THE UNIVERSITY OF HULL

School of Life Sciences
MSc Cancer Imaging
2017/18
Research Project and Dissertation - 58187
Project Guide

Important submission dates
Project Choice Form: 28/04/2018
Literature Review: 02/06/2018
Dissertation: 24/08/2018

Module Name: Research Project

Module Code: 58187 **No. credits:** 60 **Semester:** 3

Module co-ordinator: Dr.Chris Cawthorne (c.cawthorne@hull.ac.uk, tel 01482 461879)

Teaching staff: Dr. Ged Avery, Dr. Chris Cawthorne, Dr. Najeeb Ahmed, Dr.Nikos Efthymiou, Dr.Lawrence Kenning, Prof.Steve Archibald

Level 7

Aims and rationale of the module

The aims of this module are:

1) To provide students with a literature review topic to serve as the basis for the development of an original research project.

2) To enable students to carry out a clearly defined research project in the field of cancer imaging

Before the start of the lab project, the student will produce a 4,000 word literature review (20% of final mark), closely related to the topic of his/hers project and set by the same supervisor. This mark is further divided:
- 60% - literature review mark from the supervisor
- 40% - mark from a second marker (another member of staff from a related area)

The results from the research project will be written as a 16,000 word dissertation (80% of final mark). This mark is further divided:
- 55% - dissertation mark from the supervisor (including up to an extra 10% available based on performance in the lab and lab-book.
- 35% - mark from a second marker (another member of staff from a related area)
- 10% - presentation of work for a panel (10 minutes)

For assessment criteria details see Assessment Sheets at end of the Handbook.
A **Record of Progression Meetings with Supervisor** form is provided at the end of the handbook. It is intended to provide a transcript of student-supervisor meetings. These are not mandatory but provide students with a reminder of key stages in progression of their research project, and how their work is keeping pace with these. It also assists supervisors with structuring the supervision of their students, and provides an easily accessible reminder of the student's progress (maintained by the student). Finally, it provides a written record of the monitoring of student progression and performance accessible to the external examiners.

Indicative content, and contact time and type

The key theme of this module is the production of original research in the field of Cancer Imaging, and as such it aims to bring together the theoretical knowledge of both cancer, imaging and experimental design gained throughout the course to answer an original research question. As such, the research project will focus on a topic chosen from a list of available projects made available to the student (i.e. the preference of the student will be taken into account by the programme committee), and students will be assigned a primary research supervisor who leads in the chosen field for the duration of the semester. Research projects will involve the compilation, collation, analysis and interpretation of clinical imaging datasets made available for a range of imaging modalities (for example) or the collection of data in the preclinical setting using primarily PET/SPECT/CT/MRI; in both cases the project will include an extensive literature review of the area of study to give context.

Clinical practice is evidence based, and evidence is derived from research in the clinical setting. For the research project, a research question is outlined in the project title along with the title of a related literature review. The module is structured such that by undertaking the literature review the student gains in-depth knowledge of the context of the research question being asked, and can then use this knowledge in the project planning stage. For the duration of the module, students are allocated an academic supervisor who will provide one-to-one support in the development, execution and completion of the assigned project.

The vast majority of this module (600 hours (450 h laboratory work, 150 h dissertation and literature review)) will be undertaken as independent study with supervisory support.

Learning outcomes

Upon successful completion of this module, students will be able to:

1. Identify and select an area of research interest, from a prescribed list of projects, and formulate a project proposal (outline the hypothesis, establish specific aims and objectives, and design an achievable workplan in the timeframe of the project), identifying and justifying suitable research methodologies.

2. Write a comprehensive literature review through identifying, accessing, retrieving, interpreting, selecting and critically evaluating related studies from a range of sources.

3. Compile and analyse imaging data from a particular modality, interpret post-analysis research findings and draw appropriate conclusions based both on research findings and the relevant peer-reviewed literature.

4. Create a high-quality research dissertation in accordance with scientific conventions, appropriate for both academic and professional audiences.

Assessment summary (including reassessment)

The module is assessed in two parts, the first being the completion of a 4000 word literature review based on a title aligned with the research goals of the project and the second the completion of the dissertation itself. A literature review has been chosen as a preliminary assessment to ensure that the student is fully engaged with the context in which the research question is being posed and is thus prepared to test the hypothesis in the most relevant way; it also allows engagement with the intellectual themes of the project and is intended to encourage a deep level learning approach as it is aligned with the project itself. The dissertation is central to the assessment as its creation is a learning outcome in itself; allowing students to engage with the appropriate scientific form for their research. Dissertation was chosen over for example the writing of a scientific paper as this latter is a shorter and less satisfactory format in the educational setting; it is also arguably more difficult to present negative findings in this format.

1. 4000 word literature review (LO 1-2) (20%)
2. 16000 word dissertation (LO 1,3,4) (80%)

Module outcomes	Assessment method 1	Assessment method 2
1	X	X
2	X	X
3		X
4		X

Other information (including prerequisites, advisory constraints): None

CHOOSING A REVIEW AND PROJECT TITLE AND SUPERVISOR
On pages 4 to 9 you will find a list of 6 available project outlines offered by a range of supervisors from the University of Hull and Castle Hill Hospiatl, with associated relevant literature review titles. Initially you should make a list of the projects that you are interested in and talk to staff in more detail about the projects. There will be an approximately three weeks available for you to contact staff about individual projects.

Please select **three** projects, in order or preference, and fill in the form available on the Canvas site and supplied with this handbook (p17). We will try to accommodate student choices as much as possible but make sure you have contacted more than one member of staff as back up. In case of multiple students choosing the same project supervisor the programme director will make a final decision. Failure to submit a choice form may result in you being allocated a project that you have not chosen.

Please email in your project choice form or your project choices list to Dr. Cawthorne by **28th April 2018.**

Note about problems:
One of the most common problems faced is that just when you need to see your project director he/she is away on business/ill etc.
In these circumstances you should see Dr. Cawthorne/Dr.Hardman who will suggest a temporary surrogate project supervisor from whom you can obtain guidance or advice.
In order to organise your work, please ask your supervisor if they will be planning to be away during the duration of the project.

Review/Project titles and Supervisors:

Project title:

Assessment of heterogeneity in PD-L1 treated lung cancer patients

Supervisors: Dr Najeeb Ahmed, Prof. Mike Lind, Dr. Chris Cawthorne

Jack-Brignall PET-CT Centre, Castle Hill Hospital, Cottingham
Tel. 01482 875875 (Dr. Ahmed) e-mail: najeeb.ahmed@hey.nhs.uk
Queens Centre for Oncology, Castle Hill Hospital, Cottingham
Tel: 01482 461375 (Prof.Lind) e-mail: mike.lind@hey.nhs.uk
Cancer Imaging Group, PET Research Centre, University of Hull
Tel: 01482 465505 (Dr.Cawthorne) email: c.cawthorne@hull.ac.uk

Rationale:

PD-L1 is a novel targeted immunotherapy with application in a range of cancers, however there is no accepted biomarker for patient stratification. It has been suggested that response is related to mutational burden, ie the genetic heterogeneity of particular tumours. As the current pathway for the investigation of patients with suspected lung cancer often involves an ^{18}F-FDG PET-CT scan, the proposal is to look at analysing the textural features of these imaging examinations and assess if they correlate with therapy response seen in the clinic.

