the correct symbols and prefixes. The same applies to mathematical scientific symbols. Proof read your report by paying attention to the symbols and omissions of this kind.

3. Number each sheet at the top. As you write, make cross-references by section rather than by pages. Page numbers may change later. If you wish to refer to the page numbers in the text, do it only after you have the final version of the report.

4. Chapters, sections and subsections should be numbered for references, but avoid cumbersome sub-sub-section numbering such as 4.2.3.6. Mixed labelling can be useful, for instance 4.2(c)(vi). However, labelling down to such detail level is only practised in a closely argued or legalistic document, such as a tender for contract. To keep the contents list short, include only numbered headings. There is probably no need to exceed two digit numbers, such as 4.2 or 3.4.

5. Headings should be used at the beginning of chapters, and wherever necessary elsewhere. Carefully selected headings make the report clearer and will avoid confusing the reader. They should be distinguished by a change of font, size or underline in the report.

Information formats

1. Tables should be used to present information concisely where graphs or histograms are not appropriate. In setting out tables, arrange the data so that there are more rows than columns and use a minimum of horizontal lines.

   Table headings should follow the chapter number (e.g., in Chapter 1, Table 1.1, 1.2, 1.3 ...) in the order in which they are mentioned. They can then be referred to in the text by number only (e.g., Table 1.1).

   Place the tables in the text near to where they are first referred. Where you use a very large number of tables, they may be more conveniently collected at the end of the report.

2. Equations should be numbered by section (e.g., in section 2, Equation 2.3, 2.7, …). This ensures that if one is deleted or you need to refer to an equation you have not previously numbered, only those in that particular section need to be re-numbered. Keep the number to the right margin of the page. Check all references to equations in the text when editing your final draft.

3. Graphs, histograms, drawings, diagrams and photographs should all be referred to as figures: Figure 1.1, Figure 1.2, and so on.

   If the size is small, you may put two on a page. Insert a caption for each figure. Place the figures in the text next to where they are first mentioned. As for tables, if there are a large number of them, it is more convenient to collect them together and place at the end of your report.

   You will have to annotate the figures below each one. So keep the labelling inside the figures to a minimum using letters, abbreviations and symbols, but avoid phrases. Use the figure caption to explain the detail. For example, a number of curves on a graph may be labelled A, B, C and then identify each of them in the caption.

4. Use black ink to draw and label figures, as this produces best photocopies. Avoid the use of colours to differentiate between curves or parts of a diagram. Colours reproduce as shades of grey in photocopies.

   If you have photographs in your report, you will need a set for each copy of your report. Photographs again do not photocopy well.

   Check all references to figures in the text and any information you quote from within the details of the figure.

Use of references

1. Give the reference in the text for any work from which you have quoted results, taken tables, reproduced figures, or used any information.

2. You can quote a reference by number, such as Jones1 or refer to the publication by name of the author(s) and year of publication, for example, "Jones and Brown 1978" or "... it was found (Jones and Brown 1978)".

3. Where there are more than two authors, use "et al." in the text; e.g., "Jones et al. 1978".

4. When the same author(s) has more than one publication in the same year, use a, b, c, etc., to identify each (see example below).

5. At the end of your report, give the list of references, either in numerical order if you used numbered references, or in alphabetical order of the first authors' names as follows:

   Haughton, P M (1977) 'Physics and the ear: an outline of the mechanisms of hearing,' *Physics Education*, vol. 12, July: 313 – 317.

   Hope, A (1978a) 'Video recording: the battle behind the scenes', *New Scientist*, vol. 78, no. 1097 (6 April): 8 – 10.

   Hope, A (1978b) '100 years of microphones', *New Scientist*, vol. 78, no. 1102 (11 May): 378 – 379.

   Surrey, A J, and Bromley, A J (1973) 'Energy resources' in Cole, H.S.H. et al. (eds) *Thinking about the future*, Brighton: Chatto and Windus/Sussex University Press, 90 – 107.

   Taylor, R (1970) *Noise*, London: Penguin.

