The Woolf Academic Handbook

For Information about Academic Records please contact help@woolf.university or jason.jones@woolf.education.

Contents

I. Introduction

The Academic Handbook is a practical introduction for new faculty members and students. It is not meant to be comprehensive; rather it is meant to be short enough to provide an overview of academic topics relevant to enrolled students and faculty members engaged in teaching.

For information about a specific course of study, see the course description for that course.

For matters of governance and quality assurance, see the Policy of Quality Assurance, to which this handbook is subordinate (link).

For guidance on specific policies not addressed in the above, contact: support@woolf.university.

II. Mission Statement

Woolf exists to promote academic excellence, broaden access to higher education, and guard values that are humane, democratic, and international. Above all, Woolf values freedom of thought, freedom of enquiry, and freedom of expression.

Background. Talent may be evenly distributed but opportunity is not – we are working to widen the horizon of opportunity by connecting students and teachers across the world.

Education. Woolf prioritises an education that will serve its students both in the near-term and in the long-term. Woolf seeks to provide a personalised, bespoke education. In all fields, Woolf seeks to instil values of curiosity, intellectual discipline, and clarity of expression.

Research. Woolf prioritises research-driven teaching that uses the latest academic scholarship, and Woolf encourages its faculty members to engage in groundbreaking research.

Collegiate organisation. Woolf's collegiate organisation strengthens the institution through diversity, competition, and loyalty. Colleges bear responsibility for the support of their members, including both faculty members and students.

Society. Woolf encourages partnerships with governments, educational institutions, research centres, schools, and businesses of all kinds – provided these partnerships do not infringe on the values of Woolf.

Technology. To the extent that existing or new technologies can improve the educational outcomes for students, widen access to the Woolf global network, improve the career experience of academics, better secure credible governance, lower the costs of institutional management, and generally support the mission of Woolf – these are embraced.

In all things, Woolf values excellence and measures itself against the highest international standards. Woolf seeks to raise those standards further.

III. Teaching

Woolf uses various teaching styles, including small group synchronous meeting teaching, large synchronous lectures, and supervised research.

Colleges

All teaching is provided by Woolf colleges. Any Woolf college can offer a course if a faculty member in the college is also a member of the course. A college can offer a degree or lower learning outcome if the college is approved by Woolf to offer the degree, and it is able to offer the requisite courses for that degree.

Degrees, courses, cohorts

Degrees and other awards are composed of courses (sometimes called 'modules'). A course is taught at a specific time to a group of students - this is called a cohort. Cohorts contain lessons with content, assignments, deadlines, and synchronous meetings. When students apply to a course, they may be given the opportunity to select which cohort they want to enrol in (for example, a cohort taught in the mornings and another taught in the evenings, potentially with different faculty or instructors, as listed on the cohort profile).

Optimal format for accreditation

Many pedagogical styles and course formats have value. Those which are optimal for accredited learning on the Woolf platform consist of courses divided into lessons, where each lesson contains:

- asynchronous content
- an assignment to be completed and graded by an instructor
- a synchronous session to meet with an instructor and other students.

This creates a strong, auditable record of compliance with the standards of accreditation required of all colleges at Woolf.

Learning outcomes

All learning styles, including self-directed study, synchronous sessions, and examinations - count towards the hours required for earning credit in appropriately accredited courses.

Learning outcomes depend on the number of credits a student earns; once a student has enough credits, the student must apply to Woolf to have their credits converted to the learning outcome.

Undergraduate level

25 hours	1 ECTS	Award
750 hours	30 ECTS	Undergraduate Certificate
1500	60 ECTS	Undergraduate Diploma
2250	90 ECTS	Undergraduate Higher Diploma
4500	180 ECTS	Bachelor's Degree

Graduate level

25 hours	1 ECTS	Award
750 hours	30 ECTS	Postgraduate Certificate
1500	60 ECTS	Postgraduate Diploma
2250	90 ECTS	Master's Degree (MBA, MA, MSc, etc.)

Course creation

Any verified Woolf Faculty member in a valid college can create a course and submit it to Woolf for review. The first time a course is submitted for review, it must contain full and complete course content meeting the criteria for approval. Upon successful completion of the review, the course will appear in public and can admit students and other faculty members. All courses offered on the Woolf platform must meet the exact same quality assurance standards, regardless of whether it is offered with external regulatory accreditation applied to the course.

Purchased research materials

Courses must state clearly, in the course description, whether students are required to purchase outside resources. Most taught courses should include all of the necessary academic resources, including all texts, in a digital format with the course. However, specialist research or other courses may require access to, or purchase of, outside materials, so students should check the course description before enrolling. If a student is uncertain, contact the college offering the course.

Student application flow

When students apply to a course, the application is visible to the college Dean, Admins, and the Academic Board – after their approval, the application is received by those faculty members offering the specific course in the college. Each faculty member can either decline the student application, or send the student an invitation to enrol. The

student can review the cohort of the course to which they have been invited, including the profile of the instructors, and the student can accept the one they deem suitable.

Course roles
All courses and their curriculum must be approved by the Academic Board of the college. All courses are taught under the supervision of the college's Academic Board. Academic board members must have a verified identity and doctorate.

Faculty, Instructors, and Professional Experts
Only Faculty members can create and lead a course, but many others contribute to its success. Faculty members must have verified PhDs, Instructors must have verified graduate degrees, and Professional Experts have at least 5 years of verified industry experience.

Course Editors
Colleges can appoint Course Editors to provide support for building and maintaining courses up to the point of their approval by the college's Academic Board. Course Editors are not able to see or modify student grades.

Students
Students must meet the entrance requirements for a course, have their application approved, and must accept an invitation for enrolment for a specific cohort; after paying and accepting an enrolment agreement, students are given access to their cohort's version of the course. (For more on courses and cohorts see §VI 'Teaching, Degrees, Courses, Cohorts' below.)

IV. Research

Faculty are encouraged to engage in research and to include research in their teaching. Woolf is a licensed Higher education Institution in Europe, and all faculty are encouraged to engage in Funding and Tender opportunities hosted by the European Commission (link).

Please write to support@woolf.university for grant hosting support and Woolf's EU Participant Identification Code.

The Woolf library
The Woolf library (link) maintains open access to digital collections with over 200m academic articles and scholarly resources. Faculty are encouraged to engage in original research on primary and secondary materials, including peer reviewed academic articles published in the last 5 years – and to encourage their graduate students to do the same.

Public engagement
Faculty are encouraged to host seminars and free courses that are open to public participation by creating a course and setting it to 'freemium' – this will allow members of the public to register at no cost with 1-click, and remove the need for ID and education verifications for participants. For advice on launching a public seminar or free course contact support@woolf.university.

V. Assessment

1. General Assessment Procedures
Academic assessment at Woolf is of two kinds: general assessment and cumulative assessment. general assessment applies to the continuous, lesson-by-lesson evaluation of student progress. Students receive a grade that encompasses their submitted assignment and ability to respond to issues raised during the teaching session.

Cumulative assessment applies to the examinations, portfolio submissions, long essays, oral examinations, completed dissertations, and theses – typically occurring at the end of a course. These assignments require the students to deepen and extend the scholarly engagements initiated in their prior work.

Degree-seeking students who fail any one section of a degree, cannot progress to complete the degree, and will by default fail the course. Failed modules may be re-taken solely at the discretion of Woolf's faculty.

2. Cumulative Examination of Courses
Cumulative examination may consist of a final project, written examination, multiple choice questions, or oral examination.

For examination by final project (long essay, portfolio, technical project), not more than 50% may be material taken from general assignments. The topic must be agreed in advance with the faculty member. The scope of the assignment must be aligned with the textual materials already available to the student. Academic examination essays are expected to be of a high standard and must be well-structured, well-crafted, and contain extensive and appropriate citations to the primary and secondary literature of the course.

For written exams, essay prompts are provided and questions may include gobbets or photographic evidence with prompts to elicit commentary. Online proctoring techniques are at the discretion of the college. Multiple choice questions are provided at the discretion of the college.

For oral examinations, a student must field questions about a pre-submitted and already graded dissertation or other assignment in order to demonstrate mastery of

the subject matter. Oral examinations must be conducted by a faculty member other than the immediate teacher or supervisor that has overseen the student's submitted essay. In undergraduate or master's-level courses, oral examinations are typically used to shift the established grade of a long essay or dissertation, according to the viva voce examination template in this handbook.

For undergraduate or master's-level dissertations and final projects: both the supervising faculty member and another faculty member of Woolf grade the work independently of each other. Their grades are averaged, but any spread greater than ten points that cannot be immediately resolved by the two graders will trigger a review by a third faculty member for final decision. MA-level dissertations are normally examined by viva voce, and the examiner will be a faculty member different than the supervising faculty member.

3. Weight of Grades

The final grade on a course is determined by the weighting rules stated in the course offering. Unless otherwise stated, all courses are weighted as follows: 50% of the grade derives from the average of the general units, and 50% of the grade derives from the cumulative examination.

The final grade on a degree is weighted in proportion to the ECTS points of the component courses. For example, a degree composed of 5 ECTS and 10 ECTS courses will weigh the 10 ECTS courses proportionately more, according to the number of ECTS credits.

4. Woolf's International Grade Classification

Woolf's faculty members are trained in a number of different grading scales; these scales are cross-referenced and linked to each other. This handbook employs American grades and classification, with US grades as the default on the Woolf platform.[1] US grades are granular, and they are distributed with the least number of gaps, which is why they have been selected as the default grading scheme for transcripts. Woolf's international conversion scheme is as follows:

[1] Cf. the Fulbright Commission (http://www.fulbright.org.uk/going-to-the-usa/pre-departure/academics), Princeton Review (https://www.princetonreview.com/college-advice/gpa-college-admissions), European Commission (https://eacea.ec.europa.eu/national-policies/eurydice/content/second-cycle-programmes-49_en), and University of Malta (https://www.um.edu.mt/__data/assets/pdf_file/0005/47390/harmonisedregs-09.pdf).

US GPA	US Grade	US Percent	UK Mark	UK Classification	Malta Grade	Malta Mark	Malta Classification	Swiss Grade
4	A+	97 - 100	70+	First class honours	A	80-100%	First class honours	6.0
3.9	A	94-96	67-69	Upper-second class honours	B	70-79%	Upper-second class honours	
3.7	A-	90-93	65-67	Upper-second class honours				5.5
3.3	B+	87-89	60-64	Lower-second class honours	C	55-69%	Lower-second class honours	
3	B	84-86						
2.7	B-	80-83	55-59	Lower-second class honours				5
2.3	C+	77-79	50-54	Third class honours	D	50-54%	Third-class honours	
2	C	74–76						
1.7	C-	70–73	45-49	Third class honours				4.5
1.3	D+	67–69	40-44	Ordinary / Unclassified				
1	D	64–66	35-39	Ordinary / Unclassified				
0.7	D-	60–63						4
0	F	Below 60	Below 35		F	45-54%		1-3.5

5. Woolf Grading Criteria, Definition of Grades, and Classification
Grading (marking) of student work keeps in view the scale of work that the student can reasonably be expected to have undertaken in order to complete the task.

a. The assessment of work for the course is defined according to the following rubric of General Criteria:

i. Engagement:

- Directness of engagement with the question or task
- Range of issues addressed or problems solved
- Depth, complexity, and sophistication of comprehension of issues and implications of the question or task
- Effective and appropriate use of imagination and intellectual curiosity

ii. Argument or solution:

- Coherence, mastery, control, and independence of work
- Conceptual and analytical precision
- Flexibility, e.g. discussion of a variety of views, ability to navigate through challenges in creative ways
- Completion leading to a conclusion or outcome
- Performance and success of the solution, where relevant

iii. Evidence (as relevant):
- Depth, precision, detail, range and relevance of evidence cited
- Accuracy of facts
- Knowledge of first principles and demonstrated ability reason from them
- Understanding of theoretical principles and/or historical debate
- Critical engagement with primary and/or secondary sources

iv. Organisation and presentation:
- Clarity and coherence of structure
- Clarity and fluency of writing, code, prose, or presentation (as relevant)
- Correctness of conformity to conventions (code, grammar, spelling, punctuation or similar relevant conventions)

b. US grades for the course are defined according to the following rubric:
97-100
Work will be so outstanding that it could not be better within the scope of the assignment. These grades will be used for work that shows exceptional excellence in the relevant domain; including (as relevant): remarkable sophistication and mastery, originality or creativity, persuasive and well-grounded new methods or ideas, or making unexpected connections or solutions to problems.

94-96
Work will excel against each of the General Criteria. In at least one area, the work will be merely highly competent.

90-93
Work will excel in more than one area, and be at least highly competent in other respects. It must be excellent and contain: a combination of sophisticated engagement with the issues; analytical precision and independence of solution; go beyond paraphrasing or boilerplate code techniques; demonstrating quality of awareness and analysis of both first principles or primary evidence and scholarly debate or practical tradeoffs; and clarity and coherence of presentation. Truly outstanding work measured against some of these criteria may compensate for mere high competence against others.

87-89
Work will be at least very highly competent across the board, and excel in at least one group of the General Criteria. Relative weaknesses in some areas may be compensated by conspicuous strengths in others.

84-86
Work will demonstrate considerable competence across the General Criteria. They must exhibit some essential features of addressing the issue directly and relevantly across a good range of aspects; offer a coherent solution or argument involving (where relevant) consideration of alternative approaches; be substantiated with accurate use of resources (including if relevant, primary evidence) and contextualization in debate (if relevant); and be clearly presented. Nevertheless, additional strengths (for instance, the range of problems addressed, the sophistication of the arguments or solutions, or the use of first principles) may compensate for other weaknesses.