Methodology:

A series of patient images derived from ^{18}F-FDG PET-CT scans of patients that went on to be treated with PD-L1 inhibitors will be analysed and a series of textural parameters will be generated. These will be correlated with patient outcomes to assess prognostic power.

Review title: Evaluate the application of texture analysis to imaging with Positron Emission Tomography.

Project title:

Evaluation of the Intravoxel Incoherent Motion (IVIM) in Brain Cancer.

Supervisors: Dr. Lawrence Kenning, Dr. Chris Cawthorne, Dr. Nikos Efthymiou

Jack-Brignall PET-CT Centre, Castle Hill Hospital, Cottingham
Tel. 01482 875875 (Dr. Kenning) e-mail: lawrence.kennig@hey.nhs.uk
Cancer Imaging Group, PET Research Centre, University of Hull
Tel: 01482 465505 (Dr.Cawthorne) email: c.cawthorne@hull.ac.uk

Rationale:

Intravoxel Incoherent Motion (IVIM) in Brain

Intravoxel Incoherent Motion is a novel non-invasive MRI method for obtaining perfusion and diffusion metrics without the use of gadolinium-based contrast agents. Conventional diffusion-weighted imaging is able to generate apparent diffusion coefficient (ADC) values reflecting diffusion in the extracellular environment but no perfusion metrics. Furthermore, these ADC values have the potential to be falsely elevated in highly perfused tissues.

Over-estimation of ADC values in tumours is potentially misleading for staging and follow-up. IVIM utilises bi-exponential fitting of multi-b-value diffusion data to extract the fast (D*) and slow (D) diffusion components, improving tissue characterisation.

Methodology:

This project would involve coding an analysis tool to investigate normal and pathological values of f, D* and D extracted from IVIM brain datasets. These will then be compared to conventional ADC and the final diagnosis.

For the validation of the fitting algorithm the new Medical Image Analysis framework developed in the University of Hull, will be used. The framework provides an interface for ROI selection and image manipulation.
The successful candidate should have a motivation to became a software tester of the framework, while working on real clinical case studies. High level programming skills are not necessary.

Review title: Discuss how Diffusion Weighted MRI is currently applied in the Cancer Clinic.

Project title:

Development of motion signal extraction framework for the Microsoft Kinect camera

Supervisors: Efthimiou N., Cawthorne C.

PET Research Centre, University of Hull, Cottingham Road, Hull
Tel. 01482 465505 (Dr.Cawthorne) e-mail: c.cawthorne@hull.ac.uk
Tel. 01482 4665513 (Dr Efthymiou) e-mail: n.efthymiou@hull.ac.uk

A stand-alone cross-platform framework for image analysis, reconstruction and data processing of a variate of data acquired by PET/SPECT scanners and potentially MRI is under development. The framework links and makes use of external open source libraries in order to handle data formats and perform various complex tasks. The GUI is developed on QT and there is a strong drive to have cross-platform compatibility (especially between Windows and Linux).

The goal will be to provide a responsive / neat / intuitive plug-in able to acquire data from a Microsoft Kinect camea in an easy 'plug and play' fashion and extract from those warp spaces and/or motion signals for motion corrected or compensated medical image reconstruction.

This is a project on scientific programming but many programming challenges have to addressed. The successful candidate will need to fluent in a C variance, with drive to improve his skills on C++ and CMake.

Review title: Discuss the utility of opensource software in medical applications.

Project title:

Analytic simulation of motion correction phantom for PET studies

Supervisors: Efthimiou N., Cawthorne C.

PET Research Centre, University of Hull, Cottingham Road, Hull
Tel. 01482 465505 (Dr.Cawthorne) e-mail: c.cawthorne@hull.ac.uk
Tel. 01482 4665513 (Dr Efthymiou) e-mail: n.efthymiou@hull.ac.uk

Normal PET scans can last for several minutes. Patients are asked to manage and regularize their breathing pattern but that is not feasible for prolong periods of time. Therefore, some form of motion correction or motion compensated reconstructions are becoming standards in the industry or at the very least provided by the manufactures as an extra option.

In an academic environment, access to clinical data is not feasible on every occasion. Digital Anthropomorphic voxelised phantoms are a proven viable alternative to acquired data. The phantoms can be simulated analytically or with Monte Carlo techniques.

The aim of this project is the study the appropriateness of the commercial XCAT phantom for the simulation of the breathing cycle. The successful candidate will be familiar with the anatomy of the lungs and surrounding tissues as illustrated in the XCAT phantom. Then, various segmentation methods will be assessed. The goal of this project is to propose the optimal segmentation technique for the XCAT phantom breathing motion pattern.

The successful student should be versatile with the use of spreadsheets for data analysis.

The project will allow the student to build on a diverse range of skills involving physics and anatomy and simple image processing.

Review title: Discuss current approaches to motion correction in clinical PET-CT.

Project title:

MATLAB scripts for illustration of various concepts on Medical Imaging

Supervisors: Efthimiou N., Cawthorne C.

PET Research Centre, University of Hull, Cottingham Road, Hull
Tel. 01482 465505 (Dr.Cawthorne) e-mail: c.cawthorne@hull.ac.uk
Tel. 01482 4665513 (Dr Efthymiou) e-mail: n.efthymiou@hull.ac.uk

MATLAB has been proven a valuable tool in teaching. Educators in disciplines across the Sciences use MATLAB. Their main objective is to teach scientific concepts while instilling quantitative thinking in their students.
The Image Analysis module utilises MATLAB scripts for the illustration of advanced concepts and practical demonstration of the content of the lectures. As scripting programming languages are commonly used in many working environments (clinical and non-clinical) the module offers students practical sessions to improve their skills.
The successful candidate would be driven to enhance his understanding of many aspects of Medical Image Analysis and motivated to do so by improving the scripts used in the module. The scripts should be well documented, as it is a good programming practice.
The validation of the delivered code will be performed on clinical and preclinical data.
The student will gain in depth knowledge of the mathematical and physical background of medical imaging and build or improve his/her knowledge on MATLAB scripting.

Review title: Discuss the application of MATLAB for the illustration of mathematical imaging concepts in the context of medical imaging.

Project title:

Investigation of novel GPU accelerated ray-tracing for medical imaging applications.

Supervisors: Efthimiou N., Cawthorne C.

PET Research Centre, University of Hull, Cottingham Road, Hull
Tel. 01482 465505 (Dr.Cawthorne) e-mail: c.cawthorne@hull.ac.uk
Tel. 01482 4665513 (Dr Efthymiou) e-mail: n.efthymiou@hull.ac.uk

Software for Tomographic Image Reconstruction (STIR) is an open source toolbox primarily aimed at providing tools to enable the reconstruction of datasets acquired using Positron Emission Tomography (PET). It is over ten years old, has been well validated and is the leading tool for image reconstruction research in PET, cited by the majority of research groups in the field. Although it is implemented in C++, which for many years was considered the golden standard for speed, it is still time-consuming to obtain results especially for the comparison of multiple techniques on dynamic (multiple-frame) datasets.

Recently the introduction of GPU-based processing has driven computing speeds to previously unobtainable levels, and it is of global interest to configure this open source platform for GPU processing (via CUDA or openCL).

Ray tracing in medical imaging is used for the calculation of the model of the scanner. Currently the most common algorithms are variations of the Siddon's ray tracer. Though, robust and fast, it has not been designed to be GPU friendly. Recent advancements in fields as virtual and augmented reality have demonstrated various GPU specific real-time ray tracers.