   Walters, A P (1976) *Piano Mechanics*, University of Nottingham: BSc Project Report (unpublished).

6. The main point to consider in giving a reference list is that the work should be easily identifiable if the reader wishes to look it up.

   All the above references give the name(s) of the author(s), their initials and the year of publication. References to periodicals should include the title of the periodical (underlined or italicised), the volume number, the issue number (where there is one) or the date of issue (particularly for a weekly periodical), the title of the article and the page number of the first and last

pages. Book references should include the title of the book (underlined or italicised) and the name of the publisher and place of publication. Give the title of any reports you refer to and a sentence explaining their source if they are not published by a recognised publisher.

7. You must acknowledge all your sources of information, whether publications or people. You will be penalised if you try to claim something that you have taken from somewhere as your own work. Keeping silence on the source of your idea is plagiarism.

8. We suggest you make notes on the references as you read them or take material from them, using the format style given above. Producing a reference list at the end of your project can be tedious and result in inaccuracies. You may have returned a paper to the library, and will have to waste time looking up references.

9. Appendices, acknowledgements and references are not normally given a section number, but if you include more than one appendix, give each a number of its own (e.g., Appendix 1: Electrical Specification).

Computer programs

Increasing number of projects involve some software development. In some projects, software is actually the whole point of the project. You will need to be aware before you take on a project. On the other hand, you may only need to use a commercially available program or a program you or another student have either written or adapted.

Simple programming and data manipulation are considered as a tool you use in your project. The details can often clutter up the text in your report. If the software you have worked on is considered to be more than a minor part of the project, you may include a description of the procedure in the report text and put the details of the software to an Appendix. This will allow you to write your report more clearly.

If, however you have based your work on a novel mathematical model, you should describe this in the text, fully explaining the code in detail.

Very often, students get too engrossed on computing during their project, and spent too much time on it even though the project is not specifically on computing and software development. Be cautious of spending a disproportionately excessive amount of time at the computer.

11.0 Examples of Layout Style

The basic structure of a Final Report should follow that described in section 9.0. However, most project final reports will contain substantial differences. The course team feels that it would be helpful to include in this section some examples of good practice. In addition to showing examples on specific aspects of the content, they also give you the opportunity to see some of the different styles of layout that might be used.

The examples are taken from different disciplines, so you should look at them as something that you could follow, rather than something that you must follow. When looking at the examples, please take note of the formatting styles and ignore the contents which are not relevant to your project.

Example 1

Abstract

The original project objective was to develop a voice scrambler which complies with the rules of secured telephone communication. The concept of analogue encryption-decryption was adapted into the system. The overall system consists of an audio input device, which is the scrambler circuit and the audio output device, which is the descrambler circuit. Basically, the scrambler circuit will work as the encryption part and the descrambler circuit will work as the decryption part.

First, at the scrambler circuit, there will be a phase shift oscillator that will function as a carrier supplier to the balanced modulator circuit. At the balanced modulator circuit, the modulating signal from the input voice of the speaker will mix with the carrier signal from the phase shift oscillator. The output signal will look like a band of spiky signal where the scrambling will take place. The carrier signal will function as the envelope of the modulating signal. Then, the modulated signal will be passed through the telephone line to the receiver.

Therefore, if anybody wants to tap-in to listen to the conversation, they will only hear a scrambled or an alien voice. When the signal reaches the receiver, it has to go through the descrambler circuit so that the same carrier frequency signal will be injected to cancel out the accompanying carrier signal from the scrambler circuit. Hence, the receiver will get back the original voice signal from the transmitter. Eventually, there will be a low-pass filter to filter out the high frequency noise. Therefore, a secured telephone conversation can be achieved.