80-83
Work will be competent and should manifest the essential features described above, in that they must offer direct, coherent, substantiated and clear arguments; but they will do so with less range, depth, precision and perhaps clarity. Again, qualities of a higher order may compensate for some weaknesses.

77-79
Work will show solid competence in solving problems or providing analysis. But it will be marred by weakness under one or more criteria: failure to fully solve the problem or discuss the question directly; some irrelevant use of technologies or citing of information; factual error, or error in selection of technologies; narrowness in the scope of solution or range of issues addressed or evidence adduced; shortage of detailed evidence or engagement with the problem; technical performance issues (but not so much as to prevent operation); poor organisation or presentation, including incorrect conformity to convention or written formatting.

74-76
Work will show evidence of some competence in solving problems or providing analysis. It will also be clearly marred by weakness in multiple General Criteria, including: failure to solve the problem or discuss the question directly; irrelevant use of technologies or citing of information; factual errors or multiple errors in selection of technologies; narrowness in the scope of solution or range of issues addressed or evidence adduced; shortage of detailed evidence or engagement with the problem; significant technical performance issues (but not so much as to prevent operation); poor organisation or presentation, including incorrect conformity to convention or written formatting. They may be characterised by unsubstantiated assertion rather than argument, or by unresolved contradictions in the argument or solution.

70-73

Work will show evidence of competence in solving problems or providing analysis, but this evidence will be limited. It will be clearly marred by weakness in multiple General Criteria. It will still make substantive progress in addressing the primary task or question, but the work will lack a full solution or directly address the task; the work will contain irrelevant material; the work will show multiple errors of fact or judgment; and the work may fail to conform to conventions.

67-69
Work will fall down on a number of criteria, but will exhibit some of the qualities required, such as the ability to grasp the purpose of the assignment, to deploy substantive information or solutions in an effort to complete the assignment; or to offer some coherent analysis or work towards the assignment. Such qualities will not be displayed at a high level, and may be marred by irrelevance, incoherence, major technical performance issues, error and poor organisation and presentation.

64-66
Work will fall down on a multiple General Criteria, but will exhibit some vestiges of the qualities required, such as the ability to see the point of the question, to deploy information, or to offer some coherent work. Such qualities will be substantially marred by irrelevance, incoherence, error and poor organisation and presentation.

60-63
Work will display a modicum of knowledge or understanding of some points, but will display almost none of the higher qualities described in the criteria. They will be marred by high levels of factual or technology error and irrelevance, generalization or boilerplate code and lack of information, and poor organisation and presentation.

0-60
Work will fail to exhibit any of the required qualities. Candidates who fail to observe rubrics and rules beyond what the grading schemes allow for may also be failed.

c. Synchronous Meeting Discussion and Viva Voce Examination
Synchronous meeting discussions and *viva voce* examinations are conducted on the same format: written work is submitted in advance, and a discussion follows. This provides students an opportunity to clarify and explain their written claims, and it also tests whether the work is a product of the student's own research or has been plagiarised.

For undergraduate and master's-level viva voce examination, the submitted work is graded, and the grade is recorded prior to the oral examination.

The synchronous meeting discussion and viva voce examination acts to shift the recorded grade on the submitted essay according to the following rubric:

+3
Up to three points are added for excellent performance; the student displays a high degree of competence across the range of questions, and excels in at least one group of criteria. Relative weaknesses in some areas may be compensated by conspicuous strengths in others.

+/- 0
The grade is unchanged for fair performance. Answers to questions must show evidence of some solid competence in expounding evidence and analysis. But they will be marred by some weakness under one or more criteria: failure to discuss the question directly; appeal to irrelevant information; factual error; narrowness in the range of issues addressed or evidence adduced; shortage of detailed evidence; or poor organisation and presentation, including consistently incorrect grammar. Answers may be characterised by unsubstantiated assertion rather than argument, or by unresolved contradictions in the argument.

-3 (up to three points)
Up to three are subtracted points for an inability to answer multiple basic questions about themes in the written work. Answers to questions will fall down on a number of criteria, but will exhibit some vestiges of the qualities required, such as the ability to see the point of the question, to deploy information, or to offer some coherent analysis towards an argument. Such qualities will not be displayed at a high level or consistently, and will be marred by irrelevance, incoherence, error and poor organisation and presentation.

0
Written work and the oral examination will both be failed if the oral examination clearly demonstrates that the work was plagiarised. The student is unfamiliar with the arguments of the essay or the sources used for those arguments.

6. Woolf Late Submission of Assignments
All assignments (including homework, labs, quizzes, exams, projects and any and all summative and cumulative assignments or assessments) must be submitted no later than the due date stated on the module or course, unless an alternative arrangement has been made with the instructor and a new due date is established in writing prior to the deadline.

Extensions or exceptions are at the discretion of the college. Unless a college has a specific academic policy the default penalties for late work will be as follows:

1. If a student submits an assignment after the established deadline they may be subject to a penalty at the instructor or faculty member's discretion, up to and including failure for the assignment.

2. By default, late assignments will have their final score reduced by the equivalent of ⅓ of a letter grade on the US system as described in §4 above, for every 24 hours that the assignment is late. The college has the authority to set an alternative penalty–greater, lesser, or no penalty at all–provided that the policy has been documented in writing prior to the commencement of the course.

Exceptions may be made for students with mitigating circumstances, and students who anticipate being in such circumstances are encouraged to submit a Mitigating Circumstances report using Woolf's Red Flag procedure. (For more on Mitigating Circumstances see §IX; 2 "Mitigating Circumstances and the Escalation of Issues and Appeals" above.) It should be noted that the Mitigating Circumstances report would need to be filed in advance of the deadline.

Unless the college has an alternative policy, coursework will not be accepted after the last day of the module or course.

VI. Doctoral Thesis Examination Regulations

Over the course of doctoral study a student, working closely with a faculty supervisor, becomes progressively more independent and autonomous. The culmination of this three-year process is the doctoral thesis, an original work of 80-100,000 words (exclusive of appendices, and in any case not over 120,000 words) that advances knowledge in the candidate's field.

1. Doctoral Thesis Viva Voce Examination Rules

Doctoral theses at Woolf are defended by viva voce examination. The purpose of such examinations are to explore the claims made by the doctoral thesis as well as to ratify the doctoral candidate's knowledge of their scholarly field. Viva voce examinations vary in length but are often between one and three hours–though a rich or enjoyable conversation may well extend beyond this.

a. The examiners consist of one faculty member of the College other than the thesis supervisor, who will Chair the meeting; and one external examiner from outside of Woolf. The candidate and the supervisor will agree on the examiners before scheduling the viva. The thesis supervisor will always be present at the examination, and the Dean of the College may be, ex officio.
b. Students may elect whether they wish to allow a public audience to attend the viva voce examination, in which case the meeting Chair may open the discussion to questions at the end of the formal examination.
c. The thesis examination should be coordinated by the thesis supervisor, and should ordinarily be arranged within one month of receipt of the thesis. Except for confirming the date of the examination, the student will not contact the examiners beforehand.
d. The examination should be within two or three months after the thesis has been submitted. Examiners must have a minimum of four weeks to read the thesis before the examination, unless by mutual agreement.
e. Before the examination, the examiners may write the thesis supervisor indicating any areas of special concern that are likely to arise. This is most appropriate if the examiners feel any outcome beyond "minor corrections required" is likely; the supervisor may notify the student in order for the student to research the areas of concern and better prepare verbal answers to the matters raised in preparation of undertaking major corrections.
f. After the examination, the examiners will complete the post-viva form (below) and return it to the supervisor. If the examiners cannot agree, then the matter will be referred to the Dean of the College for consideration, and if either the examiners or the student disagree with the Dean's judgement, it will be escalated to the Quality Assurance, Enhancements, and Technology Alignment Committee (QAETAC) for final resolution.

g. The post-viva form should give a detailed description of the strengths and weaknesses of the candidate's performance at the examination as well as the thesis itself, making clear the stakes of the candidate's research. If there are any concerns that warrant either minor correction or major revisions, these should be spelled out in detail.
h. Possible outcomes of the viva examination are:
    i. The student will receive the doctorate for the thesis as written.
    ii. The student will receive the doctorate, subsequent to minor corrections.
    iii. The student should pursue revision and resubmission.
    iv. The student can receive a Master's degree in their subject for the thesis as written or with minor corrections.
    v. The student will fail.
i. Minor corrections should be completed by the student within one month of receiving the list of corrections from the supervisor.
j. Students pursuing revision and resubmission will ordinarily have six months to complete revisions before standing for examination again.
k. If a student has been referred for a Master's degree with minor corrections, they have two weeks to complete them.

2. Post-Viva Examiner Report Form

Examiner Report Form 2022-23

Name of Student	
Title of Thesis	
Degree Sought	
Date of Viva Voce Examination	
Name of Internal Examiner	
Name of External Examiner	
Home Institution of External Examiner	
Name of Thesis Supervisor	

Performance at the Viva

Please assess the candidate's performance during the viva voce exam. If there were any concerns about the quality of the thesis in advance, please explain how those concerns were addressed by the candidate.

Recommendation

The examiner will please tick the appropriate box.

The thesis is accepted as written.	
The thesis is accepted, subsequent to minor corrections (listed below)	
The candidate should pursue major revisions, and resubmit the thesis for examination.	
The candidate should receive a Master's degree for this work. (If any corrections are required, please specify them below.)	
The candidate should fail the degree.	

Corrections (if required)

In the event that minor corrections are required, please detail these here.

Referral (if applicable)

If the candidate is required to revise and resubmit the thesis, please explain what must be done to bring the thesis to the requisite standard. Likewise, if the candidate is to fail the degree, please indicate the grounds.

Signatures

Name	Institution	Signature

VII. Plagiarism

Plagiarism is the use of someone else's work without correct referencing.[2] The consequence of plagiarism is the presentation of someone else's work as your own work. Plagiarism violates Woolf policy and will result in disciplinary action, but the context and seriousness of plagiarism varies widely. Intentional or reckless plagiarism will result in a penalty grade of zero, and may also entail disciplinary penalties.

Plagiarism can be avoided by citing the works that inform or that are quoted in a written submission. Many students find that it is essential to keep their notes organised in relation to the sources which they summarise or quote. Course instructors will help you to cultivate professional scholarly habits in your academic writing.

Depending on the course, short assignment essays may not require students to submit a bibliography or to use extensive footnotes, and students are encouraged to write their assignments entirely in their own words. However, all essays must acknowledge the sources on which they rely and must provide quotation marks and citation information for verbatim quotes.

There are several forms of plagiarism. They all result in the presentation of someone's prior work as your new creation.

Cut and Paste
Material taken verbatim from any source should be properly cited and referenced.

Paraphrasing
Even when material has been reworded, the source must still be acknowledged.

Unauthorised Collaboration
Collaboration with other students can result in pervasive similarities – it is important to determine in advance whether group collaboration is allowed, and to acknowledge the contributions or influence of the group members.

---

[2] This section draws upon statements about plagiarism from the University of Oxford (https://www.ox.ac.uk/admissions/graduate/applying-to-oxford/university-policies/plagiarism?wssl=1, https://www.ox.ac.uk/sites/files/oxford/field/field_document/Academic%20good%20practice%20a%20practical%20guide_0.pdf, https://www.ox.ac.uk/students/academic/guidance/skills/plagiarism?wssl=1), and from the University of London (https://london.ac.uk/current-students/examinations/rules-assessment-offences-and-cheating/coursework-offences).

False Authorship (Essay Mills, Friends, and Language Help)
Paying an essay writing service, or allowing a generous friend to compose your essay, is cheating. Assistance that contributes substantially to the ideas or content of your work must be acknowledged.

VIII. Colleges

In line with Woolf's Policy of Quality Assurance, Woolf is organised into colleges on the model of collegiate universities, including the Universities of Oxford, California, and London.

Digital colleges appear on the Woolf software platform; they consist of groups (free associations) of faculty with verified doctorates and verified identities. Colleges may admit new faculty members. Colleges can enrol students and set tuition prices.

Colleges do not normally specialise in any particular topic, and may admit students in all those fields represented by the Faculty of the college. It is expected that the diversity of colleges at Woolf will increase over time, both geographically and linguistically.

1. College roles
College roles reflect the requirements of Woolf's Policy of Quality Assurance. The requirements of the roles, and the division of review, maintains an environment of high academic standards.

Deans
All colleges (and schools) have a College Dean, who is the main contact for the college. The College Dean is unanimously elected at the time that the college forms, insofar as the Dean invites the Academic Board and other Faculty to join the college at formation, and these must approve of the Dean and the other members.

Deanships do not have natural term limits. Deans may exit the role by appointing a replacement, which can be done at any time. The only qualifications required to be a College Dean are those required to be a College member.

Administrators
Deans may appoint any college member to be an 'Admin'; Admins are able to oversee all aspects of college membership, including assigning roles to members (depending on their eligibility). Admins may remove members from the college or approve applications to join the college. Admins are able to configure other settings in the college, including payment integrations.

The Academic Board
Every college must appoint its own Academic Board with at least 2 Academic Board members approved by Woolf. Academic Board members must have verified PhDs.

The primary purpose of the college's Academic Board is to uphold the academic integrity of the college. At the start of every new cohort, the cohort's curriculum is submitted to the Academic Board for approval. Thus only the academic board can approve of the launch of a new cohort in a course, with its curriculum. At the end of the cohort, the teachers must submit the grades to the Academic Board for approval, and only after their approval are the grades added to the students' transcripts. During this process, students can be graded as failed, or the academic board may ask questions of the lead faculty member on the course.