This project seeks to propose and implement an upgrade of the current STIR, Siddon ray-tracer, in a flexible and efficient manner, to effect the reduction of computational time and drive towards achieving real time medical imaging. The successful student should have a good knowledge of GPU programming.

Review topic: Discuss the application of high performance computing in medical imaging research.

Project title:

Ultrasound assessment of chronic liver disease

Supervisors: Dr. Chris Cawthorne, Dr Pamela Parker

PET Research Centre, University of Hull, Cottingham Road, Hull
Tel. 01482 465505 (Dr.Cawthorne) e-mail: c.cawthorne@hull.ac.uk
Tel. 01482 xxxxxx (Dr Parker) e-mail: pamela.parker@hey.nhs.uk

Rationale:

Liver disease is an increasing problem world-wide and liver disease is the only major cause of death still increasing year-on-year. Liver disease is the fifth 'big killer' in England & Wales, after heart, cancer, stroke and respiratory disease. In addition, liver disease kills more people than diabetes and road deaths combined.

Liver disease often starts with fatty infiltration of the normal liver tissue. Left untreated this can progress to fibrosis and cirrhosis. Severe cirrhosis can lead to the development of hepatic cellular carcinoma and a very poor prognosis. Often, the process is silent, but when liver disease has developed and presents as an acute illness it has a 25-50% immediate mortality rate.

Commonly the first diagnosis of liver disease is through ultrasound imaging where the increased fat in the liver is detected. This diagnosis will then lead the patient into secondary care follow up and further tests usually involving liver biopsy and multiple further imaging tests. Liver biopsy is not without risk and major complications include significant haemorrhage leading to death. Therefore, minimising the need for liver biopsy is a priority.

Ultrasound imaging is a relatively cheap and simple first line investigation. Significant fatty infiltration can be diagnosed. However, it can be very difficult to determine the extent of fatty infiltration and therefore the significance of this. This can lead to an under or over diagnosis of this common but potentially life changing condition. New machine technologies have helped in lesion detection but the traditional diagnostic features of the ultrasound imaging that aided diagnosis of fatty liver disease have changed these parameters. This has led to an inconsistency between ultrasound operators in their diagnosis of fatty liver disease.

The aim of this project is to evaluate the agreement between operators in the diagnosis of fatty liver disease.

Methodology:

50 sets of images of previously reported fatty livers will be reviewed retrospectively. 20 operators with a range of experience from 1 – 30 years will score the images. The scores will be compared and any variability between reviews will be assessed.

Review title: Discuss the current applications of ultrasound in the cancer clinic.

Project title:

Development of novel phantoms for preclinical dynamic PET reconstruction validation.

Supervisors: Dr. Chris Cawthorne, Dr Nikos Efthymiou

PET Research Centre, University of Hull, Cottingham Road, Hull
Tel. 01482 465505 (Dr.Cawthorne) e-mail: c.cawthorne@hull.ac.uk
Tel. 01482 4665513 (Dr Efthymiou) e-mail: n.efthymiou@hull.ac.uk

Rationale:

Quantitation in PET requires an input function, which in the clinical setting can be derived from blood sampling or directly from the image. In the preclinical setting, blood sampling is harder to achieve and precludes longitudinal study. In mice, studies suggest that the vena cava is more suitable than the heart for image-derived input function measures, and this project seeks to create a suitable phantom of this vessel to validate this use.

Methodology:

A novel phantom of the vena cava, surrounded by normal tissue density material, will be designed and fabricated using a range of methods. Dynamic datasets will then be derived by injection of 68Ga and 18F solutions (at typical activities used in preclinical studies) over short timecourses. Data will be reconstructed using a variety of techniques and compared to ground truth data derived from measures made in the PET Research centre dose calibrator and automatic gamma counter. Optimium techniques for IDIF recovery in mice will then be defined.

Review title: Discuss the use of image-derived input functions in small animal PET studies.

Project title:

Impact of CT acquisition parameters on PET quantification

Supervisors: Dr. Chris Cawthorne, Mr. Glenn Wooley, Mr.Manos Papadopoulos

PET Research Centre, University of Hull, Cottingham Road, Hull
Tel. 01482 465505 (Dr.Cawthorne) e-mail: c.cawthorne@hull.ac.uk

CT in PET can be used for a wide range of clinical purposes, including fully diagnostic , anatomical localisation and/or attenuation correction (AC). The purpose of each CT scan will determine the acquisition protocol used, and hence patient dose. The drive for single visit imaging means that fully diagnostic high dose CT scans are required in addition to low dose whole body AC CT scans for correction of PET data. The aim of this project is to optimise CT protocols in relation to the impact of low dose AC scans on PET quantification.

The project will involve collecting and analysing PET phantom data on the Siemens Biograph mCT PET/CT scanner at castle hill hospital using a range of CT parameters. For each phantom, PET image quality parameters will be investigated in relation to a range of acquired CT parameters using a combination of National Electrical Manufacturers Association (NEMA) and in house software.

Review title: Discuss the use of CT in the cancer clinic.

Project title:

In vitro assessment of CXCR4 antagonists as novel PET imaging agents

Supervisor: Dr. Chris Cawthorne, Prof. Steve Archibald

PET Research Centre, University of Hull, Cottingham Road, Hull
Tel. 01482 465505 (Dr.Cawthorne) e-mail: c.cawthorne@hull.ac.uk
Tel. 01482 465488 (Prof.Archibald) e-mail: s.archibald@hull.ac.uk

CXCR4 is a g-protein coupled receptor overexpressed in the majority of solid cancers, with prognostic value for metastasis. Molecular imaging of CXCR4 via PET offers the ability to assess whole body disease burden as well as the potential to stratify patients for anti-CXCR4 therapy. To this end, several radioligands have been developed over the past 5-10 years, with 68Ga-Pentixafor entering clinical trials. This project aims to assess a family of macrocyclic CXCR4 antagonists as CXCR4 imaging agents in vitro, with a focus on establishing cell uptake and internalisation in a range of CXCR4 expressing cell lines.

Methodology:

This project involves the culturing of a range of cancer cell lines, and the assessment of radioligand uptake using established methodology. Full training (including the handling of PET radioistopes) will be provided.

Review title: Discuss the potential role that CXCR4 imaging may have in the cancer clinic.

Project title:

Investigation of the effects of multiple animal acquisitons on image quality metrics on the Sedecal SuperArgus scanner.

Supervisor: Dr. Chris Cawthorne

Tel. 01482 465505 (Dr.Cawthorne) e-mail: c.cawthorne@hull.ac.uk

Rationale

Preclinical PET imaging of mice is an expensive technique, with a drive for the acquisition of multiple animals in the field of view to maximise data acquisition from a single radiotracer delivery. Although attenuation from a single animal is often considered negligible, the effect of multiple animals on image quality parameters has only been partially assessed in preclinical PET. This project seeks to assess the effect of dual animal scanning on the image quality metrics measured using the national electronic manufacturer's associated preclinical image quality phantom (NEMA NU4 - 2008), at a range of activities.

Methodology

Preclinical PET acqusitions will be made using the NEMA NU4 phantom alongside a series of activity-filled cylinders intended to recapitulate the scanning of two animals per session on the Sedecal SuperArgus PET-CT. Full training the handling of radioisotopes will be provided.

Review title: Discuss the importance of quality control in clinical and preclinical PET scanning.