Example 2a

Contents

Example 2b

Contents

5 The Quadrature oscillator

5.1 Definition of parameters and qualitative statements

5.2 Formulate the conditional rules

5.3 Development of the BASIC simulation program

5.4 Analysis of performance

5.5 Applying a load change

5.6 Summary of the final model

6 Conclusions and Recommendations

6.1 Conclusions

6.2 Recommendations

Acknowledgements

Appendices

Example 3

1 Introduction

1.1 Background to the project

This choice of project arose from the author's interest in telecom engineering and his belief that in the discipline of engineering, in general, he can benefit from studying how different oscillator solves problems of voice scrambling of telephone. In the scrambler circuit, there will be a phase shift oscillator that will function as a carrier supplier to the balanced modulator circuit. At the balanced modulator circuit, the modulating signal from the input voice of the speaker will mix with the carrier signal from the phase shift oscillator. The output signal will look like a band of spiky signal where the scrambling will take place. The carrier signal will function as the envelope of the modulating signal. Then, the modulated signal will be passed through the telephone line to the receiver.

1.2 Project objective

The objective of the project is to design and develop a new configuration circuit of voice scrambler, to understand the basic idea of RF (Radio Frequency) design, to design and learn how to enhance the security of telephone networking, and to learn about analogue encryption/decryption.

1.3 Methodology

In order to meet the objective of the project, a thorough grounding in the subject of scrambler circuit and its application to telecom engineering was required. The first step was to find a body of relevant literature from which to build this grounding and this was done primarily through the searching of a computer database.

From the results of the search, selected papers were obtained and a period of fairly intense reading was undertaken. This initially covered the fundamentals of oscillator circuits and later progressed to the specific application of the oscillator of processes similar to that described in this paper.

Basically, the circuit that is being constructed shows us the whole system involved. From the block diagram above, we can understand that audio input signal (typically human voice) is being inputted to the scrambler circuit. After going through the scrambling process, the modulated signal will flow through the transmission line. At the receiving end, the modulated signal will enter the descrambler circuit to be descrambled and lastly reach the receiver. So, in this project, we will see two identical circuits mirroring each other, with the only difference that at the descrambler part, there will be a low pass filter.

1.4 The literature search

An initial search of the IEE Inspec computer database was conducted just before work on the project started in earnest. At this stage, the only information that had been read on the subject was a small number of introductory articles in information and communication technology trade magazines. The search keywords used were kept very general as the author believed that there would be few relevant references available. This assumption turned out to be grossly inaccurate. The keyword sequences used were:

- OSCILLATOR
- OSCILLATOR with VOICE SCAMBLER

The first sequence returned 4,062 entries, while the second returned 843 entries. These numbers were quite daunting at this early stage with no criteria available to be more selective. It was decided therefore to list twenty of the most recent papers and to select the most relevant sounding papers from this. In fact, none

of these papers appeared to be particularly relevant to this project and therefore it was decided to conduct another search; once more specific keywords had been defined.

After consultation with the librarian who was to conduct the search, a new strategy was drawn up. The IEE Inspec database was used again, this time with the following constraints:

Keywords;	Oscillator with voice scramb (LER)
Other constraints;	English language, later than 1985.

This returned a more manageable total of 138 references and a list was produced of these. These were still far too many and so, five loose categories were drawn up in which to place the references.

- General industrial applications
- Robots
- Stability
- Mobility of robots
- General fuzzy control techniques

Twenty three papers fell into one or more of these categories and from this reduced list, eight of the most relevant looking papers were ordered. These were supplemented by approximately fifteen papers, covering in the main the more fundamental and historical background of the subject. These were supplied by Dr G K Singh of the University of Plymouth.

As a result of reading these papers, two textbooks were obtained which provided useful additional information.

Example 4

Aims and objectives

The principal aim of this project was to develop a voice scrambler circuit which complies with the rules of secured telephone communication. The concept of analogue encryption-decryption was adapted into the system. The overall system consists of an audio input device, which is the scrambler circuit and the audio output device, which is the descrambler circuit. Basically, the scrambler circuit will work as the encryption part and the descrambler circuit will work as the decryption part.

The objectives are to study several types of oscillator circuit configuration that can produce an oscillating signal at the output, considering some parameters for efficiency of RF design, and to choose between analogue and digital circuit to fulfil the carrier supplying task, to learn what type of circuit that produces both sidebands of the mixed output signal, and to learn the circuit that made frequency shifting possible and the circuit that separate different frequency bands.