Faculty, Instructors, and Professional Experts
In line with Woolf's Policy of Quality Assurance, Faculty must have a verified PhD and be a member of a valid college. Instructors must have a verified graduate-level qualification. Industry Experts must have at least five years of experience in the relevant industry of instruction, and be approved by both Woolf and their college.

2. College ranking
Colleges are an important component in fostering an environment of academic excellence. It is expected that as the number of colleges at Woolf increases, they will

compete with each other for standing in collegiate rankings; rankings are public and depend upon a number of metrics of quality assurance, which are subject to review by the Faculty Council.

3. College naming conventions
Pre-existing colleges, schools, or research institutes that join Woolf are encouraged to keep their name, except where this includes regulated terms (such as 'university'). For those beginning to offer accredited programmes for the first time, it may also be an opportunity to reflect on the institution's future and name.

Where college names contain the term 'School' or 'Institute' or 'Centre', they are still constituent colleges of Woolf.

New Colleges created on the Woolf platform are normally named after a scholar or someone who has contributed greatly to the arts and sciences, using the following format: [NAME] College.

Colleges should not imply an official relationship to an existing institution, except where so endorsed, nor should they inappropriately suggest royal or state patronage. Colleges are encouraged to support the widest diversity of subjects possible, but colleges choosing to concentrate on a specific field use the following format: [NAME] College of [FIELD], such as 'Ambrose College of Material Science'.

IX. Compensation

1. **Price**
Tuition prices (fees) are set by the college. Students may receive various offers to enrol at different prices. These prices are subject to change at the discretion of the college. Colleges may also choose to introduce their own fees for their own purposes.

2. Costs
Woolf supports colleges by charging a percentage of revenue for administration. This charge is invoiced monthly or quarterly to all colleges.

Colleges may choose to distribute funds to their members however they see fit.

Further costs can include books or currency transaction charges. All courses must state whether they require the purchase of outside texts or resources.

Note that copyright licensing through Woolf can cost up to $0.25 per page, per student; Woolf encourages all courses to use open-access academic publications.

X. Student Support

Students should seek support, in the first instance, from the Faculty member leading their course or by consulting their College. Additional support is available on the help tab in their account menu or by visiting help.woolf.university.

1. Office Hours
In addition to providing their core lessons, teachers are encouraged to make available a 'digital open office hour' that can be booked by their own students, should they require extra academic support that cannot be provided within the normal teaching sessions. New students are especially encouraged to book an extra session during their first week studying with Woolf.

2. College Advisors
Colleges at Woolf exist to support their members and provide helpful resources to students.

Every student should be assigned a College Advisor, and who acts as the first point of contact for non-technical academic issues related to the student's progress, particularly where these may benefit from an independent point of view.

3. Transcripts
Students are able to download their transcript, and to get a link for sharing, by following these instructions. In situations that require a paper transcript, please email registrar@woolf.university for help.

XI. Discipline, Complaints, and Appeals

Students and faculty should always seek an amicable resolution to matters arising by addressing the issue with the person immediately related to the issue. Students should handle minor misunderstandings or disagreements within a regular teaching session or by direct message, or with their College. If a simple resolution is not possible, or the matter remains unresolved for one party, the steps outlined in this section apply to all groups, colleges, and units of Woolf.

1. The Red Flag System
An issue with a red flag should be submitted in the case that a member of Woolf seeks to make an allegation of serious misconduct about another member, including matters of cheating, plagiarism, and unfair discrimination or intolerance.

Any member of Woolf, seeking to raise a matter of serious concern, should submit a red flag by emailing *redflag@woolf.university*. Provide a short, clear description of the issue.

If a student submits an issue with a red flag, or if a faculty member submits an issue about a student, it will trigger a meeting with the student's College Advisor. If the issue

is not resolved, the matter will be escalated to the College Dean, or to a committee designated by the College Dean, which will have the power to clear the flag.

If an issue is submitted with a red flag by a faculty member about another faculty member, then the issue is reported directly to the College Dean.

For both students and faculty members, after the Dean's decision, the one who submits the complaint is provided the opportunity to accept or appeal the decision; if the one submitting the issue appeals the decision, it will be assigned to the Quality Assurance, Enhancement, and Technology Alignment Committee, which is a subcommittee of the Faculty Council.

2. Mitigating Circumstances and the Escalation of Issues and Appeals
When serious circumstances ('Mitigating Circumstances'), beyond the control of a student or faculty member, adversely affect academic performance or teaching support, a Mitigating Circumstances report must be submitted using Woolf's red flagging system. Mitigating Circumstances may include but are not limited to serious medical problems, domestic and personal circumstances, major accidents or interruptions of public services, disturbances during examination, or serious administrative or procedural errors with a material effect on outcomes.

Mitigating circumstances do not normally include a member's personal technology problems, including software, hardware, or personal internet connection failures; employment obligations or changes in employment obligations; permanent or sustained medical conditions (unless there is a sudden change of condition); or circumstances where no official evidence has been submitted.

Mitigating circumstances are normally only considered when a red flag has been submitted for the issue before the deadline of an affected written project or assignment, or within one week of a cumulative examination. Proof of mitigating circumstances may result in an extended deadline or examination period, or the possibility to retake an examination; it will not result in any regrading of existing submissions or exams.[3]

3. Grade Appeals
Students who dissent from the grades they have received should follow the normal procedure for submitting a red flag.

XII. Technical Support

[3] In writing this section, we have consulted, https://london.ac.uk/current-students/examinations/submitting-evidence-mitigating-circumstances

Students or faculty members in need of technical support for their engagement with the Woolf platform should, in the first instance, consult the digital guide at *help.woolf.university*. If further technical support is required, email support@woolf.university or the designated support person at the college (if there is one).

All users of the Woolf platform are responsible for the maintenance of their own equipment, including their hardware, software, and internet connection. Users of the Woolf platform, including all enrolled students, must accept the Technology Agreement, which forms part of Woolf's Terms, by which members attest that they possess the technical infrastructure needed to engage successfully with the Woolf software platform – including the hardware and software necessary to make a video conference call over the internet, compose and submit typewritten work to the Woolf platform, and engage over extended periods of time with digital resources at the direction of their faculty members.

\WOOLF/

BSc in CS Program Handbook

Date of Publication: August 2023

Foreword

This manual has been designed to familiarize you with the policies and procedures that shape the Woolf BSc in CS Program. This manual should not be viewed as complete and is not designed to replace the Woolf Academic Handbook. It is intended to provide information you will need in order to make decisions about your graduate studies and to acquaint you with the administrative requirements, policies and procedures you will be expected to meet that are outside the scope of the Woolf Academic Handbook. This document should thus be used in tandem with the Woolf Academic handbook. Where either manual seems incomplete, you are encouraged to inquire with your Faculty Advisor. For questions beyond the domain of your Advisor you are encouraged to reach out to help@woolf.university.

We hope that your experience within Woolf's program will be fulfilling, stimulating, and engaging. We are excited to welcome you to the Woolf community.

The Mission of Woolf

Woolf exists to promote academic excellence, broaden access to higher education, and guard values that are humane, democratic, and international. Above all, Woolf values freedom of thought, freedom of inquiry, and freedom of expression.

We do this through our commitment to high-quality education and through widening the horizon of opportunity by connecting students with quality academics across the world.

Through Woolf's world-class platform and programs students gain exposure to new ideas, new ways of understanding, and new ways of learning. By uniting exceptional faculty with motivated students, Woolf is able to build an outstanding academic community leading to journeys of intellectual transformation. From this we hope that students will share their academic, intellectual and other talents in serving their communities across the world.

Woolf is guided by the following tenets:

Background. Talent may be evenly distributed but opportunity is not – we are working to widen the horizon of opportunity by connecting students and teachers across the world.

Education. Woolf prioritizes an education that will serve its students both in the near-term and in the long-term. Woolf seeks to provide a personalized, bespoke education. In all fields, Woolf seeks to instill values of curiosity, intellectual discipline, and clarity of expression.

Research. Woolf prioritizes research-driven teaching that uses the latest academic scholarship, and Woolf encourages its students to engage in groundbreaking research.

Society. Woolf encourages partnerships with governments, educational institutions, research centers, schools, and businesses of all kinds – provided these partnerships do not infringe on the values of Woolf.

Technology. To the extent that existing or new technologies can improve the educational outcomes for students, widen access to the Woolf global network, improve the career experience of academics, better secure credible governance, lower the costs of institutional management, and generally support the mission of Woolf – these are embraced.

In all things, Woolf values excellence and measures itself against the highest international standards. Woolf seeks to raise those standards further.

Academic Program Information

Program Description

The Bachelor of Science in Computer Science (BS in CS) is a 120-credit program that includes a selection of online courses. The program is an integrated, sequential course of study in which students obtain and demonstrate the knowledge and skills required of the computer science industry.

The BSc in CS teaches students comprehensive and specialized subjects in computer science; it develops skills in critical thinking and strategic planning for changing and fast-paced environments, including technological and operational analysis; and it develops competences in leadership, including autonomous decision-making, and communication with team members, stakeholders, and other members of a business.

Courses include instruction targeting the areas above as well as and other relevant learning goals, opportunities for repeated practice, and methods for students to demonstrate their accomplishment of the outcomes.

The BSc in CS is delivered completely digitally by combining asynchronous components (lecture videos, readings, and written assignments) and synchronous cohort meetings attended by students and an instructor or faculty member during a video call.

The asynchronous components support the schedules of students from diverse work-life situations, and synchronous meetings provide accountability, motivation, and a sense of community presence for students. The synchronous sessions allow unparalleled access to high quality instruction and enhanced collaboration among students through using face-to-face online interaction.

Faculty conduct live office hours with students and interaction between faculty members and students, both individually and as a group, is enhanced in the online environment by blending asynchronous content with real-time student responses. Faculty and enrolled students have 24/7/365 access to technical support through Woolf's support system.

Woolf's digital campus allows students to complete the program in as little as 3 years of continuous study or within 6 years as part of a part-time course of study. The degree on

the students' transcripts is a Bachelor of Science in Computer Science, which attests to their completion of the requirements.

Admission Requirements

The Woolf BSc in CS is a fast-paced, rigorous degree focused on teaching comprehensive and specialized subjects in computer science. Candidates should have a high school diploma (or equivalent).

English language competency at an IELTS 6 or equivalent is required of all applicants.

The program is suited for undergraduate students considering a career in technology or the innovation (start-up) economy. The overall programme is designed for those with little or no background in computer programming and only basic mathematical knowledge is required.

In all cases, the target group should be prepared to pursue substantial academic studies.

Curriculum Areas

The program is organized into a course structure of three tiered areas. Each tiered area sequentially builds off of the previous, so students must complete each tier before advancing to the next.

Each course consists of regular lessons and cumulative lessons devoted to cumulative examination. Each course requires about 150 hours to complete (see individual courses for details). A full-time student completes two lessons per week with an assignment submitted for each lesson; this pattern continues for each regular lesson in the class.

Summative examination lessons allow an appropriate amount of time for students to review and revise their prior work and deepen their synthetic grasp of the materials in preparation for cumulative examination or project.

Learning Outcomes

The program teaches students comprehensive and specialized subjects in computer science; it develops skills in critical thinking and strategic planning for changing and fast-paced environments; and it develops competences in leadership, including autonomous decision-making, and communication with employers, stakeholders, and other members of a team.

Knowledge

- Students will grasp major concepts of computer science and web engineering, and be able to classify specific computer science issues and engineering tasks as instances of broader principles and generalizations.
- When completing assignments, students will demonstrate an understanding of advanced general computer science concepts and will be able to use terminology from the domain correctly, and they will rely on specific facts, including those at the forefront of their field of study.
- Students will be able to contextualize factual knowledge of computer science issues in view of relevant social and ethical issues.

- Students will display creative thinking on the basis of the knowledge they gain in the course in response to concrete and abstract problems.

Skills

- Students demonstrate some application of theoretical and practical knowledge in responding to problems.
- Students formulate their ideas in clearly structured conventional formats and use appropriate evidence to support their claims.
- Students will monitor, evaluate, and adjust their own learning needs in order to succeed as independent learners.
- Students will also collect and analyze data to respond to both well-defined practical problems and well-specified abstract problems.

Competences

- Students will manage well-defined IT projects with a range of responsibilities that require independent decision-making and handling of unpredictable situations.
- Students will gain professionalism, discipline, and creativity through managing projects and collaborating with others.
- Students will develop the learning skills needed to continue to undertake further, self-directed studies in computer science and programming with a high degree of autonomy.

Faculty

All instruction is provided by competent academics with qualifications commensurate to their role. All teachers are also expected to have relevant teaching experience in the domain of their expertise. All faculty members at Woolf are expected to be in possession of a research doctorate in the domain of their teaching or supervision; moreover, they are expected to have a record of research or a research agenda reflecting the capacity for research.

Woolf uses clear, fair, and transparent processes for teaching recruitment, conditions of employment, and professional advancement. Notices of availability are publicly listed on the Woolf platform and, when available, other sites visited by academics. Criteria for teaching positions, including any associated conditions of ongoing employment, are clearly stated. Applications for teaching are reviewed by the Administrative Board, or a committee of the Board, until a position(s) is filled. Notices state the supporting documentation required as evidence for the review of an applicant. All applicants are required to demonstrate their competence for the teaching position by providing a copy of their credentials to be verified before the position is filled. This policy applies to all teaching roles of Woolf Education Ltd, including any teaching services provided by third party vendors, which are subject to the same process of review. In all cases, the final decision for filling a role in accordance with the criteria stated on the public notice is made by the Administrative Board.