GENERAL POINTS FOR PREPARATION OF REVIEW AND DISSERTATION

These notes set out some guidelines for the presentation and layout of your Literature Review and Dissertation, as well as outline the procedures by which these will be assessed. For specific notes to each, please read Sections 4 and 5, respectively.

You should also read the section "Preparing a Dissertation for a taught Higher Degree" in the University *Postgraduate Taught Handbook.*

The following gives guidelines additional to the University regulations for preparing the dissertation (see notes in the *Handbook for Postgraduate Students*). The student must pay for the production, copying and binding of the dissertation although there is a small amount of money to cover the costs involved in carrying out the project. If the project is carried out jointly with an outside organization who may wish an extra copy or copies, this will be paid
for by the School. In addition, we will lend you a copying card to make an unbound copy of the thesis for depositing with the Course Co-ordinator. This copy will be used for providing copies for other bodies on request.

General notes, Formatting and Presentation

- **Spacing:** Use double spacing for majority of text. Single spacing should be used for the abstract, indented quotations, footnotes, formulae, tables and diagrams, appendices and references.
- Literature review and dissertation should be printed in single sided format.
- **Font type:** For the main text and figure legends please use a Serif font such as Times. For figure labels please use a Sans-Serif font such as Arial. Use font size 12 for main text.
- The report must be printed on A4 size paper of good quality.
- The margins of the report should measure not less than 40mm at the left edge (to be bound) and not less than 20mm for the other edges.
- **Page numbers:** Text pages must be numbered consecutively from beginning to end.
- SI units should be used throughout although in some cases other units are acceptable if these are widely used in the relevant literature. The use of acronyms and abbreviations cannot be avoided although these should be explained at their first use, in footnotes or/and in a glossary.

Figures and Tables

- Great care should be taken in the presentation of diagrams, graphs and tables. Proper labelling is required and thoughtful consideration of graphs is essential. In particular, beware of computers automatically drawing inappropriate straight lines and putting figure
legends in the wrong place.
- Convention dictates that table headings are over the table whereas figure legends appear underneath.
- Where necessary obtain statistical advice and give the complete statistical information, for example, give the appropriate error limits whenever means are given.
- When referencing Figures, use "From…" if not adapted and "Adapted from…" if adapted.
- However, making your own original figures adds value to your work.
- Small tables can be inserted in the text whereas large tables and figures should be in their own page.
- Make figure legends as complete as possible. For data figures they should read as a mini method (the rule of thumb is that another scientist should be able to reproduce your data from the information in a figure legend)

Referencing

- As a guide to format, students should consult the instructions for authors in an appropriate journal. The references should be given according to the standard system (Harvard System, University of Hull guidelines, see guidebook provided at the end of this book as well as at http://www2.hull.ac.uk/lli/referencing/harvard.html)
- Students should give references for as many statements as possible and there should be a clear distinction between their thoughts and those of others; correct and complete citation will avoid any accusations of plagiarism. It is imperative that all sources and information, including grey literature,

are cited and that all contacts are acknowledged. This is particularly important for those students working with other organizations or taking information from several sources. All sources of information should be referenced and the student should differentiate between those references consulted directly and those taken by being cited by another author; in the latter case, for example, where the paper by Bloggs (1995) was not consulted but merely taken after being referenced in Smith (1997), the citation should be as (Bloggs 1995 in Smith 1997). This avoids any errors introduced by the latter author being attributed to the student.
- Quotations and passages *verbatim* from other works should be avoided wherever possible but correctly attributed if it is necessary to give them.
- Acknowledge in the text any personal communications (as pers com.) giving the name and affiliation in the text (e.g. Dr F Bloggs, Any Agency, Anytown).

SPECIFIC POINTS FOR LITERATURE REVIEW PREPARATION

You will be required to submit a literature review on your topic of choice by 2nd June (2pm).

Your literature review title is related and closely tied in with your project and will help to build up your knowledge on the topic.
This document should do the following:
- Give an introduction to your research topic with focus on a specific question
- Give an overview of the literature on this specific topic
- Allow you to contextualise your project in the relevant literature.
- **It will form a reference point for your dissertation introduction but it is should not be used directly as the introduction.**
- The **bibliography/reference list** for this review should include all your sources and must be given in a consistent format (check Harvard format, as before).

Specific formatting

- The literature review should be **maximum 4,000 words**. Abstract, table of contents, figure and table legends and reference list are not included in this word count. Please place total word count on your title page.
- Use figures and tables as much as possible/where appropriate.
- **Binding (literature review):** The literature review should be ring bound between card covers. The front cover should bear the title of the report, the name of the student and the year of submission. A ring binding service, for which a small charge is made, is available in the Central Print Unit on Inglemire Lane.

SPECIFIC POINTS FOR DISSERTATION PREPARATION

You will be required to submit a dissertation of your laboratory project work by 24th of August (2pm).

Extensions to the time limit are not frequently granted without clear evidence of mitigating circumstances, and failure to submit on time will result in the student being penalised and will delay the project assessment and graduation.
A plan of the dissertation should wherever possible be submitted to the supervisors midway through the project. The student should then forward a rough, first draft of the dissertation to his/her main supervisor by **late-July**. This is in order for the supervisor to assess the progress and the direction of the thesis (and to make sure that the style is satisfactory). This also gives the supervisor time to make suggestions to improve the final dissertation. In any
event, it is in the student's interest to get the complete draft read through and checked before the final copy is submitted.
All students are reminded that the dissertations are carried out partly during the summer holiday period and thus supervisors may not be available for a few weeks. Arrangements should be made, in advance, for assistance during critical periods of the work. Finally, students are reminded that their supervisors may wish to see parts of the dissertation, as they are completed rather than waiting for a complete draft. Please discuss this during your initial meetings so you know what to expect.

Specific formatting

- The dissertation should be at **maximum 16,000 words**. Abstract, table of contents, figure and table legends and reference list are not included in this word count.
- A minimum of 3 copies should be produced and submitted. Two copies should be soft bound and one should be ring bound (same details as for literature review).
Binding (dissertation): Soft binding can be done at S. Ingram & D. Robinson Ltd., The Bindery, Carnegie Heritage Information Centre, (Old Carnegie Library), 342 Anlaby Road, Hull, HU3 6JA, http://haveitbound.com/

Structure and Content

All sections should be numbered and given on a Table of Contents.
- **Title page:** should contain project title, name and number of student, degree, date and total word count.
- **Abstract:** should work as a stand-alone document and is the first part of your dissertation, even before your table of contents. As it is located at the front of the dissertation, it must give an indication of all aspects of the report (a brief mention of the aims, background, methods, results and conclusions) – in approximately 300 words.
- **Acknowledgements:** should mention all major sources of help, any collaborating bodies, funding, sources of information and substantial assistance. Remember, the dissertation is a public document and cryptic comments will not mean much to the average
reader.
- **Table of Contents**: should include a list of all sections (numbered) with page numbers (and Appendices). If you prefer you can also add a table of figures and tables (optional).
- **Introduction:** should give the background to the topic and the study area and thus lead to the **Aims and Objectives** (i.e. what needs to be done); previous studies do not have to be discussed in detail and some of this information will be required (and thus repeated) in the Discussion.
- **Materials and Methods:** here you should indicate the laboratory methods and techniques/image processing methdoloogy, and the methods used to analyse the data (i.e. what and how it will be done).
- **Results:** In this section you should present the tables and figures and comments on them. The aim of the text is to draw the reader's attention to the main points (i.e. the information) of the results obtained (i.e. the data) (i.e. what you found, measured, observed
from your work);
- **Discussion**: Here you should take the main points from the results and explain, compare and contrast them in context of the available literature. Make sure your work is prominent and not buried in other peoples' work - just because their work was in print doesn't make it
more important (or even better) than yours (i.e. what your work means and why). Mentioning section or figure numbers works well.
Include a section in the discussion on a critique of your methods.
- **Conclusions**: reiterate the main findings of your work, using bulletpointed if necessary.
- **Future work/Future perspectives**: add suggestions and recommendations for further and future work - this shows that you are thinking objectively about the work and its implications (Examiners are keen on this).
- **Reference List**
- **Appendix:** here you can include useful information or data which is necessary for someone to repeat your findings but which will obscure the main messages in the results section. It is unlikely that the complete data will be collated anywhere else.

