CAPSTONE PROJECT HANDBOOK (ODL) 2021 – 2022

Module Title	**: Capstone Project 1, Capstone Project 2**
Module Code	**: CT0136-5-M-ODL, CT0137-7-M-ODL**
Year	**: 1**
Credits	**: 5 and 7**
Co – requisite or pre-requisite module(s)	**: Research Methods for Capstone Projects (CT0135-3-M-ODL)**
School	**: School Of Computing**
Trimester	**: CP1 -Trimester 2, CP2 – Trimester 3**

Contents

1.0 Introduction

Welcome to **Capstone Project 1 and 2**

The Capstone Project is a form of independent research designed to prepare students for professional/industry practice. It differs from a conventional research project/dissertation in that the emphasis is on the application of the skills and knowledge acquired during the DSBA course to address a real world problem through the processing and manipulation of actual data sets. This contrasts with a traditional research project are often theoretical or academic in the focus and orientation.

The Capstone Project is divided into two modules, Capstone Project 1 (CP1) and Capstone Project 2(2), which delineate between the research and simulation/application stages of the project. For CP1 you are required to organize, plan and carry-out various tasks required for successful completion of the project, leveraging the topics covered in RMCP to appropriately formulate a plan and methodology to support the project.

Projects may be undertaken by an individual student. This phase focuses on the research, scoping, designing and planning of the project. Project proposals will be presented as a report followed by oral presentation at the end of the semester. Upon successful completion of this phase, students will continue with Capstone Project Part 2 where the project outcomes will be created and delivered.

For CP2 students are required to implement their methodology so as to manifest their proposed solution by integrating knowledge acquired, skills and ideas from previous modules. Student is expected to solve real world problems working across knowledge domains and apply appropriate tools and methods.

2.0 Module Team

Module Leader: Imran medi (Imran.medi@staffemail.apu.edu.my)

Module Team: Prof. Dr. R. Logeswaran (logeswaran@staffemail.apu.edu.my)
           Dr. Preethi Subramanian (preethi@staffemail.apu.edu.my)

3.0 Module Learning Outcomes

Upon successful completion of CP1, you will be able to:

CLO 1	Formulate the strategies and initiatives to evaluate real world problems.(A4, PLO5)
CLO 2	Propose a solution by effectively planning the entire activities of the project (A5, PLO9)
CLO 3	Perform an oral defence to justify the proposed solution (A5, PLO11)

Upon successful completion of CP2, you will be able to:

CLO 1	Critically evaluate the data acquired as part of the approach in delivering a solution for a real world problem.(C6, PLO4)
CLO 2	Display the ability to apply knowledge and skills learned throughout the course and manage the project deliverables (A5, PLO10)
CLO 3	Perform an oral defence to communicate the solution through a final presentation. (A5, PLO8)

4.0 How will I learn on this module?

In this module you are expected to apply what you learnt during the course, as well as supplement this with independent study, to address an industry/real world relevant problem. You will become a specialist in the area you chose to investigate and be able to apply experiential learning, problem solving, analytical and decision-making skills to providing solutions to real-world situations. More importantly, you will learn to manage yourself, carry out a research and to accept responsibility for determining what you are required to do, as well as carrying it out.

Thus, in conclusion the Capstone Project is the vehicle that will promote your capacity to take initiatives and develop independence of thought in a supportive framework - qualities universally identified as being essential to industrial and commercial needs.

5.0 Attendance and Absence

You are expected to have a minimum of 6 documented meetings with your supervisor, 3 per semester via MS Teams.

6.0 Learning Resources

Essential Readings:

- Creswell, J.W. (2018) Research Design: Qualitative, Quantitative and Mixed Methods, Approaches. 5th ed. CA. USA: SAGE Publications, Inc. ISBN-13: 978-1506386706
- Townsend, K., Saunders, M.N.K. (2018). How to Keep Your Research Project on Track:
- Insights from When Things Go Wrong. Chaltenham, UK: Edward Elgar Publishing. ISBN-13: 978-1786435750
- Walliman, N. (2018). Research Methods: The Basics. 2nd Ed. London. UK : Routledge. ISBN-13: 978-1138693999

7.0 Assessments

This module is assessed by:

Assessment Summary						
Form of Assessment	**Description**	**Duration (hour(s))**	**Hand out Date**	**Hand in Date**	**Marks Allocation**	**CLOs Assessed**
Capstone Project 1						
Final Assessment	Individual Project - Report		Trimester 2: Week 1	Trimester 2: Week 14	80%	CLO1, 2
	Individual Project - Presentation		Trimester 2: Week 1	Trimester 2: Week 15	20%	CLO3
Capstone Project 2						
Final Assessment	Individual Project - Report		Trimester 3: Week 1	Trimester 3: Week 14	80%	CLO1, 2
	Individual Project - Presentation		Trimester 3: Week 1	Trimester 3: Week 15	20%	CLO3

To pass a module, you must attempt every element of assessment and achieve at least 50% in the module overall.