Woolf's policies and procedures apply consistently to full-time, part-time, *ad hoc*, and third-party teaching activities. All teaching activities fall within the scope of Woolf policy. Teaching staff, including part-time or *ad hoc* teaching staff are directed towards updates and developments in their field as well as the methodological requirements for their programs.

All Faculty Members are encouraged to discuss innovative forms of teaching, formulate how these may be implemented, and propose those implementations in the Faculty Council. At the end of all courses, students provide feedback on their learning experience, and twice per year faculty provide feedback by survey. All teachers are expected to maintain a record of student outcomes, and teaching activities are periodically reviewed or observed. In cases of disagreement, or suspected misconduct, fraud, or prejudice, a Red Flag should be submitted under the Red Flag Procedure.

All courses and programs are subject to processes of quality enhancement to improve student outcomes, including the course's continued review to assess its scholastic rigor and value.

Faculty Requirements

Academic Staff are called Faculty members at Woolf. Faculty members at Woolf must possess a research doctorate and are expected to have a record of peer-reviewed research. All teaching is under the authority and oversight of a faculty member – including instructional design, synchronous meetings, and lectures. In cases where pre-recorded lectures or podcasts are provided that contain content from outside of Woolf, any such content is to be produced by lecturers who are experts with a research doctorate in the relevant domain, or where relevant, by those with at least 7 years of industry-specific experience.

Teaching Staff are called Expert Instructors, Domain Experts, or simply Instructors. Expert instructors are used in courses to provide domain-specific industry insights, including insights and feedback on student work during synchronous meeting sessions. Expert instructors must have management experience and be in possession of at least a master's level qualification. Expert instructors are under the direct authority of the Faculty Members and must be trained in Woolf's pedagogical methods.

Faculty Advisors

Colleges at Woolf exist to support their members and provide helpful resources to students.

In the tradition of Harvard's "Houses" and Oxford's "Colleges", Woolf provides every student with membership in a Woolf college for support during their academic journey. Every student should be assigned a Faculty Advisor, who is a faculty member from within the student's own college, and who acts as the first point of contact for non-technical academic issues related to the student's progress, particularly where these may benefit from an independent point of view. Students are strongly encouraged to meet with their advisors at least once each semester.

Thus every faculty member oversees their own registered students through the normal synchronous teaching sessions, and office hours, and additionally provides availability that can be booked for advisees, should the need arise.

Program Outline

Outline of Program		
Course Title	**Credits**	**Course Description**
1. Introduction to Programming in Python	1.5	This course is intended for students with little or no programming experience. It aims to help students develop an appreciation for programming as a problem solving tool and to provide a foundation in Python programming. Students will learn how to think algorithmically, solve problems efficiently, and prepare for further computer science studies.

2. Optimize Your Learning	1.5	During the course, students will develop competence in skills that are most critical for effective self-directed and self-regulated learning (i.e. self-management, self-monitoring, and self-modification), while also learning how to use learning strategies to maximize their overall learning efficiency and efficacy. They will also utilize the Emotional Intelligence framework to explore their identity, self-image, motivation, and self-regulation skills, to support their development as self-directed learners.
3. Web Foundations	1.5	This course provides a foundation in building for the web. It helps students understand how the internet works, examines the role of the internet in their lives, and teaches them the basics of web development. The course prepares students for the advanced course in Web Application Development.
4. Programming 1	3	The course helps students develop an appreciation for programming as a problem-solving tool. It teaches students how to think algorithmically and solve problems efficiently, and serves as the foundation for further computer science studies.

5. Mathematical Thinking	3	This course helps students develop the ability to think logically and mathematically. It prepares students for more advanced courses in algorithms and discrete mathematics. An emphasis is placed on the ability to reason logically, and effectively communicate mathematical arguments.
6. Collaborating for Impact	3	The course will start by focusing on the social awareness and relationship management components of Emotional intelligence, which were briefly introduced in the pre-requisite course, Optimizing Your Learning. Students will then be introduced to a variety of collaboration and leadership theories and frameworks, and they will examine theories of team dynamics and dysfunction, and reflect on how these relate to their past experiences of collaboration in academic and personal settings.
7. Communicating for Success	3	Communicating for Success supports students in developing communication skills that are essential for success in their personal and professional lives. The course will focus on close reading, written communication, verbal communication, and non-verbal communication skills. An emphasis will be placed on weekly submissions, and peer and instructor feedback, to allow students to practice and improve their skills.

8. Programming 2	3	This course expands on Programming 1, and deepens students' knowledge of Python with a focus on data access and management.
9. Web Application Development	3	This course builds on Web Foundations, and provides a comprehensive introduction to client and server-side development for the web.
10. Front End Web Development	3	Front End Web Development builds on previous knowledge of web development, and extends students' familiarity with modern HTML, CSS, JavaScript, and Web APIs. Students learn to develop and deploy client-side web applications with greater scope and complexity. Complex frontend features require using HTML, CSS, and JavaScript together. Students will usually have taken Web Application Development (or similar course under advisement from their faculty) as a prerequisite for this course.

11. Data Structures and Algorithms 1	3	This course teaches the fundamentals of data structures and introduces students to the implementation and analysis of algorithms, a critical and highly valued skill for professionals.
12. Product Management and Design	3	This course teaches students to build products users want and love. It gives students a foundation in the tools and practices of modern product management and interaction design. Students will work in pairs to apply product development skills to real user challenges.
13. Team Software Project	3	In this course, students practice the skills necessary to work effectively on a professional software product team. By working in small teams to build a web application, they integrate the technical, communication, and collaboration skills built in previous courses.

14. Industry Experience 1	6	Industry Experience is a form of experiential learning that enables students to apply their academic knowledge in a professional context. Students work to build software that meets the needs of a professional organization by completing either (1) an approved internship, or (2) a product studio.
15. Programming in Python	3	This course is intended for students who have completed Programming 1. It aims to help students deepen their programming skills, concentrating on Python. Students will learn how to think algorithmically and solve problems efficiently.
16. Engineering for Development	3	Engineering for Development, Challenge Studio 1, and Challenge Studio 2 are courses that help students investigate the role that technology can play in solving some of the world's most intractable social and economic development challenges.

17. Discrete Math	3	This course builds on Mathematical Thinking and provides the mathematical foundation needed for many fields of computer science, including data science, machine learning, and software engineering.
18. Computer Systems	3	This course explores computing beyond software. Students will go a level deeper to better understand the hardware and see how computers are built and programmed. It is modeled on the popular, project based “Nand to Tetris” textbook, which walks learners through building a computer from scratch. It aims to help students become better programmers by teaching the concepts underlying all computer systems. The course integrates many of the topics covered in other computer science courses, including algorithms, computer architecture, operating systems, and software engineering.
19. Challenge Studio 1	3	Engineering for Development, Challenge Studio 1, and Challenge Studio 2 are 3 courses that help students investigate the role that technology can play in solving some of the world’s most intractable social and economic development challenges.

20. Data Structures and Algorithms 2	3	This course builds on Data Structures & Algorithms 1. Students will explore non-linear data structures, and implement and analyze advanced algorithms.
21. Introduction to Data Science	3	Data science is applicable to a myriad of professions, and analyzing large amounts of data is a common application of computer science. This course empowers students to analyze data, and produce data-driven insights. It covers all areas needed to solve problems involving data, including preparation (collection and integration), presentation (information visualization), analysis (machine learning), and products (applications).
22. Challenge Studio 2	3	Engineering for Development, Challenge Studio 1, and Challenge Studio 2 are 3 courses that help students investigate the role that technology can play in solving some of the world's most intractable social and economic development challenges.

23. Network and Computer Security	3	Network and Computer Security teaches students the principles and practices of security for software, systems, and networks. It aims to make students critical examiners and designers of secure systems. Students will learn the mathematical and theoretical underpinning of security systems, as well as practical skills to help them build, use, and manage secure systems.
24. Industry Experience 2	6	Industry Experience 2 provides a form of experiential learning that enables students to apply their academic knowledge in a professional context. Students work to build software that meets the needs of a professional organization by completing either (1) an approved internship, or (2) a product studio.
25. Backend Development	3	Back End Development builds on previous knowledge of web development and security, and equips students with knowledge of server-side development so that they can become professional back-end developers and build enterprise-scale applications. Students learn to develop and deploy server-side applications with greater scope and complexity.

26. iOS App Development	3	iOS App Development teaches students to build modern mobile applications using Apple's iOS development platform and tool chain. It prepares students to become professional iOS developers. Students learn the core principles of the Swift programming language and Apple's front-end frameworks for creating single and multi-page applications.
27. Ethics for Tech	3	This course examines the ethical questions that are emerging as a result of rapid technological change. It prepares students to become responsible technologists, and provides a basis for ethical decision-making in their professional work.
28. Android App Development	3	Android App Development teaches students to develop applications for Android, the most-used mobile platform in the world. Students learn to build with Android Studio and Kotlin, the modern toolkit used for professional Android development. The course prepares students to become professional Android developers.

29. Artificial Intelligence	3	Artificial Intelligence (AI) aims to teach students the techniques for building computer systems that exhibit intelligent behavior. AI is one of the most consequential applications of computer science, and is helping to solve complex real-world problems, from self-driving cars to facial recognition. This course will teach students the theory and techniques of AI, so that they understand how AI methods work under a variety of conditions.
30. Machine Learning	3	This course aims to teach students the theoretical and practical methods for solving problems using machine learning. Machine learning is one of the fastest-growing areas of computer science. Its applications are reshaping society, from consumer products (e.g., voice assistants and recommendations) to life-sciences (e.g., personalized medicine and tumor detection). This course will build on the Data Science introductory course, and help students understand how, why and when machine learning methods work.
31. Interaction Design	3	This course introduces students to the principles of human-computer interaction (HCI). Students explore how humans process information (perception, memory, attention) in the context of designing and evaluating interfaces. This course complements programming coursework by helping students understand how to design more usable systems.

32. Designing Your Future	1.5	Designing Your Future is inspired by the Stanford University course Designing Your Life. In this course, final year students will use design thinking to reflect on their undergraduate studies, and to plan and prepare for their transition into full-time employment
33. Capstone	3	The Capstone Research Methods course supports students in developing critical research skills that are needed for the successful completion of their capstone project (Applied Computer Science).
34. Applied Computer Science	7.5	This capstone course enables students to demonstrate their proficiency in the technical and human skills that they have acquired throughout their undergraduate studies. The capstone requires students to conceptualize, plan, and implement a software project to completion, and evaluate their project's processes and outcomes.

Assessment and Grading

General Procedures

Academic assessment at Woolf is of two kinds: regular and cumulative. Regular assessment applies to the continuous evaluation of student progress, concentrating on the

proficiency of submitted assignments, and the ability of the student to respond to issues raised by the instructor during an instructional session. Cumulative assessment applies to the final project assignment. This requires the students to deepen and extend the scholarly engagements initiated in their prior work.

Students who fail any one course of the degree, cannot progress to complete the degree, except by approval of the College Dean or College Academic Committee. Failed courses may be retaken at the approval of the College Dean or College Academic Committee, or by appeal, at the discretion of the Quality Assurance, Enhancement, and Technology Alignment Committee (QAETAC). For more information about QAETAC please see the Woolf Academic Handbook.

Cumulative Examination of Courses

Traditionally, cumulative examination of courses is by a submitted final project in the form of a long assignment.

The long assignment is meant to synthesize, deepen, and extend the learning outcomes of the regular lessons while introducing new material and insights. Not more than 50% of the long assignment may be material taken from other assignments. The topic of the assignment must be agreed in advance with the instructor. Examination assignments are expected to be completed at a high research standard, and must be well-structured, well-crafted, and contain appropriate citations to the primary and secondary literature of the course.

Mode of Teaching and Assessment

The Online Campus

Woolf University's courses are offered almost exclusively through its proprietary learning platform. The platform supports both asynchronous and synchronous modes of learning. The asynchronous portion of programs includes structured course materials that the course lead and course instructors prepare ahead of time. These courses are done independently of students' classmates and according to the student's own schedule, but prior to the synchronous sessions. Synchronous sessions are held in the "virtual classroom," where students and faculty use internet technology such as video conferencing and web cameras to ensure they are actively engaged in the learning process. It is essential for students to connect with each other, share information, and create professional networks and relationships as they would in a traditional program or within a professional setting. For information about the technical specific requirements please see the Technical Requirements section within the Woolf Academic Handbook.

Structure of the Courses

The bSc in CS combines asynchronous components (lecture videos, readings, and written assignments) and synchronous meetings attended by students and an instructor or faculty member during a video call.

Asynchronous components support the schedules of students from diverse work-life situations, and synchronous meetings provide accountability and motivation for students.

Each short foundation course, and the extended specialist courses, consists of regular lessons and cumulative lessons devoted to summative examination.

As is typical for synchronous teaching, the student will compose one assignment (such as a report, 1,000 word essay, financial model, or presentation) per lesson, which is the topic of meeting discussion. A full-time student completes two lessons per week with an assignment submitted for each lesson; this pattern continues for each regular lesson in the course.

Summative examination lessons allow an appropriate amount of time for the student to review and revise his or her prior work and deepen their synthetic grasp of the materials in preparation for cumulative examination or project.

Contact Hours

For the breakdown of hours, consult the Pedagogical Procedures and Assessment sections.

Students engage in 8 synchronous meeting sessions in which questions and answers about asynchronous study materials are addressed.