Scientific writing style advice

As the dissertation is a scientific and/or management document, the text should be as concise and objective as possible. The correct and appropriate writing style for the dissertation does not always come easily to students but they should bear in mind the following:
- avoid the use of questions in the text;
- avoid the use of personal pronouns and write in an impersonal style;
- do not use emotive terms nor give unsupported speculation;

- be careful with grammar, e.g. the word data is a plural (c.f. datum)
(try replacing it with the word 'measurements' and see if the sentence still reads ok);
- write in the past tense for what was done and the present tense for what the data now show;
- avoid the use of 'The Figure x shows that ...' or 'The Table x shows that ....'; merely give the statement and then add (Figure x) or (Table x) at the end of the sentence;
- avoid colloquialisms and a chatty style - imagine that a non-native English speaker is reading the text and will want to understand all aspects;
- give all non-English words and Latin species names in italics;
- avoid repetition where possible (if the lines 'as mentioned above' or 'as mentioned in section x' appear then you are repeating yourself);
- avoid the use of contractions (can't, didn't, etc) and beware of apostrophes indicating possession (particularly the exception to the rule and the difference between its and it's - in this case, the latter represents a contraction of 'it is');
- number all sections, e.g. 1., 1.1, 1.2, 1.2.1, 1.2.2, etc. but don't end up with too many sections and subsections (do not uncritically use the automatic section numbering system included in wordprocessing packages);
- avoid short paragraphs and long, rambling sentences;
- despite being in a rush to hand in the dissertation, give the text a final read-through as this will pick-up the final typographical errors (this may save having to make these corrections after the binding and examination process).

PROJECT WORK: REGULATIONS AND CODES OF PRACTICE

The following notes outline the regulations and various codes of practice governing project work in the School.

The responsibility for the personal safety of students and staff within the School is vested in the Head of the School, who (a) appoints safety officers to act on his behalf in many of the matters affecting the personal safety of individuals and the use of equipment, and (b) delegates the day-to-day instruction and supervision of students in safety matters to the members of his academic and technical staff.

The Safety Officers in the School of Life Sciences are:

School Safety Officer:

Mrs J Brigham

Radiation Protection Supervisor:

Dr F Voncken, Dr. C. Cawthorne

Biological Protection/COSHH (Control Of Substances Hazardous to Health) Officer:

Mrs J Brigham

Qualified first aiders:

Mrs. K Bulmer

Ms. Katherine Darlington

Emergency telephone numbers:

The normal procedure is to phone the REPORT CENTRE (in Administration) **5555**

They will then contact the Emergency Services required. The reason for this is
that they are best able to guide the emergency services to the correct / quickest access routes to the area concerned.

If you are forced to report directly, ring **(9)999**

GENERAL POINTS

Before starting practical work, students must discuss their project with their Project Supervisor.

In most cases the chemicals and the glassware needed by a project student will be available in the project director's laboratory. Other chemicals and equipment may be obtained from the SLS stores upon production of an order slip countersigned by the project director. Note that nonconsumables are issued on a sale-or-return basis and should be returned to stores when no longer required (normally on completion of the project).

Students must not use School computers without the permission of an academic member of staff. Under no circumstances must students attempt to modify computer programmes, interfere with databases or load alien software.

SAFETY REGULATIONS

Students **must** attend a Health and Safety seminar with the School Superintendent before they start work in the laboratories. The exact timing and date for this session is yet to be defined but will be booked for the **start of May 2017.**

Access to the School facilities (i.e. laboratories, library etc.) is restricted to the following times:

Monday to Friday 8:30 - 17.30

HOWEVER, STUDENTS CAN WORK IN THE RESEARCH LABORATORIES ONLY AT TIMES PREARRANGED WITH THEIR PROJECT DIRECTOR.

A student can undertake laboratory work only when his/her project director or some other suitably qualified person, who must have agreed with the supervisor to act on his/her behalf, is on hand to oversee the work. The personnel who are empowered to act in such a capacity are: another member of the academic staff, the technician in charge of the laboratory area in which the work will be carried out, a post-doctoral fellow, the School Laboratory Superintendent and Deputy Superintendent. A student must not work alone in
a laboratory without their project director's permission. No student should work in a laboratory if no other personnel are present on the floor on which the laboratory is located.

All students must observe the following general safety rules:

(i) No smoking, eating or drinking in the research areas.

(ii) Outdoor clothing, bags and books (other than laboratory note books) must not be taken into the laboratories.

(iii) Laboratory coats (buttoned up) must be worn at all times.

(iv) Eye protection must be worn as appropriate.

(v) Laboratory overalls must not be worn outside the School.

(vi) No social visits must be made to students working in other research laboratories in the School.

(vii) No visitors in the laboratories.

(viii) Do not undertake any experimental work unless your supervisor has advised you on the correct procedures to follow, the potential hazards, emergency procedures, and the correct
routes for the disposal of waste products.

(ix) Do not use any piece of equipment except after instruction has been received from the supervisor or technician in charge of the laboratory.

The following items require special attention:

- Autoclaves
- Steamers
- Pressure cookers
- Microwave ovens
- Homogenizers
- Ultrasonic disintegrators
- Centrifuges
- U.V. sources
- Radioactive sources
- Safety cabinets (for inoculation)
- Sterile cabinets (not to be used for inoculation)
- HPLC, FPLC, GC
- Low pressure and high-pressure systems
- Electrophoresis equipment

(x) Do not attempt to repair or modify equipment.

IF YOU DO DAMAGE A PIECE OF EQUIPMENT THEN NOTIFY THE TECHNICIAN IN CHARGE AS SOON AS POSSIBLE.

(xi) Do not take chemicals, glassware or equipment from other laboratories without permission.

Students must observe all of the safety regulations and codes of practice in force in the laboratories in which they will carry out their practical work. In most of the research laboratories, these are much more stringent than those in operation on the teaching floor because of the more hazardous nature of the experimental work.

The regulations and codes of practice, copies of which are lodged in the School Library, will be explained to you by your project director. In essence they cover:

- general safety procedures in the work place. (Health and Safety at Work etc. Act 1974).
- the prevention or control of exposure to substances hazardous to health (very toxic, toxic, harmful, corrosive, irritant, carcinogenic, mutagenic or teratogenic) (COSHH Regulations 1995*).
- the use of radioactive materials or radiation-producing equipment (Ionizing Radiation Regulations 1999).
- the use of microorganisms (Advisory Committee on Dangerous Pathogens 1995*).
- the use of animals [Animal (Scientific Procedures) Act 1986].

*Copies are kept in the safety section of the School Library, along with guidance on hazards associated with chemicals and microorganisms.