If you fail to pass the module, you will be required to re-sit any assessment components for which you did not pass. *Details on Regulation and Policies are available at* https://lms2.apiit.edu.my/course/view.php?id=750

8.0 Submission and Feedback

How do I submit my assessments?
Each module will have a different set of assessments and submission dates/times as stated in Section 7 above. It is your responsibility to be aware of the deadlines and to meet them.

You must submit all pieces of assessment required for each module to Admin Services, or online through APU's official submission portal for electronic submissions, on or before the submission date for each piece of assessment. Failure to do so may result in failure of the module overall.

Failure to meet a deadline will be treated as a non-submission and a Grade Point 0 will be awarded for that component. The only exceptions to these rules apply where a valid claim for extenuating circumstances can be made and is approved.

There may be occasions when you are unable to submit or undertake a piece of assessment due to circumstances beyond your control. APU has put in place a procedure for dealing with such extenuating circumstances. You can find more information in the Student Guide to Extenuating Circumstances which is available in the Regulations & Policies section on Moodle.

How do I get feedback on my work?
You will normally receive feedback on all assessments, other than examinations, within 20 working days following the date of submission.
APU aims to release feedback within set weeks so that you can have as much of your feedback at once making the process less stressful.
Feedback will vary between modules; however, you will receive feedback via the submission link in Moodle.

How can I give feedback on the module?
You are welcome to discuss your views with your lecturer on the module at any time. Views may also be expressed through your Programme Leader or via Programme Committee Meetings (PCM). During the course of the module, you will be encouraged to fill in the anonymous evaluation questionnaires to assist the University in its monitoring and planning. Such questionnaires are important for the benefit of your fellow and future students. We would be grateful for your full and prompt co-operation in completing them in a constructive and objective way. You will be able to access the Online Course Appraisal System at: http://webapps.apiit.edu.my/appraisal/
Students who do not complete their course appraisal by the stipulated date indicated on their examination schedule (posted on the webspace) could find their results withheld until they complete their course appraisal.

9.0 Academic Integrity

This module requires that you demonstrate what you have learnt and that you have achieved the learning outcomes of the module. The University requires you to comply with the regulations on academic conduct. Academic misconduct includes but is not restricted to cheating in examinations, making - up data and plagiarism.

Plagiarism is the use of someone else's work (words, images, tables or ideas etc) without acknowledging the source. This includes materials from the internet as well as library books and the work of another person. Plagiarism is an assessment offence and any individual (who is suspected of plagiarism) will be referred to the University Academic Dishonesty Board. Please refer to https://lms2.apiit.edu.my/course/view.php?id=750 for further information.

10: Capstone Project Guidelines

10.1 Introduction to Research

In this section, we discuss the nature of the research experience you will be undergoing. It is important to put the capstone project in perspective. You are undertaking a large-scale research, which requires new knowledge and solutions.

By the time, you have successfully completed your capstone project you will have become an expert researcher proficient in the manipulation of data sets for the purposes of forecasting, modelling and prediction. This means that:

- First, at the most basic level, you have produced something that your peers and industry will be interested in.
- Second - in order to do this, you will have demonstrated expert knowledge of what is happening in your chosen area.
- Third - you will have displayed the astuteness to discover where you can make a new and useful contribution to your chosen field of study, organisation and/or industry.
- Fourth - you will have shown in-depth knowledge and understanding of the data science techniques that are currently being used in your area and their limitations.
- Fifth - you will have communicated your results and findings effectively.
- Sixth - you will have demonstrated the international context emphasised throughout this Programme. You will be aware of what is written by other researchers and analysts worldwide.