Synchronous meeting engagements include not only 60-75 minutes of intensive contact time between the students and faculty member in every lesson (up to twice per week), but also extends beyond the synchronous meeting session itself to include ongoing supervisory support on an ad hoc basis (typically by email or brief virtual meeting). Students are closely supervised by asynchronous direction, oversight, feedback, and guidance; and occasionally new handouts or other scholarly materials are provided to follow up on issues raised in a synchronous meeting discussion. Thus, on our calculation, we allocate four further hours of contact time beyond the synchronous session to capture the individual, personalized, intensive, bespoke form of guidance that a student receives. We calculate all other forms of contact time at a 1:1 ratio, including lectures, whether delivered synchronously or as pre-recorded videos or podcasts.

Example regular lesson Breakdown

* = contact hours = 66

† = assessment hours = 1.25

Hours	**Activity**
1.25*†	synchronous session
4*	Time under the direction and control of a tutor
1.5*	Lecture videos or podcasts
8.25	Independent reading & note-taking
7.5	Assignment composition
22.5	**Total**

Pedagogical Procedures

The MSc in CS will be delivered using online and blended learning techniques, which support a variety of teaching and learning methods, including the following:

- synchronous meetings;
- assigned lectures by video or podcast;
- assigned readings;
- handouts delivered electronically;
- digital material, including slideshow presentations and other assigned media provided in course packets and by weblink.

The core pedagogical method used in this course will include synchronous meetings between a faculty member, or a subject expert instructor under the oversight of a faculty member, and a small group of students. Student interaction plays a key role in the organization of each synchronous meeting, which focuses on a discussion of a student's pre-submitted assignment.

Online delivery, although identical in content for an in-person session, provides significant advantages to students in terms of accessibility – students can more easily reach academic experts across borders and more easily integrate study within the pattern of their own life or career. Further advantages of the online delivery include the digital quality assurance techniques outlined within the Academic Handbook.

Preparing for a single synchronous meeting requires about 21.25 hours. A representative workload consists of the following: students must review about 100 pages of reading material (or equivalent video content, audio content, or interactive content) and prepare a piece of written work of 2-4 pages in response to a specific set assignment question. Before the start of the synchronous session, this work is submitted to the instructor for review.

Every student must then be prepared to discuss and defend his or her written work directly with the instructor (who is an expert in the field) and the other students for up to 75 continuous minutes. Faculty members and subject experts seek to deepen the students' understanding of the material and probe aspects of the written assignment that may benefit from clarification, revision, or further exploration.

At the end of the synchronous session, the instructor provides the student with feedback on the meeting assignment, including a mark, and provides bespoke guidance for the next assignment. Students are provided with a curated reading list from the instructors, assigned pre-recorded lectures, and a research question to guide the organization of their next synchronous meeting assignment or assignment. Engaging in this activity twice per week is a full workload of about 45 hours.

The synchronous meeting system is designed to be mentally demanding and personally engaging. The pedagogical style is known for producing high-quality domain-specific learning outcomes because students must learn assigned materials and related case studies for themselves, before presenting their work to an instructor in their own words for discussion twice per week. By requiring students to describe and analyze topics in

their own words, synchronous meetings engage and extend a student's existing range of abilities.

The synchronous method is also known for producing high-quality domain-agnostic learning outcomes because students must be prepared to organize and present their perspective on an assignment twice per week, and be prepared to think analytically and creatively about what they have done. Students must learn to present their viewpoint, even while being prepared to adopt a new position in light of the evidence and under the questioning of the teacher.

Assessment

General Procedures

For the MSc in CS, assessment is of two kinds: regular assessment and summative assessment.

Regular assessment applies to the continuous evaluation of student progress, concentrating on the proficiency of submitted assignments, and the ability of the student to respond to issues raised by the instructor during a synchronous meeting session.

Cumulative assessment applies to the final project assignment. This requires the students to deepen and extend the scholarly engagements initiated in their prior work.

Students who fail any one course of the degree, cannot progress to complete the degree, and will by default fail the BSc in CS. Failed courses may be re-taken at the discretion of Woolf's Faculty Members.

Cumulative Examination of courses

For each course, a percentage of the grade derives from the average of the regular assignments, and a larger percentage of the grade derives from the cumulative examination. The cumulative examination of courses is by a submitted final project in the form of a long assignment.

The cumulative examination/long assignment is by summative assignment (3,000 word essay, or similarly-sized financial model, or presentation), which must synthesize, deepen, and extend the learning outcomes of the regular units while introducing new material and insights. Not more than 50% of the long assignment may be material taken from synchronous meeting assignments. The topic of the assignment must be agreed in advance with the faculty member and subject matter experts. Examination assignments are expected to be completed at a high research standard, and must be well-structured, well-crafted, and contain appropriate citations to the primary and secondary literature of the course.

Grading Progress

Students receive grades and feedback on each assignment throughout a course. Depending on the specific course, students may receive both a grade and a written or audio comment from an instructor. Courses display the weight assigned to each grade-bearing category (such as regular assignments, attendance, and/or final projects). Students have access to their grade book at all times and can see a record of all grades, attendance records, and assignment submissions.

The grade book displays the current running average for the grades in the course in accordance to the grade weights, inclusive of all those assignments which the student has submitted and on which the instructor has provided grades. At the end of the course, grades

are finalized and added to the student's transcript, which is accessible at all times for students enrolled in credit-bearing programs.

Grading System

The final grade for a course is determined by the weighting rules stated in the course offering. Unless otherwise stated, all courses are weighted as follows: 50% of the grade derives from the average of the instructional assignment session, and 50% of the grade derives from the cumulative examination.

The final grade on a degree is weighted in proportion to the credits of individual courses. For example, a degree composed of a 3 credit course and a 6 credit course will weigh the 6 credit courses proportionately more, according to the number of credits.

Woolf's International Grade Classification

Woolf's teachers are trained in a number of different grading scales; these scales are cross-referenced. This handbook employs the American grading system and classification, with US grades as the default.[1] US grades are the most granular and distributed with the least number of gaps, which is why we have selected them as a default marking scheme for transcripts. Woolf's international conversion scheme is as follows:

US GPA	US Grade	US Per Cent	UK Mark	UK Classification	Malta Grade	Malta Mark	Malta Classification
4	A+	97 - 100	70+	First class honors	A	80-100%	First class honors
3.8-4.0	A	94-96	67-69	Upper-second class honors	B	70-79%	Upper-second class honors
3.7	A-	90-93	65-67	Upper-second class honors			
3.3	B+	87-89	60-64	Lower-second class honors	C	55-69%	Lower-second class honors
3	B	84-86					
2.7	B-	80-83	55-59	Lower-second class honors			
2.3	C+	77-79	50-54	Third class honors	D	50-54%	Third-class honors
2	C	74–76					
1.7	C-	70–73	45-49	Third class honors			
1.3	D+	67–69	40-44	Ordinary/Unclassified			
1	D	64–66	35-39	Ordinary/Unclassified			
0.7	D-	60–63					
0	F	Below 60	Below 35		F	45-54%	

[1] Cf. the Fulbright Commission (http://www.fulbright.org.uk/going-to-the-usa/pre-departure/academics), Princeton Review (https://www.princetonreview.com/college-advice/gpa-college-admissions), European Commission (https://eacea.ec.europa.eu/national-policies/eurydice/content/second-cycle-programmes-49_en), and University of Malta (https://www.um.edu.mt/__data/assets/pdf_file/0005/47390/harmonisedregs-09.pdf).

Woolf Grading Criteria, Definition of Grades, and Classification

Grading of student work keeps in view the scale of work that the student can reasonably be expected to have undertaken in order to complete the task. The Woolf grading scheme draws heavily from the marking scheme set out by the University of Oxford (cf. History Faculty Course Handbook 2016-2018).

a. The assessment of work for the course is defined according to the following rubric of general criteria:

i. i. Engagement:

- Directness of engagement with the question or task
- Range of issues addressed or problems solved
- Depth, complexity, and sophistication of comprehension of issues and implications of the question or task
- Effective and appropriate use of imagination and intellectual curiosity

ii. Argument or solution:

- Coherence, mastery, control, and independence of work
- Conceptual and analytical precision
- Flexibility, e.g. discussion of a variety of views, ability to navigate through challenges in creative ways

iii. Evidence (as relevant):

- Depth, precision, detail, range and relevance of evidence cited
- Accuracy of facts
- Knowledge of first principles and demonstrated ability reason from them
- Understanding of theoretical principles and/or historical debate
- Critical engagement with primary and/or secondary sources

iv. Organization and presentation:

- Clarity and coherence of structure
- Clarity and fluency of writing, code, prose, or presentation (as relevant)
- Correctness of conformity to conventions (code, grammar, spelling, punctuation or similar relevant conventions)

b. US grades for courses are defined according to the following rubric:

97-100

Work will be so outstanding that it could not be better within the scope of the assignment. These grades will be used for work that shows exceptional excellence in the relevant domain; including (as relevant to the domain): remarkable sophistication and mastery, originality or creativity, persuasive and well-grounded new ideas or methods, or making unexpected connections or solutions to problems.

94-96

Work will excel against each of the General Criteria. In at least one area, the work will be merely highly competent.

90-93

Work will excel in more than one area, and be at least highly competent in other respects. It must be excellent and contain: a combination of sophisticated engagement with the issues; analytical precision and independence of solution; go beyond paraphrasing or boilerplate code techniques; demonstrating quality of awareness and analysis of both first principles or primary evidence and scholarly debate or practical tradeoffs; and clarity and coherence of presentation. Truly outstanding work measured against some of these criteria may compensate for mere high competence against others.

87-89

Work will be at least very highly competent across the board, and excel in at least one group of the General Criteria. Relative weaknesses in some areas may be compensated by conspicuous strengths in others.

84-86

Work will demonstrate considerable competence across the General Criteria. They must exhibit some essential features addressing the issue directly and relevantly across a good range of aspects; offer a coherent solution or argument involving (where relevant) consideration of alternative approaches; be substantiated with accurate use of resources (including if relevant, primary evidence) and contextualization in debate (if relevant); and be clearly presented. Nevertheless, additional strengths (for instance, the range of problems addressed, the sophistication of the arguments or solutions, or the use of first principles) may compensate for other weaknesses.

80-83

Work will be competent and should manifest the essential features described above, in that they must offer direct, coherent, substantiated and clear arguments; but they will do so with less range, depth, precision and perhaps clarity. Again, qualities of a higher order may compensate for some weaknesses.

77-79

Work will show solid competence in solving problems or providing analysis. But it will be marred by weakness under one or more criteria: failure to fully solve the problem or discuss the question directly; some irrelevant use of technologies or citing of information; factual error, or error in selection of technologies; narrowness in the scope of solution or range of issues addressed or evidence adduced; shortage of detailed evidence or engagement with the problem; poor organization or presentation, including incorrect conformity to convention or written formatting. They may be characterized by unsubstantiated assertion rather than argument, or by unresolved contradictions in the argument or solution.

74-76

Work will show evidence of some competence in solving problems or providing analysis. It will also be clearly marred by weakness in multiple General Criteria, including: failure to solve the problem or discuss the question directly; irrelevant use of technologies or citing of information; factual errors or multiple errors in selection of technologies; narrowness in the scope of solution or range of issues addressed or evidence adduced; shortage of detailed evidence or engagement with the problem; poor organization or presentation, including incorrect conformity to convention or written formatting. They may be characterized

by unsubstantiated assertion rather than argument, or by unresolved contradictions in the argument or solution.

70-73

Work will show evidence of competence in solving problems or providing analysis, but this evidence will be limited. It will be clearly marred by weakness in multiple General Criteria. It will still make substantive progress in addressing the primary task or question, but the work will lack a full solution or directly address the task; the work will contain irrelevant material; the work will show multiple errors of fact or judgment; and the work may fail to conform to conventions.

67-69

Work will fall down on a number of criteria, but will exhibit some of the qualities required, such as the ability to grasp the purpose of the assignment, to deploy substantive information or solutions in an effort to complete the assignment; or to offer some coherent analysis or work towards the assignment. Such qualities will not be displayed at a high level, and may be marred by irrelevance, incoherence, error and poor organization and presentation.

64-66

Work will fall down on multiple General Criteria, but will exhibit some vestiges of the qualities required, such as the ability to see the point of the question, to deploy information, or to offer some coherent work. Such qualities will be substantially marred by irrelevance, incoherence, error and poor organization and presentation.

60-63

Work will display a modicum of knowledge or understanding of some points, but will display almost none of the higher qualities described in the criteria. They will be marred by high levels of factual or technology error and irrelevance, generalization or boilerplate code and lack of information, and poor organization and presentation.

0-60

Work will fail to exhibit any of the required qualities. Candidates who fail to observe rubrics and rules beyond what the grading schemes allow for may also be failed.

c. Synchronous Meeting Discussions and *Viva Voce* Examination Template

Synchronous meeting discussions and *viva voce* examinations are conducted on the same format: written work is submitted in advance, and a discussion follows. This provides students an opportunity to clarify and explain their written claims, and it also tests whether the work is a product of the student's own research or has been plagiarized.

For the *viva voce* examination, the submitted work is graded, and the grade is recorded prior to the oral examination.

The synchronous discussion and *viva voce* examination acts to shift the recorded grade on the submitted essay according to the following rubric:

+3

Up to three points are added for excellent performance; the student displays a high degree of competence across the range of questions, and excels in at least one group of criteria. Relative weaknesses in some areas may be compensated by conspicuous strengths in others.

+/- 0

The marked script is unchanged for fair performance. Answers to questions must show evidence of some solid competence in expounding evidence and analysis. But they will be marred by some weakness under one or more criteria: failure to discuss the question directly; appeal to irrelevant information; factual error; narrowness in the range of issues addressed or evidence adduced; shortage of detailed evidence; or poor organization and presentation, including consistently incorrect grammar. Answers may be characterized by unsubstantiated assertion rather than argument, or by unresolved contradictions in the argument.