The COSHH Regulations differ from the others in that a written assessment of the health risks associated with a proposed procedure and the correct actions to be taken in the event of an accident must be made by the student and his / her project director prior to the commencement of the procedure.

All waste must be segregated before disposal by the proper channels under the supervision of the technician in charge of the laboratory.

All accidents, and unexpected incidents (e.g. explosions, implosions, electrical shocks etc.), however small, must be reported to the School Safety Officer as soon as possible. In the event of personal injury first aid should be sought immediately and an accident report form filled in.

IT IS A VERY SERIOUS OFFENCE TO TAKE ANY BIOLOGICAL MATERIALS, EQUIPMENT OR CHEMICALS OUTSIDE THE SCHOOL WITHOUT PRIOR PERMISSION.

IF IN DOUBT, ASK FOR HELP.

PROJECT CHOICE FORM

Please complete the form below and return to Dr. Cawthorne by email by **28th April 2018** at the latest.

Students who fail to meet the deadline will forfeit their choice and simply be allocated to any available project.

Student Name:

List below, in order of priority, the projects you would like to undertake:

1.
2.
3.

School of Life Sciences
58187- Assessment of Literature Review
Review Supervisor's Assessment

Candidate:
Supervisor:
Title of the Review:

Section	Marks Available	Marks Awarded	Comments
. Content: - Clear aims/objectives of review - Evidence of understanding of literature - Construction of arguments using multiple sources - Ability to present the researched literature in a structured and organised way - Construction of arguments using multiple sources	40		
2. Structure: - Inclusion of an abstract, introduction and a conclusions/future prospects section - Organisation of review into sections and subsections - Fluency - Use of original tables and figures	30		
3. Literature and References: - Adequate coverage of the literature, with the correct breath and depth - Appropriate use of references - Correct referencing style	40		
Total 100			

General Comments:
Signature:

Date:

School of Life Sciences
58187- Assessment of Literature Review
Co-Assessor's Assessment

Candidate:
Supervisor:
Title of the Review:

Section	Marks Available	Marks Awarded	Comments
. Content: - Clear aims/objectives of review - Evidence of understanding of literature - Construction of arguments using multiple sources - Ability to present the researched literature in a structured and organised way - Construction of arguments using multiple sources	40		
2. Structure: - Inclusion of an abstract, introduction and a conclusions/future prospects section - Organisation of review into sections and subsections - Fluency - Use of original tables and figures	30		
3. Literature and References: - Adequate coverage of the literature, with the correct breath and depth - Appropriate use of references - Correct referencing style	40		
Total 100			

General Comments:

Signature:
Date:

School of Life Sciences
58187- Assessment of Project Dissertation
Project Director's Assessment

Name of Candidate: **Project Director:**
Co-assessor:

Title of Project:

Section	Marks Available	Marks Awarded	Comments
1. Title and abstract - succinct and informative	7.5		
2. Introduction - review of background to the project including the use of appropriate literature, comprehension and organisation of background material AND a statement of the aims and objectives of the project – definition of the hypothesis to be tested.	20		
3. Methods – accurate description of the methods used in the project and description of the source material etc.	10		
4 Results - Appropriateness of method development. Problem solving skills and innovation in methods used. Quality of data, organisation and clarity of data (use of tables, graphs, diagrams etc.). Appropriate use of units, notations and abbreviations.	35		
5 Discussion - Interpretation of results. Integration with work in the field. Suggestions for future development. Conciseness, clarity of thought, originality.	20		
6 References. Accuracy and correct use of reference format.	7.5		
Sub-Total	100		
Project Director's Mark: Laboratory skills. presentation skills and performance in tutorials, problem solving ability, attendance, diligence, Initiative	**10**		

GENERAL COMMENTS:
SIGNATURE:

DATE:

School of Life Sciences
58187- Assessment of Project Dissertation
Co-Assessor's Assessment

Name of Candidate: **Project Director:**
Co-assessor:

Title of Project:

Section	Marks Available	Marks Awarded	Comments
1. Title and abstract - succinct and informative	7.5		
2. Introduction - review of background to the project including the use of appropriate literature, comprehension and organisation of background material AND a statement of the aims and objectives of the project – definition of the hypothesis to be tested.	20		
3. Methods – accurate description of the methods used in the project and description of the source material etc.	10		
4 Results - Appropriateness of method development. Problem solving skills and innovation in methods used. Quality of data, organisation and clarity of data (use of tables, graphs, diagrams etc.). Appropriate use of units, notations and abbreviations.	35		
5 Discussion - Interpretation of results. Integration with work in the field. Suggestions for future development. Conciseness, clarity of thought, originality.	20		
6 References. Accuracy and correct use of reference format.	7.5		
Sub-Total	100		

GENERAL COMMENTS:
SIGNATURE:
DATE:

MSc Research Project
Record of Progression Meeting with Supervisor

Student name:		**Supervisor name:**	
(signed)		**(signed)**	

Please provide dates of key stages in the project:

	Student Comments	**Supervisor Comments**
Health & Safety Course Completed		
Ethical Form Submitted		
Ethical Approval Granted		
Project title agreed with supervisor		
Project plan agreed with supervisor		
Initial pack of references given		
Work schedule agreed with supervisor (put in lab book)		
Training in techniques progress?		
Discussion of data?		
Lab book OK?		
Attendance/work rate OK?		
Literature review progress?		
Draft introduction submitted together with reference list and aims and objectives		
Supervisor feedback on introduction and references		
Materials and methods submitted		
Feedback on M & M		
Results submitted. Tables and figures and linking text		

Main conclusions discussed and agreed		
Final draft submitted		

General comments by student:	
General comments by supervisor:	

IMPORTANT NOTES REGARDING ASSESSMENTS AND MARKING

Submission format: All submissions for this module are in electronic format and need to be done through CANVAS.

Submission times: Submission deadlines are always at **2pm.**

Penalties for Late submission of work:

The late submission penalties applied to coursework submitted after the published deadline are:

Up to and including 24 hours after the deadline, a penalty of 10% will be applied

More than 24 hours late, up to and including 7 days after the deadline will result in either a penalty of 10% or reduction of the mark awarded to the pass mark (50%), **whichever results in the lower mark.**

More than 7 days after the deadline, a mark of zero is awarded.

Assessment 1

Assessment title: Literature Review

Weighting: 20% of total module mark

Hand-in week: 41 (2nd June, 2pm)

Submission: Canvas

Word count (or equivalent): 4000

Assessment overview: Your literature review title is related and closely tied in with your project and will help to build up your knowledge on the topic. This document should do the following:
- Give an introduction to your research topic with focus on a specific question
- Give an overview of the literature on this specific topic
- Allow you to contextualise your project in the relevant literature.
- **It will form a reference point for your dissertation introduction but it is should not be used directly as the introduction.**

Assessment 2

Assessment title: Dissertation.

Weighting: 80% of total module mark

Hand-in week: 02 (13th September, 2pm)

Submission: Canvas submission

Word count (or equivalent): 16000

Assessment overview:
The dissertation is central to the assessment of this module as its creation is a learning outcome in itself; allowing students to engage with the appropriate scientific form for their research. The dissertation should include an introduction that sets the context of the project and its novelty, comprehensive materials and methods that allow the research to be repeated, descriptive results and a discussion containing a critical evaluation of the results, and avenues for future work.
A plan of the dissertation should wherever possible be submitted to the supervisor(s) midway through the project. The student should then forward a rough, first draft of the dissertation to his/her main supervisor by **late-July**. This is in order for the supervisor to assess the progress and the direction of the thesis (and to make sure that the style is satisfactory). This also gives the supervisor time to make suggestions to improve the final dissertation. In any event, it is in the student's interest to get the complete draft read through and checked before the final copy is submitted.