10.2 Research Requirements: Capstone Project

Your research capstone project will need to achieve the following: -

- a written documentation (literature review, methodology, simulation/analysis/model and results) which may contribute to the body of knowledge and is original in nature and provides a solution to a real world business problem.

Your capstone project is really a data science experiment, although you will very rarely think of it as such. The most important outcome from this experiment is what you have learned (and reported in your project) and produced (simulation/model).

The **process** by which you carry out the 'experiment' is also exceedingly important; and should be reported within the capstone project report. This gives confidence to any reader that you have approached the problem in a systematic way, and that they may have some confidence in your findings.

From this perspective, your capstone project should be:

- An experiment involving the evaluation of existing research may be primarily concerned with seeing how appropriate the work is to a new problem area.
- The experimental part of a practical problem-solving capstone project would be concerned with evaluating the effectiveness and applicability of data science techniques and technologies. For example, you might be concerned with identifying which algorithms are appropriate for a particular problem.

Finally, remember that some experiments may not yield positive results. The experiment may have been performed very successfully, but the result is not what we expected or desired. This is no reason for thinking that you have failed. The knowledge gained is far more important than the result, at least from the point of view of achieving the award.

3.0 The Finished Product - The Capstone Project

The capstone project should be **approximately 10,000 words for CP1 and 16,000 for CP2 (the final CP2 report will include CP1 with revisions)**. The number of words does not include references, appendices, and information on the titling/preliminary pages.

There are standards expected for the presentation of a capstone project documentation. Typically, the format should contain the following sections:-

- Abstract - outlines the problem

  - gives summary of the results
  - no more than 1 page in length
  - should be one paragraph

- Contents - Introduction

  - including page numbers

  - specifies the problem (the what/who)
  - gives the context/environment
  - states briefly the approach you will be using (how)

- Main body of the project report, presented as a number of chapters covering

  - detailed background description to work/problem
  - what you propose to do to solve the problem
  - rationale behind the design
  - results and evaluation / critical appraisal
  - model/deliverable

  - evaluation of the model
  - Conclusions summarise results / findings

- References/Bibliography (See Appendix B for the standard notation required)

3.1   Abstract requirements

An abstract is an essential component of your dissertation and requires particular thought and attention. It is the reader's first impression of your research and should encapsulate and surmise your entire project in around 300-400. The reader should be able to read your abstract independently of your report and have an understanding of (1) what you set out to do and why (purpose of your study), (2) how you did it (methodology) and (3) what you found out together with any recommendations that you may have (results and conclusions).

3.2   Writing Technique

The biggest problem with writing any document, particularly one of a technical nature, is that we tend to forget whom we are writing for. This is a very simple trap to fall into, but is the one that is likely to cause us the most trouble, particularly if the examiners of a project cannot understand what is being reported.

If you were writing a User Manual, you would probably write it as a reference document, which is well indexed with each section self-contained. You could therefore move about it in a somewhat haphazard fashion, gaining (coherent) information as you went.

If you were writing an essay, you would probably adopt a more flowing and fluent style of writing, so that the 'story' was told to the reader who started at the beginning and progressed sequentially through.

If you were writing a novel, you might deliberately try to give false clues or defer important information until later.

- Is there an appropriate style for a capstone project ?

In practice, the answer probably lies between the first two. Do not fall into the trap of writing solely for an examiner! That presupposes some prior knowledge of who the examiner might be, and a bad guess could lead to disastrous consequences.

There is never likely to be only one reader. In fact, one could go further by saying that many readers may look at different parts of a project, and hope to extract information at very different levels. Whilst the *'golden rule'* might be always to **write for the reader**, you must take care that you appreciate who the reader might be.

The following model might prove to be useful to students writing a capstone project:

Suppose the results of your work are sufficiently innovative and have such great potential that you wish to sell the ideas to a company. The key 'players' within the company are:

- The Chief Executive (CEO) or Managing Director

- The Technical Director (or equivalent Board member)

- A Project Leader

- Analysts (possibly data analysts, data technicians, programmers, etc.) These are all potential readers of your project report (in parts).