-3 (up to three points)

Up to three are subtracted points for an inability to answer multiple basic questions about themes in the written work. Answers to questions will fall down on a number of criteria, but will exhibit some vestiges of the qualities required, such as the ability to see the point of the question, to deploy information, or to offer some coherent analysis towards an argument. Such qualities will not be displayed at a high level or consistently, and will be marred by irrelevance, incoherence, error and poor organization and presentation.

0

Written work and the oral examination will both be failed if the oral examination clearly demonstrates that the work was plagiarized. The student is unfamiliar with the arguments of the essay or the sources used for those arguments.

Curriculum

Android App Development

Course Description

Android App Development teaches students to develop applications for Android, the most-used mobile platform in the world. Students learn to build with Android Studio and Kotlin, the modern toolkit used for professional Android development. The course prepares students to become professional Android developers.

The course begins with the fundamentals of Kotlin, the official language for Android development. Students learn its basic syntax, as well its object-oriented programming principles and key language features such as classes, collections, higher-order functions, and extensions. Students then delve into building Android apps, first by exploring layout and how to use common UI components. They learn Activity Lifecycle, and how to monitor and handle app states as users navigate through an app. Students learn how to create dynamic applications that persist data, and how to use APIs to pass data. The second part of the

course covers advanced functionality including animations, notifications, offline caching, and authentication and with Firebase.

Students learn by building small programming projects. The course culminates in a final group project where students build an Android app of their choice from scratch, going from initial design to deployment in the Play Store. Students will have obtained enough knowledge and have the option to obtain the Associate Android Developer certification offered by Google.

Applied Computer Science

Course Description

This capstone course enables students to demonstrate their proficiency in the technical and human skills that they have acquired throughout their undergraduate studies. The capstone requires students to conceptualize, plan, and implement a software project to completion, and evaluate their project's processes and outcomes.

The capstone builds on the initial project scoping work that was carried out in Capstone Research Methods, which culminated in students submitting a project proposal, and gaining formal approval for their capstone Project Proposal.

In this course, students will implement their proposed project with the support of a supervisor. Students with a common supervisor will be put into capstone advisory peer groups and will be required to meet with their group and supervisor regularly to update each other on their capstone progress and to provide feedback. Students will also have regular meetings with their capstone supervisor to provide additional support and guidance throughout the course.

Upon completion of their capstone projects, all students will be required to participate in a capstone symposium at the end of the term, where they will present their working projects/prototypes to internal and external stakeholders.

Artificial Intelligence

Course Description

Artificial Intelligence (AI) aims to teach students the techniques for building computer systems that exhibit intelligent behavior. AI is one of the most consequential applications of computer science, and is helping to solve complex real-world problems, from self-driving cars to facial recognition. This course will teach students the theory and techniques of AI, so that they understand how AI methods work under a variety of conditions.

The course begins with an exploration of the historical development of AI, and helps students understand the key problems that are studied and the key ideas that have emerged from research. Then, students learn a set of methods that cover: problem solving, search

algorithms, knowledge representation and reasoning, natural language understanding, and computer vision. Throughout the course, as they apply technical methods, students will also examine pressing ethical concerns that are resulting from AI, including privacy and surveillance, transparency, bias, and more.

Course assignments will consist of short programming exercises and discussion-oriented readings. The course culminates in a final group project and accompanying paper that allows students to apply concepts to a problem of personal interest.

Back End Development

Course Description

Back End Development builds on previous knowledge of web development and security, and equips students with knowledge of server-side development so that they can become professional back-end developers and build enterprise-scale applications. Students learn to develop and deploy server-side applications with greater scope and complexity.

In this project-based course, students deepen their understanding by building the back end for a cross-platform application. The project will require implementing advanced features that add complexity and uniqueness to a server's structure. Examples of these include payment gateways, chat rooms, full text search, WebSockets, etc. Students will design and build out all of the API endpoints needed for the application and properly secure them for use in any web or mobile front-end application. In doing so, they will explore the differences and tradeoffs between web services, APIs, and microservices. They will learn best practices for code quality including unit testing and error handling. They will also learn to efficiently document their APIs.

Students will understand key Developer Operations (DevOps) practices including environment design, testing, development controls, and uptime management. They will implement modern DevOps workflows (e.g., containers, cloud virtual machines), and learn tradeoffs between different approaches. They will set up continuous integration and continuous delivery, and explore various strategies for automated testing and application monitoring.

Capstone Research Methods

Course Description

The Capstone Research Methods course supports students in developing critical research skills that are needed for the successful completion of their capstone project (Applied Computer Science).

The course provides students with an overview of the research process and types of capstone projects that they can undertake, and includes a detailed exploration of relevant quantitative and qualitative research methods.

Students will develop skills in data gathering and analysis, researching and writing an effective literature review, creating a research proposal, and managing ethical considerations with regards intellectual property rights and research with human subjects.

At the conclusion of the course, students will be required to submit their formal capstone project proposal which should include details of their project scope, research question, hypothesis, and project plan. Their proposal must receive a passing mark before they are allowed to undertake the capstone course in the final term of the degree program.

Challenge Studio 1

Course Description

Engineering for Development, Challenge Studio 1, and Challenge Studio 2 are 3 courses that help students investigate the role that technology can play in solving some of the world's most intractable social and economic development challenges.

In Challenge Studio 1, students will work in groups to design, develop, and test a solution to a development challenge of their choice. The focus of this course is to provide students with the tools and skills to create meaningful technology solutions (e.g. services, products) to a sustainable development problem. This course builds on the problem identification and analysis skills that were developed in Engineering for Impact, the product management skills that were developed in Product Management and Design, and the ethical engineering skills developed in Ethics in Tech.

At the end of Challenge Studio 1 students will submit a Minimum Viable Product (MVP) that is ready to go to market as their final project deliverable.

The course will utilize virtual studio time, where groups work together on the key incremental tasks that are required to allow them to successfully create their final project output. Studio time will be supported by lectures, seminars, and learning resources on useful skills such as human centered design, end user identification, requirements gathering, value creation, impact measurement, and creative thinking and innovation.

Challenge Studio 2

Course Description

Engineering for Development, Challenge Studio 1, and Challenge Studio 2 are 3 courses that help students investigate the role that technology can play in solving some of the world's most intractable social and economic development challenges.

Challenge Studio 2 builds on the final output from Challenge Studio 1, and supports students in creating a sustainable business model for the MVP that they developed in the previous course. This course is focused on putting the MVPs in the hands of real users, getting their feedback, and iterating and refining the product or service, while also developing a viable business model.

The course will utilize virtual studio time, where groups are able to work collaboratively on their MVPs, with the support of additional lectures, seminars, and learning resources on important topics such as product launch planning, user evaluation tools and frameworks, business canvas development, funding models, financial modeling and strategy, and pitching.

The course will culminate in a pitch showcase, where students are required to present their work to relevant stakeholders (e.g. industry leaders).

Collaborating for Impact

Course Description

Collaborating for Impact aims to support students in developing effective collaboration skills in the pursuit of collective impact and success. Few problems are solved by individuals working alone, therefore the ability to work effectively with others to achieve a common goal is a crucial professional skill.

The course will start by focusing on the social awareness and relationship management components of Emotional intelligence, which were briefly introduced in the pre-requisite course, Optimizing Your Learning. Students will then be introduced to a variety of collaboration and leadership theories and frameworks, and they will examine theories of team dynamics and dysfunction, and reflect on how these relate to their past experiences of collaboration in academic and personal settings.

The second part of this course will require students to put their communication and collaboration skills to practice by completing a group project that is designed to test their ability to work effectively as a group and deliver a high-quality output under time, resource, and information constraints.

Communicating for Success

Course Description

Communicating for Success supports students in developing communication skills that are essential for success in their personal and professional lives. The course will focus on close reading, written communication, verbal communication, and non-verbal communication skills. An emphasis will be placed on weekly submissions, and peer and instructor feedback, to allow students to practice and improve their skills.

Students will learn how to effectively read and analyze texts as a precursor to developing their own written communication skills. They will then practice crafting clear communications by learning about topics such as writing structure and organization, grammar, audience awareness, and the iterative writing process. Next, students move on to verbal communication, and will learn how to confidently and skillfully deliver effective oral presentations. Finally, students will learn about the impact of non-verbal communication on how their messages are received.

The course will culminate in a project that will require students to develop and implement a strategy for communicating a technical topic to a non-technical audience.

Computer Systems

Course Description

This course explores computing beyond software. Students will go a level deeper to better understand the hardware and see how computers are built and programmed. It is modeled on the popular, project based “Nand to Tetris” textbook, which walks learners through building a computer from scratch. It aims to help students become better programmers by teaching the concepts underlying all computer systems. The course integrates many of the topics covered in other computer science courses, including algorithms, computer architecture, operating systems, and software engineering.

Students will learn how to build a computer system using progressive steps. The course starts with a brief review of Boolean algebra, and an introduction to logic gates. Students design a set of elementary logic gates using a Hardware Description Language. They then build chips to perform arithmetic and logical operations and build the computer’s main memory unit. Subsequently, students learn to write low-level machine language, and build a CPU to create a fully functional computer system. Finally, students implement a virtual machine, compiler, and basic operating system. Projects are spread out evenly throughout the course, and are completed in pairs.

By the end of the course, students will develop a strong understanding of the relationships between the architecture of computers, and software that runs on them.

Data Structures and Algorithms 1

Course Description

This course teaches the fundamentals of data structures and introduces students to the implementation and analysis of algorithms, a critical and highly valued skill for professionals.

Students start by examining the basic linear data structures: linked lists, arrays, stacks, and queues. They learn how to build these structures from scratch, represent algorithms using pseudocode, and translate these into running programs. They apply these

algorithms to real-life applications to understand how to make complexity and performance tradeoffs. Students will also learn how to develop algorithms for sorting and searching, use iteration and recursion for repetition, and make tradeoffs between the approaches. They will learn to estimate the efficiency of algorithms, and practice writing and refining algorithms in Python.

This course emphasizes big-picture understanding and practical problem-solving in preparation for technical interviews and professional practice. Throughout the course, students will solve common practice problems, and participate in mock interview sessions. As part of their regular assignments, they will also deepen their understanding of these topics and practice technical communication by writing technical blog posts.

Data Structures and Algorithms 2

Course Description

This course builds on Data Structures & Algorithms 1. Students will explore non-linear data structures, and implement and analyze advanced algorithms.

The course begins with a brief review of basic data structures and algorithms. Students deepen their understanding of searching and sorting, with a focus on describing performance. They learn about advanced data structures including priority queues, hash tables and binary search trees. Students build on their knowledge of graph theory to implement graph algorithms, and explore topics like finding the shortest paths in graphs, and applications of algorithms in maps, social networks, and a host of real-life applications. Other key topics include: divide and conquer recursion, greedy algorithms, dynamic programming algorithms, NP completeness, and case studies in algorithm design.

The course emphasizes big-picture understanding and practical problem-solving in preparation for technical interviews and professional practice. Students will solve common algorithmic problems and participate in mock interview sessions. As part of their regular assignments, they will write technical blog posts to deepen their understanding of these topics and to practice technical communication.

Designing Your Future

Course Description

Designing Your Future is inspired by the Stanford University course Designing Your Life. In this course, final year students will use design thinking to reflect on their undergraduate studies, and to plan and prepare for their transition into full-time employment

The course begins by exploring some of the self-awareness topics (e.g. identity, self-image, mental models, and motivation) that were introduced during the Optimizing Your Learning course. Students will revisit artifacts that they created during that course and reflect on their personal and technical growth over the course of the degree program. This will allow

them to craft a compelling personal and professional narrative so that they can position themselves effectively in the job market. Students will also learn how to use a design thinking approach to explore options for their careers after graduation.

In the second half of the course, students will develop practical skills to support their transition into full-time employment. They will learn critical skills like networking, professionalism, virtual collaboration, etc. that will support them in their integration into the workplace, while also developing some practical life skills, such as financial planning and emotional wellbeing.

Discrete Math

Course Description

This course builds on Mathematical Thinking and provides the mathematical foundation needed for many fields of computer science, including data science, machine learning, and software engineering.

It focuses on core mathematical areas that are essential in the toolkit of every computer scientist: logic, combinatorics and probability, set theory, graph theory, and elementary number theory. Each topic is covered with a focus on applications in modern computer science. It begins with a unit on logic which builds on previous knowledge, with an emphasis on writing readable and precise code. Probability and combinatorics focuses on analysis of algorithms and reliability. There is an in-depth focus on graph theory, and students explore the numerous applications of graph theory in computer science (data mining, clustering, networking, etc.). Finally, the course introduces number theory, beginning with fundamental results such as the Euclidean Algorithm then applications in cryptography.

The course culminates in a final group project where students explore original mathematical sources, and describe the historical proof techniques of a discrete math topic.

Engineering for Development

Course Description

Engineering for Development, Challenge Studio 1, and Challenge Studio 2 are courses that help students investigate the role that technology can play in solving some of the world's most intractable social and economic development challenges.

In Engineering for Development, students will learn how to analyze the root causes of development challenges so that they are able to build effective technology solutions. The course aims to introduce students to selected global development challenges using the United Nations Sustainable Development Goals (SDGs) as the framework for selecting the areas of focus.

Each term, the course will focus on 1- 2 subject areas (e.g. Quality Education, Affordable and Clean Energy, Climate Action), which will serve as test cases for students to develop the skills required to effectively analyze and understand complex development issues. Students will examine the system level dynamics that are at the root of these challenges, and will also analyze and critique technology related solutions that have been developed to address these challenges.