Recommended Reading:

1. Murray R. 2011. How to write a thesis.
2. Ramlaul A. 2010. Medical imaging and radiotherapy research: skills and strategies.

Extensions: Student completes form SAS-EXT available from the office, and submits back[1] to office together with evidence. Year tutor makes decision and informs the student and relevant module-co-ordinator.

Mitigating circumstances: Student completes form SAS-M form held by office (with help if appropriate from Dr Sealy-Lewis). Application will later be considered by the extenuating circumstance committee.

Missed practical procedure- notes for STUDENTS: As soon as possible after missed practical (and within 7 days of it), student should complete a yellow Missed Practical form available from the School Office, and hand it back to the School Office with supporting evidence. This will then go to the relevant year head for consideration, who will inform the module co-ordinator of the outcome.

Missed test procedure: Student applies for Mitigating Circumstances in the usual way. If 0mitigating circumstances are not awarded, a mark of 0% is applied.

Penalties for Late submission of work:
The late submission penalties applied to coursework submitted after the published deadline are:

Up to and including 24 hours after the deadline, a penalty of 10%
More than 24 hours and up to and including 7 days after the deadline either a penalty of 10% or the mark awarded is reduced to the pass mark, **whichever results in the lower mark**
More than 7 days after the deadline, a mark of zero is awarded.

Referencing: Make sure you reference using the Harvard format.
http://www2.hull.ac.uk/lli/referencing/harvard.html
The School's Student Handbook also details referencing.

Turnitin: All electronic submissions will be put through turnitin. You will have a number of "playpen" attempts per year which will provide you with the turnitin output.

Contacting lecturers/module co-ordinators: Email is the primary method of communication, and you should use your university email address and check it daily. Staff email addresses are on the website: http://www2.hull.ac.uk/science/bbes/our%20staff/academic%20staff.aspx
When you email staff, ensure your emails are not too informal in tone, and include relevant details such as the module and e.g. specific assessment you are asking about. Bear in mind staff are usually involved in numerous modules and have emails from many students.

APPENDIX 1 – LEVEL 7 GENERAL GRADING DRESCRIPTORS

Exemplary Distinction 90-100	
All learning outcomes and associated assessment criteria have been met to an exemplary standard.	The work represents an **exemplary** response to the task set and attains the very highest standards of scholarship (authoritative and publishable) that can be expected of a level 7 submission. It is likely to demonstrate most or all of the following characteristics: **Technical Characteristics:** • All requirements are met and the work has been approached, executed or performed in an highly original way; • The organisation, structure and standard of presentation of the work, including referencing where appropriate, are exemplary throughout; • There is an exemplary standard of written and/or oral communication and the use of disciplinary terminology and techniques displays the highest level of accuracy and understanding. • **Higher Order Characteristics:** • There is an exemplary and compelling display of in-depth understanding, perceptive exploration and interpretation, stimulating and rigorous argument and striking insight; • The work reaches an exemplary standard of creativity, inventiveness, independence of judgement and consistent evidence of originality of thought and expression; • Use and application of a depth and breadth of sources, case studies, contextual evidence, ideas, concepts, theory and other relevant information and artefacts is exemplary; • The work displays an exemplary understanding of the link between theory and its application (and where relevant practice and standards); • The work attains the highest standards of scholarship that can be expected at Level 7, showing exemplary research skills and immediate potential to enter authoritatively into debates at the forefront of the academic discipline or area of professional practice

Outstanding Distinction 80-89	
All learning outcomes and associated assessment criteria	The work represents an **outstanding** response to the task set, attains some of the high standards of scholarship and shows real potential to influence the discipline or area of practice. It is likely to demonstrate most or all of the following characteristics:

have been met to a very high standard.	
	Technical Characteristics: • All requirements are met and the work has been approached, executed or performed in an original way; • The organisation, structure and standard of presentation of the work, including referencing where appropriate, are outstanding throughout; • The standard of written and/or oral communication is outstanding and the use of disciplinary terminology and techniques displays the highest level of accuracy and understanding. **Higher Order Academic Characteristics:** • There is an outstanding display of in-depth understanding, perceptive exploration and interpretation, stimulating and rigorous argument and striking insight; • The work reaches an outstanding standard of creativity, inventiveness, independence of judgement and evidence of originality of thought and expression; • The use and application of a depth and breadth of sources, case studies, contextual evidence, ideas, concepts, theory and other relevant information and artefacts is outstanding; • The work displays a very high standard of understanding of the link between theory and its application (and where relevant practice and standards); • The work is close to the highest standards of scholarship that can be expected at Level 7, showing outstanding research skills and potential to enter authoritatively into debates at the forefront of the academic discipline or area of professional practice.

Distinction 70-79	
All learning outcomes and associated assessment criteria have been achieved to a high	The work represents an **excellent** response to the task set, mostly attains the highest standards of scholarship that can be expected of a Level 7 submission and shows potential to influence the discipline or area of practice. It is likely to demonstrate most or all of the following characteristics:

standard and some to a very high standard.	**Technical Characteristics:** • All requirements are met and the work has been approached, executed or performed in an original way; • The organisation, structure and standard of presentation of the work, including referencing where appropriate, are excellent throughout; • The standard of written and/or oral communication is excellent and the use of disciplinary terminology and techniques displays the highest level of accuracy and understanding. **Higher Order Academic Characteristics:** • There is an excellent display of in-depth understanding, perceptive exploration and interpretation, stimulating and rigorous argument and striking insight; • The work displays a high standard of creativity, inventiveness, independence of judgement and evidence of originality of thought and expression; • There is excellent use and application of a depth and breadth of sources, case studies, contextual evidence, ideas, concepts, theory and other relevant information and artefacts; • The work displays high levels of understanding of the link between theory and its application (and where relevant, practice and standards); • The work provides a strong understanding and critique of the current state of knowledge and its application in the academic discipline or area of practice and displays an excellent level of scholarship. There may be scope for improvement in some areas in order to make the work of publishable quality.

High Merit **65-69**	
All learning outcomes and assessment criteria have been achieved to a very good standard.	The work represents a **very good** response to the task set, and attains very good standards of scholarship. It is likely to demonstrate most or all of the following characteristics: **Technical Characteristics:** • All requirements are met and the work has been approached, executed or performed to a very good standard; • The organisation, structure and standard of presentation of the work, including referencing where appropriate, are very good throughout; • The standard of written and/or oral communication is very good and the use of disciplinary terminology and techniques displays very good levels of accuracy and understanding.

	Higher Order Academic Characteristics: • There is a very good display of in-depth understanding, exploration, interpretation and critical analysis with some evidence of insight; • The work displays a very good standard of creativity, inventiveness, independence of judgement and some evidence of originality of thought and expression (although this may lack finesse); • The submission shows thorough use of a relevant sources and evidence, but lacks the breadth and depth of engagement required for a distinction. Some awareness of the limitations of the evidence presented is lacking; • The work displays a very good understanding of the link between theory and its application (and where relevant, practice and standards); • The work provides a very good understanding and critique of the current state of knowledge and its application in the academic discipline or area of practice. Levels of scholarship are good, but there is be scope for improvement in some areas in order for the work to be of publishable quality.