You naturally approach the company at the top, through the Chief Executive. He/she is very busy, and can only spend a very short time considering what is presented. The information must therefore be very concise and precise. **[Hint]** The CEO may be very business oriented and not a technical person, so avoid jargon and technical detail. The CEO would look at the title, and try to identify whether the subject was relevant to the company's business. **[Hint]** Make the title relatively short and meaningful, without being so vague as to be useless. Some titles look like an essay in their own right! The CEO then reads the abstract. This must be capable of being read in isolation, as the CEO may read no further. It must therefore cover the scope of the work, what has been attempted and achieved, and also its potential. **[Hint]** Keep this down to about ½ page, bearing in mind how busy the CEO is. The equivalent to this in many technical reports is the 'Executive Summary'.

Assuming that you have got past the first hurdle of selling your ideas, you must now face the Technical Director (or equivalent). They are clearly far more technically competent, but are also very busy. They might be able to recognise a good idea, when presented in concept, and your next task is to sell your ideas to them.

This leads us to the Introduction and Conclusions of the capstone project documentation. They are a complementary pair that should be capable of being read together, and to some extent in isolation from the rest of the capstone project. The Introduction identifies the problem being tackled, outlines the context and describes the approach being taken. This discussion naturally points forward to the Chapters that follow, where anyone could read the detail if they so wished. **[Hint]** This often materialises as a lot of forward references to the forthcoming chapters, and as such, may read like a list of contents if you do not provide sufficient justification for why they are included. The conclusions are like the second bookend, in that it points back to the detailed findings from the work. It is therefore a summary of what has been discovered, and possible ways forward. **Remember who is reading it, and to whom you must sell the ideas**!

Once you are past that hurdle, you probably have the ideas accepted by the management, but you are still faced with trying to get the product implemented within the company. You might assume that the capstone project report is passed to a Project Leader, whose responsibility it is to implement our ideas (or a variant of them). The Project Leader would be interested in the body of the capstone project, i.e. the chapters containing all the detailed design decisions, the rationale, background etc. (essential for ensuring that they are thinking of similar problem areas).

While you can think about presenting a lot of detailed information at this point, the level of the material must still be very carefully chosen. Remember that the Project Leader would still be interested in concepts rather than code, and although they might be technically very competent, they have a number of people to manage in implementing this new project.

Finally you come to the 'analysts'. These are the people who have to be able to work with the detail of what you have done or prototyped. They are therefore interested in design detail (rather than rationale), possibly also in coding (particularly if there is novelty in this).

You can see from this scenario that there are potentially many different readers of your capstone project, all of whom are trying to extract something different from it. It is therefore **absolutely essential** that you write for the right reader, at least if you want to be successful.

3.3   Writing Style

Whilst you are taught to write (in whatever language) from a very early age, the one aspect that is rarely covered within any curriculum is the ability to communicate. This is fundamental. You may be trained to be competent in many other disciplines, such as engineering or business, yet communication skills are often by-passed in the education process.

We do not attempt to redress this omission within this guide. Intuitively you may know what makes for good communication - you understand what is being said / written. But what are the key factors? Are there good techniques that ensure the communication takes place?

There is a significant contrast in styles between writing, say a detective novel and a technical report. In the former, the 'art' is to conceal the important information (such as who did the murder) until as long as possible, while in the latter, the ability to get information over as quickly, painlessly and completely as possible without confusion is paramount.

This naturally leads to different writing techniques. Although there are no hard and fast rules as to how this must be done, the following hints have been seen to work effectively.

The overriding principle is that communication is about conveying **messages**. You will therefore find that everything you write should be related to the messages. This leads to a number of different types of sentence, namely:

- the message itself,
- qualification of the message i.e. further explanation,
- an identification of which topics (messages) are coming up,
- a summary of what (messages) have been presented.

There are naturally different levels of message, but the same principles can be applied as the refinement process takes place (in the same way as programme development may involve top down refinement).

Try to present the message early, and then qualify it. If you find that a sentence (paragraph, section, chapter etc.) has two or more messages, split it into smaller units.

Identifying the topics that will be coming serves several purposes: it acts as a pseudo-index; it allows for a mental check on completeness; it also ensures more 'comfortable' reading, as there are no surprises awaiting the reader.

Summarising the material adds reinforcement in that the reader knows they have recognised all the points that have been covered.

If you map these very general 'rules' onto different parts of a capstone project, you find:

Introduction

Message	What the capstone project is about
Qualifiers	Why it is a relevant topic for research.
	Appropriateness to different application areas
	What techniques it draws upon
Topics Coming	The forthcoming chapters
	Why they are relevant (at a high level)
Summary	What you hope to discover / identify (A hint at the conclusions)

Within each Chapter

Message	What the chapter is about.
Qualifiers	Why the chapter is in the capstone project report
	What its contribution is to the capstone project 'message'
Topics Coming	An indication of the sections within the chapter, with the rationale (briefly) for why you are including them
	The individual sections would then follow
Summary	Reinforcement of what has been presented within the chapter (i.e. its message).