First, at the scrambler circuit, there will be a phase shift oscillator that will function as a carrier supplier to the balanced modulator circuit. At the balanced modulator circuit, the modulating signal from the input voice of the speaker will mix with the carrier signal from the phase shift oscillator. The output signal will look like a band of spiky signal where the scrambling will take place. The carrier signal will function as the envelope of the modulating signal. Then, the modulated signal will be passed through the telephone line to the receiver.

Therefore, if anybody wants to tap-in to listen to the conversation, they will only hear a scrambled or an alien voice. When the signal reaches the receiver, it has to go through the descrambler circuit so that the same carrier frequency signal will be injected to cancel out the accompanying carrier signal from the scrambler circuit. Hence, the receiver will get back the original voice signal from the transmitter. Eventually, there will be a low-pass filter to filter out the high frequency noise. Therefore, a secured telephone conversation can be achieved.

Example 5

Tables, Formulae and Diagrams

Used 10 samples per period, choosing to ignore harmonics higher than the 5th because of their small amplitude, blocking them with the anti-aliasing filters.

Possible Sampling Rates					
Sampling frequency		**Sampling interval**		**Harmonics measured**	**Samples per period**
50 Hz System	60 Hz System	50 Hz System	60 Hz System	----	----
500 Hz	600 Hz	2.0 ms	1.67 ms	5th	10
600 Hz	720 Hz	1.67 ms	1.39 ms	6th	12
700 Hz	840 Hz	1.42 ms	1.19 ms	7th	14
800 Hz	960 Hz	1.25 ms	1.04 ms	8th	16

Table 1 Digital sampling rates

Measurements of the 2nd and 5th harmonics are essential for particular transformer protection algorithms. 2nd harmonics are used to restrain tripping actions during the energisation of a transformer. 5th harmonics are used to restrain action during transformer over-excitation [Hermanto et al[34]].

Thus, it is desirable that a design for a data acquisition subsystem should be capable of measuring up to at least the 5th harmonic to allow a standardised subsystem to be employed on all the feeders. However, it may prove essential to us a lower sampling frequency on some inputs, if a single processor is to address multiple inputs.

4.1 Effect of Sampling Rates on the Algorithm

A relaying algorithm has been estimated to require approximately 2000 machine instructions to execute [Phadke and Thorpe 1988[B4]]. The speed of execution of the microprocessor depends on the size of the datapath and the clock frequency at which the machine operates. High performance PC's can now achieve speeds of approximately 14 million instructions per second (MIPs). This is equivalent to an execution time of about 75 nanoseconds.

On a 60 Hz system:

$$\frac{1.39 \times 10^{-3}\text{s}}{2000 \times 75 \times 10^{-9}\text{s}} = 9.3$$

On a 50 Hz system:

$$\frac{1.67 \times 10^{-3}\text{s}}{2000 \times 75 \times 10^{-9}} = 11.1$$

If this performance could be achieved in the protection processor while operating with a sampling rate of 12 samples per period, then on a 60 Hz system, a maximum of 9 inputs could be sampled and 11 inputs on a 50 Hz system.

However, this does not take account of the requirements for machine self-testing programme or communications loading. Thus, it should be seen as the limiting performance rather than a practicable target.

4.2 Sampling Rectified Inputs

If it is not essential to extract frequency or phase information from the input, then it may be full.

Example 6

Structure and style within the report

Chapter Four

Risk Assessment

4.1 Introduction

The operation of the RC Phase Shift Oscillator can be explained as follows. The starting voltage is provided by noise, which is produced due to random motion of electrons in resistors used in the circuit. The noise voltage contains almost all the sinusoidal frequency. This low amplitude noise voltage gets amplified when the power supply is turned on. The amplified noise drives the feedback network which is the phase shift network. Since the loop gain must be slightly greater than unity, the unstable loop will cause the oscillation signal to build up until the amplifier swings beyond the linear region. Because of this, the feedback voltage is maximum at a particular frequency, which in turn represents the frequency of oscillation. At this frequency, the condition βA=1 is achieved. Moreover, the phase shift required for positive feedback is correct at this frequency only.