Merit **60-64**	
All learning outcomes and assessment criteria have been achieved to a good standard.	The work represents a **good** response to the task set, and the standards of scholarship are mostly good. It is likely to demonstrate most or all of the following characteristics: **Technical Characteristics:** • All of the core requirements are met and the work has been approached, executed or performed to a good standard; • The organisation, structure and standard of presentation of the work, including referencing where appropriate, are good throughout; • The standard of written and/or oral communication is good and the use of disciplinary terminology and techniques displays good levels of accuracy and understanding. **Higher Order Academic Characteristics:** • Errors, where present, are extremely minor and do not detract from the overall standard of the work; • The work displays some good examples of in-depth understanding, exploration, interpretation and critical analysis with some evidence of insight; • The work displays evidence of creativity, inventiveness, independence of judgement and some evidence of originality of thought and expression (although this may lack finesse); • The submission uses relevant sources and evidence, but lacks the breadth and depth of engagement required for a distinction. Awareness of the limitations of the evidence presented may be lacking; • The work displays a good understanding of the link between theory and its application (and where relevant, practice and standards); • Understanding and critique of the current state of knowledge and its application in the academic discipline or area of practice are well demonstrated and raise the work above the minimum requirements of a pass grade.

Pass **55-59**	
All learning outcomes and assessment criteria have been met satisfactorily with some met to a good standard.	The work represents a **satisfactory** response to the task set, with standards of scholarship likely to be undermined by a generally poor linkage of issues and themes within the task set. It is likely to demonstrate most or all of the following characteristics: **Technical Characteristics:** • All of the core requirements are met and the work has been approached, executed or performed to a satisfactory standard; • The organisation, structure and standard of presentation of the work, including referencing where appropriate, are on the whole sound, although some instances of poor or limited citation may be present; • The standard of written and/or oral communication is reasonable and the use of disciplinary terminology and techniques displays adequate levels of accuracy and understanding. **Higher Order Academic Characteristics:** • Errors may be present but these are not significant enough to impact on the ability of the work to meet the learning outcomes and assessment criteria at the minimum level; • The work is conscientious and attentive to the subject matter but engages more in description (with generally poor linkage of issues and themes) than in showcasing in-depth understanding, exploration, interpretation and critical analysis; • Evidence of creativity, inventiveness, independence of judgement, insight and originality of thought and expression is occasional and limited; • The submission uses a relatively limited range of sources and evidence. There is some assessment of the evidence presented, but this is largely underdeveloped and the limitations of the evidence are not fully articulated or understood; • The work displays some, but limited, understanding of the link between theory and its application (and where relevant, practice and standards); • Understanding and critique of the current state of knowledge and its application in the academic discipline or area of practice is not fully demonstrated, meaning that the work is not lifted above the requirement of a Pass.

Marginal Pass **50-54**	
All learning outcomes and assessment criteria have been met, but to a minimum standard.	The work represents an **adequate, but weak**, response to the task set, with standards of scholarship undermined by a generally poor linkage of issues and themes within the task set. It is likely to demonstrate most or all of the following characteristics: **Technical Characteristics:** • The core requirements are narrowly met and the work has been approached, executed or performed at the minimum satisfactory standard to achieve a pass grade. There is significant scope for improvement; • The organisation, structure and standard of presentation of the work, including referencing where appropriate, are satisfactory, but a number of inconsistencies in citation may be present; • The standard of written and/or oral communication is acceptable and the use of disciplinary terminology and techniques displays acceptable levels of accuracy and understanding. **Higher Order Academic Characteristics:** • Errors are likely to be present, which mean that the work cannot rise above the very minimum pass grade; • The work is conscientious and attentive to the subject matter but engages largely in description, and has poor linkages between issues and themes. It shows some but very limited evidence of in-depth understanding, exploration, interpretation and critical analysis; • Evidence of creativity, inventiveness, independence of judgement, insight and originality of thought and expression is occasional and very limited; • The submission uses a range of sources and evidence which is only just satisfactory. There is some assessment of the evidence presented, but this is largely underdeveloped and the limitations of the evidence are not fully articulated or understood; • The work displays some, but limited, understanding of the link between theory and its application (and where relevant, practice and standards); • Understanding and critique of the current state of knowledge and its application in the academic discipline or area of practice is not fully demonstrated resulting in conclusions which do not always reflect the complexity of the subject matter.

Marginal Fail **40-49**	
One or more of the learning outcomes and assessment criteria have not been met.	The work represents an **unsatisfactory** response to the task set. Strengths of the work are outweighed by its weaknesses. It is likely to demonstrate most or all of the following characteristics: **Technical Characteristics:** • The core requirements are not met and the work has not been approached, executed or performed to a satisfactory standard; • The work is poorly structured and standards of presentation are inadequate. Citation and referencing may be present but are likely to be limited and poor. There may be some inaccurate representation of the work of others; • The written and/or oral communication and the use of disciplinary terminology and techniques are not of a satisfactory standard. **Higher Order Academic Characteristics:** • Some major errors or inaccuracies are present which mean the work is unable to meet the learning outcomes and assessment criteria even at the minimum level; • The work only superficially engages with the subject matter, engages largely in description, and shows poor linkages between issues and themes. Arguments are not fully developed and evidence of in-depth understanding, exploration, interpretation and critical analysis is weak; • Evidence of creativity, inventiveness, independence of judgement, insight and originality of thought and expression is very limited; • The submission uses a very limited range of sources and evidence and/or shows limited differentiation between the quality and appropriateness of the sources used. Assessment of the evidence presented is underdeveloped and the limitations of the evidence are not fully articulated or understood; • The work displays limited understanding of the link between theory and its application (and where relevant, practice and standards); • Overly simple conclusions are drawn which do not reflect the complexity of current thinking in the discipline or area of practice.

Fail **1-39**	
The majority of the learning outcomes and assessment criteria have not been met.	The work represents a **very unsatisfactory** response to the task set. Strengths of the work are outweighed by its weaknesses. It is likely to demonstrate most or all of the following characteristics: **Technical Characteristics:** • The core requirements are not met and the work has not been approached, executed or performed to a satisfactory standard; • The work lacks structure and standards of presentation are wholly inadequate. Citation and referencing are limited, poor, irrelevant and/or dated and include inaccurate representation of the work of others; • The written and/or oral communication and the use of disciplinary terminology and techniques are not of a satisfactory standard. **Higher Order Academic Characteristics:** • Significant errors or inaccuracies are present; • The work only superficially engages with the subject matter, is descriptive and shows little linkage between issues and themes. Arguments are not developed and it may be confused and incoherent; • Evidence of in-depth understanding, exploration, interpretation and critical analysis is absent; • Evidence of creativity, inventiveness, independence of judgement, insight and originality of thought and expression is absent; • The submission lacks supporting evidence and/or shows limited differentiation between the quality and appropriateness of the evidence used. Any limitations of the evidence are not articulated or understood; • The work displays almost no understanding of the link between theory and its application (and where relevant, practice and standards); • Overly simple conclusions are drawn which do not reflect the complexity of current thinking in the discipline or area of practice.
Non-submission **0**	

APPENDIX 2 –Teaching weeks and online timetable weeks (WDC weeks)

Week commencing	WDC week	Teaching week
29-Aug-16	1	
05-Sep-16	2	
12-Sep-16	3	
19-Sep-16	4	
26-Sep-16	5	**1**
03-Oct-16	6	**2**
10-Oct-16	7	**3**