Ethics for Tech

Course Description

This course examines the ethical questions that are emerging as a result of rapid technological change. It prepares students to become responsible technologists, and provides a basis for ethical decision-making in their professional work.

It focuses on the promise and potential ethical dilemmas that result from the latest developments of computer science. Topics addressed include ethical decision-making, privacy and confidentiality, safety, manipulation/deception, and the impact of computers on society.

Students are first introduced to a selection of classical ethical theories (e.g., Rights, Justice/Fairness, Utilitarian, etc.). These provide a vocabulary and framework for examining ethical issues in tech. These frameworks are applied to a selection of relevant ethical questions. Examples might include: should social media companies suppress the spread of fake news on their platforms? Is electronic privacy a right? Are there justifiable uses of state surveillance? Should AI be used to “predict” crime by police? What ethical codes should guide AI like self-driving cars? Students read case-studies addressing these questions, write positioning papers, and offer feedback on papers of their classmates. Each live class is a seminar, where students engage in facilitated discussion.

The class culminates in an ethical redesign project where students analyze an existing product that poses ethical questions, then propose specific changes (in software, hardware, UI design, processes, features, implementation) to reduce ethical risks posed by the product.

Front End Web Development

Course Description

Front End Web Development builds on previous knowledge of web development, and extends students’ familiarity with modern HTML, CSS, JavaScript, and Web APIs. Students learn to develop and deploy client-side web applications with greater scope and complexity. Complex frontend features require using HTML, CSS, and JavaScript together. Students will usually have taken Web Application Development (or similar course under advisement from their faculty) as a prerequisite for this course.

Students deepen their knowledge of the JavaScript language, covering in depth topics like scope and higher order functions. Students practice using modern build tools for package management, bundling, optimization, formatting and linting, and testing.

Throughout the course, students will solve practice exercises and build projects, culminating in a final project using a JavaScript framework to build a complex web application.

Students will continue to apply technical communication skills by writing technical specs, drafting architecture diagrams, and documenting APIs. They will extend their communication practice through technical blogging on topics like tool comparisons, architecture choices, benchmarks, and frontend web design. Students will grow in independence by reading documentation to learn about novel language and browser features.

Industry Experience 1

Course Description

Industry Experience is a form of experiential learning that enables students to apply their academic knowledge in a professional context. Students work to build software that meets the needs of a professional organization by completing either (1) an approved internship, or (2) a product studio.

During the internship, students work on tasks that meet the needs of the organization, guided by an on-site supervisor. Internships must entail significant, substantial computer science. In the studio, external clients (e.g., businesses, non-profits) sponsor a software development project completed by students. A typical end result is a prototype of or a fully functional software system ready for use by the clients. These projects are completed by teams of 4-6 students, who meet with the client weekly to share progress and get feedback.

Students complete online courses under the supervision of a faculty advisor. Pre-work includes instruction in communication, goal-setting, and professional development. During the industry experience, students submit bi-weekly written reflections on their personal goals, challenges, and, for the studio, team feedback. At the end of the term, students obtain written feedback from their organization supervisor. They also submit a final report which describes the problem statement, approaches/methods used, deliverables, and skills gained. Industry Experience culminates in a final presentation which is shared as a public blog post.

Industry Experience 2

Course Description

Industry Experience 2 provides a form of experiential learning that enables students to apply their academic knowledge in a professional context. Students work to build software

that meets the needs of a professional organization by completing either (1) an approved internship, or (2) a product studio.

During the internship, students work on tasks that meet the needs of the organization, guided by an on-site supervisor. Internships must entail significant, substantial computer science. In the studio, external clients (e.g., businesses, non-profits) sponsor a software development project completed by students. A typical end result is a prototype of or a fully functional software system ready for an end user. These projects are completed by teams of 4-6 students, who meet with the clients or other end users weekly to share progress and get feedback.

Students complete online courses under the supervision of a faculty advisor. Pre-work includes instruction in communication, goal-setting, and professional development. During the industry experience, students submit bi-weekly written reflections on their personal goals, challenges, and, for the studio, team feedback. At the end of the term, students obtain written feedback from their organization supervisor. They also submit a final report which describes the problem statement, approaches/methods used, deliverables, and skills gained. Industry Experience culminates in a final presentation which is shared as a public blog post.

Interaction Design

Course Description

This course introduces students to the principles of human-computer interaction (HCI). Students explore how humans process information (perception, memory, attention) in the context of designing and evaluating interfaces. This course complements programming coursework by helping students understand how to design more usable systems.

The course builds on previous knowledge of design thinking and expects students to apply the design thinking methodology as a starting point. The first part of the course focuses on designing for multiple platforms. Students create designs that solve a problem on multiple devices (e.g., web, mobile, wearables) and learn how to create a coherent design system as users move between devices. The second part of the course delves into design beyond visual user interfaces, and teaches students how to design for emerging technologies, for example, sensors, controls and ubiquitous computing. Throughout the course, students learn and apply a variety of evaluation methodologies used to measure the usability of design.

This is a project-based course and, in each part, students will work in a team to design, prototype and test a solution to a problem. Students will present their designs in class sessions, and practice giving and receiving meaningful critiques.

Introduction to Data Science

Course Description

Data science is applicable to a myriad of professions, and analyzing large amounts of data is a common application of computer science. This course empowers students to analyze data, and produce data-driven insights. It covers all areas needed to solve problems involving data, including preparation (collection and integration), presentation (information visualization), analysis (machine learning), and products (applications).

This course is a hybrid of a computing course focused on Python programming and algorithms, and a statistics course focusing on estimation and inference. It begins with acquiring and cleaning data from various sources including the web, APIs, and databases. Students then learn techniques for summarizing and exploring data with spreadsheets, SQL, R, and Python. They also learn to create data visualizations, and practice communication and storytelling with data. Finally, students are introduced to machine learning techniques of prediction and classification, which will prepare them for advanced study of data science.

Throughout the course, students will work with real datasets (e.g., economic data) and attempt to answer questions relevant to their lives. They will also probe the ethical questions surrounding privacy, data sharing, and algorithmic decision making. The course culminates in a project where students build and share a data application to answer a real-world question.

Introduction to Programming in Python

Course Description

This course is intended for students with little or no programming experience. It aims to help students develop an appreciation for programming as a problem solving tool and to provide a foundation in Python programming. Students will learn how to think algorithmically, solve problems efficiently, and prepare for further computer science studies.

The course begins with an introduction to programming constructs in a simplified visual environment. Students will learn to specify commands, and to construct complex programs from simple instructions. The next part of the course introduces a formal programming environment, and students learn the basic syntax and structures of Python. Topics covered include variables, expressions, conditional execution, functions, loops, and iterations. Throughout the course, students will be exposed to abstraction and will learn a systematic way of constructing solutions to problems. They will work on team projects to practice pair programming, code reviews, and other collaboration methods common to industry.

The course culminates in a final group project and presentation during which students demonstrate and reflect on their learning.

iOS App Development

Course Description

iOS App Development teaches students to build modern mobile applications using Apple's iOS development platform and tool chain. It prepares students to become professional iOS developers. Students learn the core principles of the Swift programming language and Apple's front-end frameworks for creating single and multi-page applications.

The course begins with an introduction to the Swift programming language and Xcode, Apple's development environment for iOS. Students learn the core object-oriented programming principles of Swift, its Model/View/Controller paradigm, and its supporting classes. They then learn to create user interfaces with UIKit, Apple's front-end framework.

The second part of the course teaches students to create dynamic iOS applications that pass information between views and objects, and respond to user events. Students learn how to incorporate networking into their mobile apps, and how to get and parse information from the internet through APIs. They also learn techniques for creating asynchronous apps, including industry-standard patterns and frameworks to persist data locally and synchronizing data between the local device and the cloud.

Students learn by building small programming projects. The course culminates in a final group project where students build an iOS app of their choice from scratch, going from initial design to deployment in TestFlight.

Machine Learning

Course Description

This course aims to teach students the theoretical and practical methods for solving problems using machine learning. Machine learning is one of the fastest-growing areas of computer science. Its applications are reshaping society, from consumer products (e.g., voice assistants and recommendations) to life-sciences (e.g., personalized medicine and tumor detection). This course will build on the Data Science introductory course, and help students understand how, why and when machine learning methods work.

Students will be introduced to major paradigms in machine learning, and gain working knowledge of supervised and unsupervised learning techniques. Students will learn to solve common problems such as regression, classification, clustering, matrix completion and pattern recognition. They will learn how to train and optimize neural networks. They will explore modern software libraries that enable programmers to develop machine learning systems. Students will use these libraries along with publicly available data sets to build models, then learn how to evaluate and verify the results. Throughout the course, as they apply technical methods, students will also examine the societal context of machine learning and considerations of transparency, bias and privacy.

Course assignments will consist of short programming exercises and peer discussions of ethical considerations. The course culminates in a final group project and accompanying paper that allows students to apply concepts to a problem of personal interest.

Mathematical Thinking

Course Description

This course helps students develop the ability to think logically and mathematically. It prepares students for more advanced courses in algorithms and discrete mathematics. An emphasis is placed on the ability to reason logically, and effectively communicate mathematical arguments.

The course begins with a brief review of number systems, and their relevance to digital computers. Students review the algebraic operations necessary to perform programming functions. In the unit on logic and proofs, students learn to identify, evaluate, and make convincing mathematical arguments. They are introduced to formal logic, and methods for determining the validity of an argument (truth tables, proofs, Venn Diagrams). Students learn to decompose problems using recursion and induction, and how these methods are used in real-world computational problems. The final unit is an introduction to counting and probability. Topics covered include principles of counting, permutations, combinations, random variables, and probability theory.

Throughout the course, students apply their knowledge by solving logic puzzles and creating programs in Python.

Network and Computer Security

Course Description

Network and Computer Security teaches students the principles and practices of security for software, systems, and networks. It aims to make students critical examiners and designers of secure systems. Students will learn the mathematical and theoretical underpinning of security systems, as well as practical skills to help them build, use, and manage secure systems.

The first part of the course is focused on applied cryptography. Students learn general cryptographic protocols and investigate real-world algorithms. The second part of the course covers software and system security, including access controls, trends in malicious code, and how to detect system vulnerabilities. There is a special focus on web security, and modern practices for building secure web architectures. The final section of the course focuses on network security and covers concepts of networking, threats, and intrusion protection.

Course projects will require students to think both as an attacker and as a defender, and write programs that examine security design. Students will also examine recent security and privacy breaches. Working in pairs, they'll conduct an in-depth investigation, and give a presentation to help classmates understand its technical underpinnings and social implications.

Optimizing Your Learning

Course Description

Optimizing Your Learning aims to transform incoming first year students into effective and empowered self-directed learners.

In the modern world, long-term academic, professional, and personal success is driven by the ability of individuals to take control of their learning. Therefore, this course helps students to develop the knowledge, skills, and mindsets necessary to take ownership of their learning and build their self-efficacy.

During the course, students will develop competence in skills that are most critical for effective self-directed and self-regulated learning (i.e. self-management, self-monitoring, and self-modification), while also learning how to use learning strategies to maximize their overall learning efficiency and efficacy. They will also utilize the Emotional Intelligence framework to explore their identity, self-image, motivation, and self-regulation skills, to support their development as self-directed learners.

The course culminates in the creation of a personal learning charter that will help guide students in their learning throughout their undergraduate studies, which can also be applied to their learning activities in other realms of their lives.

Product Management and Design

Course Description

This course teaches students to build products users want and love. It gives students a foundation in the tools and practices of modern product management and interaction design. Students will work in pairs to apply product development skills to real user challenges.

The course begins with a focus on user research. Students learn and apply the design thinking framework to product development. They learn to define user needs through user interviews and market analysis. They learn to translate user needs into product specifications, and define metrics to test product success. They learn to create and test design prototypes (wireframes, user journeys). The second part of the course focuses on UX/UI design. Students learn key concepts in UI/UX design including information hierarchy, and typography and color. Students will create high-fidelity UI mockups using industry-standard tools. They'll then conduct usability tests to gauge the effectiveness of their designs.

As students work in pairs, they will practice the complementary and collaborative roles of PMs and UX designers in early product development. They'll also practice giving design critiques to other teams, and responding to feedback on their designs. By the end of

the courses, each pair will have a user-tested, refined, and development-ready design for a web or mobile application.

Programming 1

Course Description

The course helps students develop an appreciation for programming as a problem-solving tool. It teaches students how to think algorithmically and solve problems efficiently, and serves as the foundation for further computer science studies.

Using a project-based approach, students will learn to manipulate variables, expressions, and statements in Python, and understand functions, loops, and iterations. Students will then dive deep into data structures such as strings, files, lists, dictionaries, tuples, etc. to write complex programs. Over the course of the term, students will learn and apply basic data structures and algorithmic thinking. Finally, the course will explore design and implementation of web apps in Python using the Flask framework.

Throughout the course, students will be exposed to abstraction and will learn a systematic way of constructing solutions to problems. They will work on team projects to practice pair programming, code reviews, and other collaboration methods common to industry. The course culminates in a final group project and presentation during which students demonstrate and reflect on their learning.

Programming 2

Course Description

This course expands on Programming 1, and deepens students' knowledge of Python with a focus on data access and management.

Previously introduced programming topics include data types, operators, variables, and control flows are reinforced, this time in the context of retrieving and manipulating data. Students learn to use Regular Expressions, a powerful tool for finding and extracting data from string and other data types. They are introduced to modern web protocols, and learn how to retrieve data from web services using Python and JSON, and how to access and parse data in XML. Students learn the basics of working with databases and the relationships between databases. They learn how to write queries in SQL, the foremost programming language for generating, manipulating, and retrieving information from a relational database.