The Barkhausen Criterion will also be fulfilled only at this particular frequency. It states that: "the frequency at which a sinusoidal oscillator will operate is the frequency at which the total phase shift as a signal flows from the input terminals, through the amplifier and the feedback network, and back again to the input, is precisely zero (or an integral of 2π)". At the desired oscillation frequency, the total phase shift is zero if the feedback network introduces a phase shift of 180° and the amplifier introduces another phase shift of 180°.

In order to fulfil the condition βA = 1, another requirement for the oscillation to sustain is the amplifier gain magnitude |A| must be equal to the inverse of the feedback transfer function magnitude $1/|\beta|$. In other words, the magnitude of $|\beta|$, which varies with frequency, must be equal to 1/|A| at the desired oscillation frequency. This is an integral part of the Barkhausen Criterion (i.e., βA = 1).

Satisfying the above conditions of oscillation, the value of R and C is selected such that each RC combination produces a phase shift of 60°. Thus, the total phase shift produced by the three RC networks is 180º. Therefore at the specific frequency f_o, the total phase shift from the input of the amplifier, around the circuit and back to the input is 360° and thereby satisfying the Barkhausen Criterion.

Eventually, a pair of diodes is used to modify the linear operating range over which the output voltage is linearly related to the input voltage and also to stabilise the oscillation frequency.

4.2 Minimum requirement to circuit work well

The circuit works very well means that the receiver can receive a very pure hygienic crystal-like sound just as the original transmitted signal (the modulating signal) at the transmitter. To achieve this vital goal of the circuit, we need to inject a carrier signal at the receiver part exactly the same as the carrier signal at the transmitter part. Below are the comparisons of the effect of not having the same carrier signal at both sides.