Within each Section

Message	What the section is about.
Qualifiers	The relevance of the section
	How it contributes to the message of the chapter
Topics Coming	An identification of sub-sections etc.

4.0 Getting Started

4.1   Choosing your topic

You should have formulated a topic during the RMCP module. Make sure it is a topic which you can see yourself researching for some time - many researchers have come to grief simply because they lose interest in the area they are investigating. More importantly, it has to be a project that is realistic in terms availability of dataset and timeline. Talk to your supervisor about your idea(s) in order to establish its potential.

4.2   Working with your supervisors

You will be allocated a supervisor as well as an 2nd marker for the duration of your project. It is vital that you communicate with both supervisor and 2nd marker, as their experience and expertise will provide you with insights into the research process and ensure that you remain focused on your capstone project area.

Good rapport and communication between you and your supervisor are the most important elements of supervision. Remember you will need to communicate regularly with your supervisor both in preparing both your methodology and the implementation/simulation of your model. The Figure 1 below depicts the role of a supervisor in your capstone project.
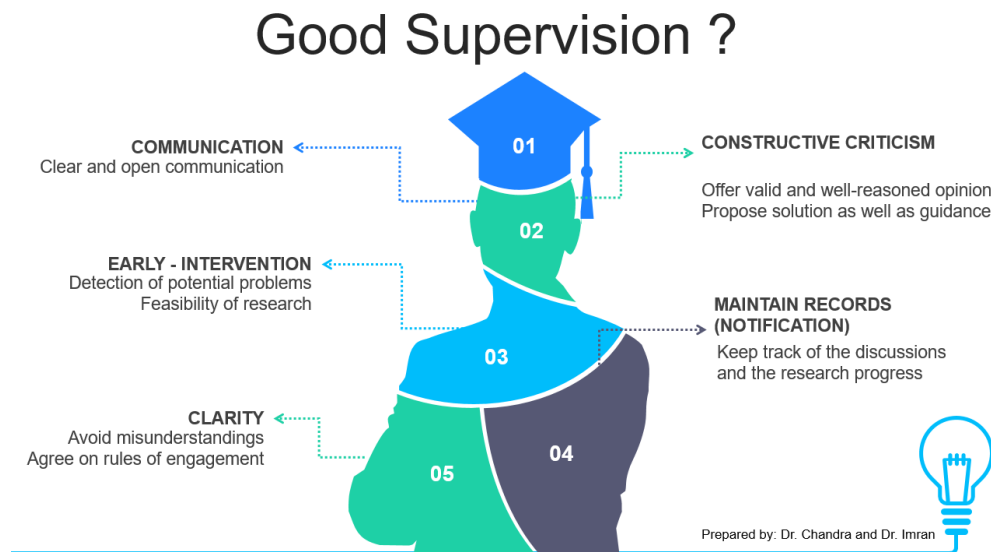

Figure 1: Good Supervision Criteria

Please note that you are expected to formally meet with your supervisor at least 5 times during the project. These mandatory 5 meetings must be documented using the Project Log Sheets available from admin.

4.3   Writing your proposal

So you have chosen a topic and discussed it with your principal supervisor/associate supervisor and possibly with other teaching staff - you have now to write a capstone project proposal. Your proposal should

- identify the area of study
- show how the area of study relates to your study programme
- include a capstone project development plan and an identified project critical path
- identify the resources necessary for the successful completion of the project
- describe the anticipated results and products where appropriate

The purpose of this proposal is to ensure that you have a viable topic and adequate resources to complete your research successfully.

Your proposal for the capstone project will be examined to ensure that the topic is suitable for your award. This is done during the Research Methodology for Capstone and Projects module.

5. Deadline for Capstone Project

5.1   Organising yourself and others

To maximise your chances of completing your project to your declared deadline you should draw up a timetable that contains a number of target deadlines for you to aim at. Of course it is unrealistic to expect that you will go through these stages in a straightforward way. We have set you a deadline for you to aim at – in exceptional circumstances this deadline may be extended but must be accompanied by adequate evidence (medical certificate or police report) of extenuating circumstances.

5.2   Being Ethical in your Research

It is vital that research should not 'harm' an individual in any way. As such you should consult your supervisor to ensure that you consider the ethics of what you are doing. The general points are listed below (More details can be found in the APU Research Ethics Document.) Research should:

- Not involve vulnerable subjects (e.g. children/elderly)
- Not involve deception in gathering primary data and evidence.
- Avoid exposing participants or researchers to increased levels of physical or psychological harm or likelihood of damage to reputation or competitive standing.
- Avoid situations where employees give data or opinions which might be problematic if revealed to other employees or management of the organisation.
- Always obtain informed consent from participants.

- Turnitin similarity score must be within an acceptable range and it is a serious offense to plagiarize people's work. You should discuss with your supervisor if you are unable to grasp the paraphrasing skills.

**Do ensure that the capstone project submission must be accompanied with the Ethics Forms prepared by APU.

6.0 Organization and Format of the Capstone Project

6.1 Structure of the Capstone Project report The Capstone Project is split into CP1 and CP2 reports. A report is made up of three main parts namely preliminary pages, text and references. These are arranged as in Table 6.1.

Table 6.1: Arrangement of parts in CP1 and CP2 reports

The Capstone Project is split into CP1 and CP2 reports. A report is made up of three main parts namely preliminary pages, text and references. These are arranged as in Table 6.1.

Table 6.1: Arrangement of parts in CP1 and CP2 reports

	Subject	Status	Example Appendix	Notes
1	Blank paper	Compulsory	-	-
2	Title page	Compulsory	B	*without page number* but counted as (i)
4	Declaration of Project Confidentiality	Compulsory	C	page number using Roman numeric (ii)
6	Supervisor's Declaration	Compulsory	D	page number using Roman numeric (iii)
7	Declaration of Originality and Exclusiveness	Compulsory	E	page number using Roman numeric (iv)
8	Dedication	Optional	F	page number using Roman numeric (if any)
9	Acknowledgements	Optional	G	
10	Abstract	Compulsory	H	page number using Roman numeric
11	Table of Contents	Compulsory	I	
12	List of Tables	Compulsory (if any)	J	
13	List of Figures	Compulsory (if any)	K	
14	List of Symbols/Abbreviations/ Notation/ Terminology	Compulsory (if any)	L	
16	Body of report	Compulsory	O	page number using Arabic numeric starting with page 1
17	References	Compulsory	-	page number using Arabic numeric continue from the body of report
18	Appendices	Optional	-	page number using Arabic numeric continue from references

The students are advised to refer to Moodle for the required templates and breakdown of required chapters

CP1 comprises chapters 1, 2, and 3 of the Capstone Project, which are the Introduction, Literature Review and Methodology. CP2 consists of the updated first 3 chapters (CP1), as well as the Simulation/Experiment, Analysis, Discussion, Conclusion chapters.

6.2   Appendices

Appendices are supplementary materials to the text. These include tables, charts, computer program listings, and others. The following should be noted:

iii.   Appendix is not a must in a project report. If necessary, data used for analysis, example of question-naires, maps, photographs and other materials which are lengthy to be included in the text or materi-als that are not required implicitly to clarify matters discussed can be accompanied as appendix.

iv.   Appendix can be named as Appendix A, Appendix B, and so on, depends on types and quantity to be included. Specific titles can also be given.

6.3   Binding

Both CP1 and CP2 reports must be bound properly. A report should be temporarily bound for the purpose of examination. A CP2 report for final submission must be permanently bound with hard cover.

Cover Colour and Writing

CP2 submitted to the University must be permanently bound. A Buckram type cover must be used and written with golden ink for the lettering. The minimum size of the letters should be 24 points. The cover colours and their codes should be as follows:

Level	Colour
Master/MSc (Taught programs)	Blue

Front Cover

The front cover should be written with the title of the capstone project, the student's name and "Asia Pacific University of Technology and Innovation (APU)" using capital letters.

Spine

On the spine should be written the student's name, the degree, the year the capstone project is approved (the year the final bound project report submitted) and APU as found in Moodle

7.   Referencing

7.1   APA Referencing System

APA referencing system is the most common style of referencing used at Asia Pacific University and is the officially adopted standard for all students except those studying modules in law or psychology.