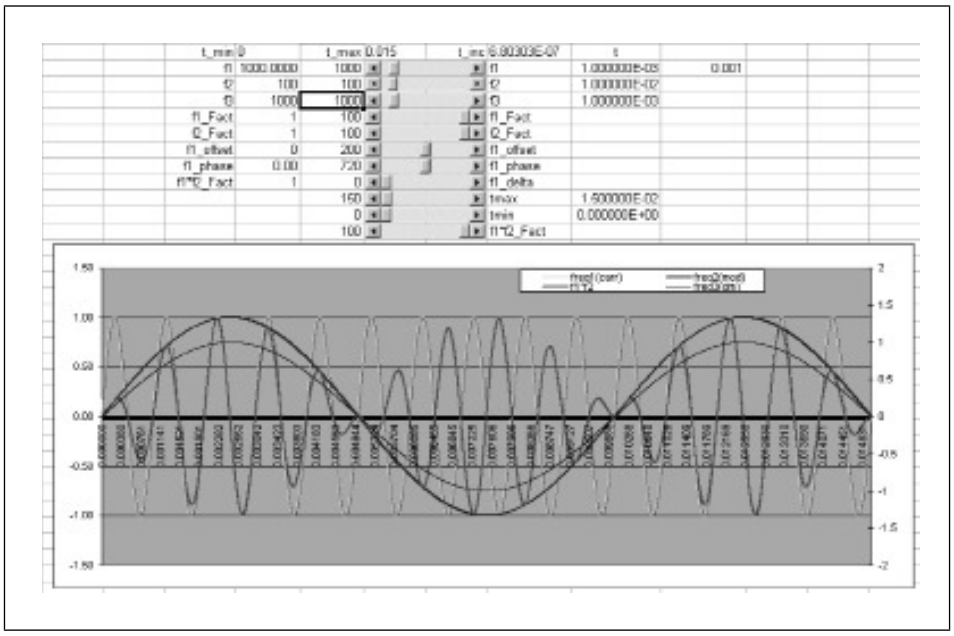

Figure 1

From the given chart of **Figure 1**, we can see that there are several line graphs with different colours for us to analyse. The yellow line is the carrier signal at the transmitter part, denoted as f1. Meanwhile, the pink colour superimposed on it is the injected carrier signal at the receiver part denoted as f3. The blue colour line is the modulating signals at the transmitter side (denoted by f2) while the purple colour line is the output modulating signal (the same signal as the blue colour line signal) at the receiver part. We see that the amplitude is different between both signals (between blue and purple) although they should have the common amplitude value. Actually, both have the same amplitude. It is just that we use different scale for each modulating signal so that we can have a better understanding on what is going on inside the circuit. Lastly, the red colour line is the product of the two signals (f1 × f2) via the transmission line between the transmitter and the receiver.

Example 7

6 Conclusions and Recommendations

6.1 Conclusions

The final proposed voice scrambler model has proved to be a success, furthermore, the circuit configuration that assembled was quite a level headed to be understood easily. The balanced modulator circuit is a very useful circuit in communication, but often poorly explained in textbooks. Consequently, we had to push ourselves to the edge in order to gain clarification of the circuit. It was obvious that analogue electronics are far more complex compared to digital electronics, although both have their own trade off. Consequently, my perspective towards the world of electronics had changed. It seems that the knowledge of electronics is expanding infinitely. Not forgetting to mention about micro, nano and optoelectronics, but the application of the current technology into creative ideas are far more important to suit the human needs. Through all these years of studying electronics, I have comprehend that in order for any person to have a better understanding of electronics' concepts, one person should dive into hands-on experiences. The more experience, the better you will become. As the old saying said, "Practice makes perfect". Eventually, the most important point that I have learnt by doing this project is, it has all the vital ingredients to shape-up a person to be more creative and innovative — so called an engineer!

The work has highlighted the need for an analysis of voice scrambler using different types of oscillator circuits. There are other options to make other types of circuit configuration especially on the carrier supplier part (sine wave oscillator), besides using the RC Phase Shift Oscillator.

Time did not permit to analyse the different types of circuit for voice scrambler schemes that would particularly benefit from oscillator. Indeed, considerable experience of circuit theory would be required before such a task could be applied to any degree of accuracy or with any confidence.

6.2 Recommendations

The recommendations for further work fall into two groups:

1. Those relating to the use of Wein bridge oscillator.

2. Those relating to the use of Quadrature oscillator.

Relating to the model

As stated earlier, the final model requires checking by using a different oscillator in hardware, as only by doing this can complete confidence in the design be achieved.

An investigation would be useful as to why the scrambler circuits performed by the use of a different oscillator, which used more sensitive parameters, failed, when other researchers have reported improved performance.

Relating to voice scrambler in general

There are many areas of voice scrambling that will benefit from further investigation, but those listed below lead directly from the work undertaken in this project or relate to questions that apply to the implementation of the model in hardware.

An ideal oscillator should be used so that it would ease the task of development and indeed the understanding of voice scrambling systems. An interactive computer based graphical environment would seem to be the most applicable to this task.

A design procedure should be developed that would allow a formal quality control audit to be achieved. Also the development of a methodology for optimising the performance of oscillator is needed.

An aspect that has not been addressed by this project, but one that would need to be before the model could be constructed in hardware, is, to what extent does the choice of sample rate have on the performance of scramblers and can existing relationships (e.g., oscillator theory) be used?

Example 8

References

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12.0 Appendix

Title page

Copyright declaration

Originality declaration

Project title

Student name

Student number

Project report submitted as part fulfilment for the degree of Bachelor of Technology (Honours) in Electronics

School of Science and Technology
Wawasan Open University

Month and year of submission

Copyright declaration

Wawasan Open University

Session: July 2010

Report title: Project title

I, **Student Name** declare that this report shall be the property of Wawasan Open University and I allow copies of it to be made for academic purposes.

_____
(Signature)

Date: _____

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I declare that this report titled "*Project Title*" is my own work except where cited in the references. The report has not been accepted, and is not being submitted in candidature, for any degree or other award elsewhere.

_____
(Signature)

_____
(Name in full)

Date: _____