Students work on small projects throughout the course. The final project challenges students to retrieve and visualize original data in Python.

Programming in Python

Course Description

This course is intended for students who have completed Programming 1. It aims to help students deepen their programming skills, concentrating on Python. Students will learn how to think algorithmically and solve problems efficiently.

Students will gain proficiency in specifying commands, and constructing complex programs from simple instructions. The course uses a formal programming environment, and students learn the syntax and structures of Python. Topics covered include variables, expressions, conditional execution, functions, loops, and iterations. Throughout the course, students will be exposed to abstraction and will gain a systematic way of constructing solutions to problems. They will work on team projects to practice pair programming, code reviews, and other collaboration methods common to industry.

The course culminates in a final group project and presentation during which students demonstrate and reflect on their learning.

Team Software Project

Course Description

In this course, students practice the skills necessary to work effectively on a professional software product team. By working in small teams to build a web application, they integrate the technical, communication, and collaboration skills built in previous courses.

Students build a multi-feature web application, either for a fictional client or an original idea of their own design. As they work together, they learn modern technical collaboration tools and practices. Topics covered include using version control for shared repository management, writing technical design documents, and conducting code reviews. They also practice project management skills by implementing the SCRUM framework, including sprint planning, reviews, and retrospectives. During each milestone, team members rotate taking on various roles including Scrum master, product owner, and technical lead. Throughout the course, students will also apply and refine the emotional intelligence, team development, and leadership frameworks previously learned. By the end of the course, students should understand and value the various roles within a software product development team, and be able to participate effectively on a product team.

There are no scheduled class sessions. Teams will submit their sprint retrospectives for feedback from peers and faculty. The course culminates in a showcase where students present their final project to their peers and external stakeholders.

Web Application Development

Course Description

This course builds on Web Foundations, and provides a comprehensive introduction to client and server-side development for the web.

In this project-based course, students will work independently to build a web application, and progressively apply new knowledge to their application. Students deepen their knowledge of HTML and learn advanced CSS, including how to use CSS variables and modern frameworks for motion and interaction. They learn about accessible web design, and how to create websites and apps that work well on mobile devices, and that support use of assistive technologies like screen readers.

Students will build the front-end of a web application using HTML, CSS and JavaScript then write a supporting back-end using either a JavaScript or Python framework. In doing so, they will demonstrate knowledge of the request-response structure, database management, and JSON-based APIs. Students will also apply technical communication skills by writing technical specs, drafting architecture diagrams, and documenting APIs.

Web Foundations

Course Description

This course provides a foundation in building for the web. It helps students understand how the internet works, examines the role of the internet in their lives, and teaches them the basics of web development. The course prepares students for the advanced course in Web Application Development.

The course begins with a brief history of the internet and network technologies. Students will learn about the physical underpinnings of the internet, barriers to connectivity, and efforts to expand access (e.g., undersea cable projects, satellite projects). They will also explore the challenges of internet security and privacy. Students will be encouraged to make these social explorations personal, and investigate the history, barriers, and opportunities for connectivity in their local regions. The course will also cover the building blocks of web application development. Students will master HTML, intermediate CSS, and basic concepts and syntax of JavaScript.

The course culminates in a “Knowledge Share” project during which students create a website to educate a non-technical audience on a key aspect of the internet or emerging technology.

\WOOLF/

MS in CS Program Handbook

Date of Publication: August 2023

Foreword

This manual has been designed to familiarize you with the policies and procedures that shape the Woolf MS in CS Program. This manual should not be viewed as complete

and is not designed to replace the Woolf Academic Handbook. It is intended to provide information you will need in order to make decisions about your graduate studies and to acquaint you with the administrative requirements, policies and procedures you will be expected to meet that are outside the scope of the Woolf Academic Handbook. This document should thus be used in tandem with the Woolf Academic handbook. Where either manual seems incomplete, you are encouraged to inquire with your Faculty Advisor. For questions beyond the domain of your Advisor you are encouraged to reach out to help@woolf.university.

We hope that your experience within Woolf's program will be fulfilling, stimulating, and engaging. We are excited to welcome you to the Woolf community.

The Mission of Woolf

Woolf exists to promote academic excellence, broaden access to higher education, and guard values that are humane, democratic, and international. Above all, Woolf values freedom of thought, freedom of inquiry, and freedom of expression.

We do this through our commitment to high-quality education and through widening the horizon of opportunity by connecting students with quality academics across the world.

Through Woolf's world-class platform and programs students gain exposure to new ideas, new ways of understanding, and new ways of learning. By uniting exceptional faculty with motivated students, Woolf is able to build an outstanding academic community leading to journeys of intellectual transformation. From this we hope that students will share their academic, intellectual and other talents in serving their communities across the world.

Woolf is guided by the following tenets:

Background. Talent may be evenly distributed but opportunity is not – we are working to widen the horizon of opportunity by connecting students and teachers across the world.

Education. Woolf prioritizes an education that will serve its students both in the near-term and in the long-term. Woolf seeks to provide a personalized, bespoke education. In all fields, Woolf seeks to instill values of curiosity, intellectual discipline, and clarity of expression.

Research. Woolf prioritizes research-driven teaching that uses the latest academic scholarship, and Woolf encourages its students to engage in groundbreaking research.

Society. Woolf encourages partnerships with governments, educational institutions, research centers, schools, and businesses of all kinds – provided these partnerships do not infringe on the values of Woolf.

Technology. To the extent that existing or new technologies can improve the educational outcomes for students, widen access to the Woolf global network, improve the career experience of academics, better secure credible governance, lower the costs of institutional management, and generally support the mission of Woolf – these are embraced.

In all things, Woolf values excellence and measures itself against the highest international standards. Woolf seeks to raise those standards further.

Academic Program Information

Program Description

The Master of Science in Computer Science (MS in CS) is a 45-credit program that includes a variety of online courses. Students may choose to receive a general MS in CS or may specialize in one of the following areas: Artificial Intelligence and Machine Learning, Cloud Computing, Software Engineering, Data Science and Data Analytics. The program is an integrated, sequential course of study in which students obtain and demonstrate the knowledge and skills required of the computer science industry.

The MS in CS program teaches students comprehensive and specialized subjects in computer science; it teaches students cutting edge engineering skills to solve real-world problems using computational thinking and tools, as well as soft skills in communication, collaboration, and project management that enable students to succeed in real-world business environments.

Most of this program is case (or) project-based where students learn by solving real-world problems end to end. This program has core courses that focus on computational thinking and problems solving from first principles. The core courses are followed by specialization courses that teach various aspects of building real-world systems. This is followed by more advanced courses that focus on research level topics, which cover state of the art methods. The program also has a capstone project at the end, wherein students can either work on building end to end solutions to real world problems (or) work on a research topic. The program also focuses on teaching the students the “ability to learn” so that they can be lifelong learners constantly upgrading their skills. Students can choose from a spectrum of courses to specialize in a specific sub-area of Computer Science like Artificial Intelligence and Machine Learning, Cloud Computing, Software Engineering, or Data Science, etc.

The Ms in CS is delivered completely digitally by combining asynchronous components (lecture videos, readings, and written assignments) and synchronous cohort meetings attended by students and an instructor or faculty member during a video call.

The asynchronous components support the schedules of students from diverse work-life situations, and synchronous meetings provide accountability, motivation, and a sense of community presence for students. The synchronous sessions allow unparalleled access to high quality instruction and enhanced collaboration among students through using face-to-face online interaction.

Faculty conduct live office hours with students and interaction between faculty members and students, both individually and as a group, is enhanced in the online environment by blending asynchronous content with real-time student responses. Faculty and enrolled students have 24/7/365 access to technical support through Woolf’s support system.

Woolf’s digital campus allows students to complete the program in as little as 50 weeks of continuous study or within 5 years as part of a part-time course of study. The degree on the students’ transcripts is a Master of Science in Computer Science, which attests to their completion of the requirements.

Admission Requirements

The Woolf Ms in CS is a fast-paced, rigorous degree focused on teaching comprehensive and specialized subjects in business administration. Candidates should have a bachelor's degree in a technical field, or have at least 5 years of related experience with at least some undergraduate level courses or an associate's degree.

English language competency at an IELTS 6.5 or equivalent is required of all applicants.

This program is designed for individuals who wish to enhance their knowledge of computer science and its various applications used in different fields of employment. It is designed for those that will have responsibility for planning, organizing, and directing technological operations.

In all cases, the target group should be prepared to pursue substantial academic studies.

Curriculum Areas

The program is organized into a course structure of three tiered areas. Each tiered area sequentially builds off of the previous, so students must complete each tier before advancing to the next.

Each course consists of regular lessons and cumulative lessons devoted to cumulative examination. Each course requires about 75 hours to complete (see individual courses for details). A full-time student completes two lessons per week with an assignment submitted for each lesson; this pattern continues for each regular lesson in the class.

Summative examination lessons allow an appropriate amount of time for students to review and revise their prior work and deepen their synthetic grasp of the materials in preparation for cumulative examination or project.

The degree has a capstone project consisting of the Advanced Applied Computer Science Project. The capstone represents a synthesis of knowledge and skills gained throughout the graduate program. Over the course of the capstone, students use multidisciplinary approaches to perform critical analyses of real technical issues in situations of uncertainty and incomplete information and develop an actionable solution, which is presented and assessed at the end of the capstone.

Learning Outcomes

The program teaches students comprehensive and specialized subjects in computer science; it develops skills in critical thinking and strategic planning for changing and fast-paced environments; and it develops competences in leadership, including autonomous decision-making, and communication with employers, stakeholders, and other members of a team.

Knowledge

- Students will have a cutting-edge knowledge and understanding of computer science allowing them to solve real-world engineering and specific computational problems using advanced techniques at the forefront of computer science
- Students will be able to analyze the societal, regulatory, and technological contexts for key computer science applications

- Students will be able to apply their technological abilities to produce innovative solutions to real-world problems and that implement techniques learned in the course
- Students will display original thinking on the basis of the knowledge they gain in the course

Skills

- Develop advanced, innovative, and multi-disciplinary problem-solving skills
- Communicate computer science methods and tools clearly and unambiguously to specialized and non-specialised audiences
- Develop advanced abilities related to computer science operational procedures and implement them in response to changing environments
- Critically evaluate alternative approaches to solving real world engineering and technological problems using cutting edge techniques in computer science on the basis of academic scholarship and case studies, demonstrating reflection on social and ethical responsibilities
- Formulate technological judgments and plans despite incomplete information by integrating knowledge and approaches from various computer science domains including machine learning, distributed computing, and cloud computing.
- Enquire critically into the theoretical strategies for solving real-world problems using computational thinking and tools.
- Develop new skills in response to emerging knowledge and techniques and demonstrate leadership skills and innovation in complex and unpredictable contexts

Competences

- Formulate research-based solutions to practical problems in environments of incomplete information
- Manage decisions with autonomy in complex and unpredictable environments
- Organize projects and people in a way that is responsive to changes in the wider technological environment
- Demonstrate learning skills needed to maintain continued, self-directed study

Faculty

All instruction is provided by competent academics with qualifications commensurate to their role. All teachers are also expected to have relevant teaching experience in the domain of their expertise. All faculty members at Woolf are expected to be in possession of a research doctorate in the domain of their teaching or supervision; moreover, they are expected to have a record of research or a research agenda reflecting the capacity for research.

Woolf uses clear, fair, and transparent processes for teaching recruitment, conditions of employment, and professional advancement. Notices of availability are publicly listed on the Woolf platform and, when available, other sites visited by academics. Criteria for teaching positions, including any associated conditions of ongoing employment, are clearly stated. Applications for teaching are reviewed by the Administrative Board, or a committee of the Board, until a position(s) is filled. Notices state the supporting documentation required as evidence for the review of an applicant. All applicants are required to demonstrate their competence for the teaching position by providing a copy of their credentials to be verified

before the position is filled. This policy applies to all teaching roles of Woolf Education Ltd, including any teaching services provided by third party vendors, which are subject to the same process of review. In all cases, the final decision for filling a role in accordance with the criteria stated on the public notice is made by the Administrative Board.

Woolf's policies and procedures apply consistently to full-time, part-time, *ad hoc*, and third-party teaching activities. All teaching activities fall within the scope of Woolf policy. Teaching staff, including part-time or *ad hoc* teaching staff are directed towards updates and developments in their field as well as the methodological requirements for their programs.

All Faculty Members are encouraged to discuss innovative forms of teaching, formulate how these may be implemented, and propose those implementations in the Faculty Council. At the end of all courses, students provide feedback on their learning experience, and twice per year faculty provide feedback by survey. All teachers are expected to maintain a record of student outcomes, and teaching activities are periodically reviewed or observed. In cases of disagreement, or suspected misconduct, fraud, or prejudice, a Red Flag should be submitted under the Red Flag Procedure.

All courses and programs are subject to processes of quality enhancement to improve student outcomes, including the course's continued review to assess its scholastic rigor and value.

Faculty Requirements

Academic Staff are called Faculty members at Woolf. Faculty members at Woolf must possess a research doctorate and are expected to have a record of peer-reviewed research. All teaching is under the authority and oversight of a faculty member – including instructional design, synchronous meetings, and lectures. In cases where pre-recorded lectures or podcasts are provided that contain content from outside of Woolf, any such content is to be produced by lecturers who are experts with a research doctorate in the relevant domain, or where relevant, by those with at least 7 years of industry-specific experience.

Teaching Staff are called Expert Instructors, Domain Experts, or simply Instructors. Expert instructors are used in courses to provide domain-specific industry insights, including insights and feedback on student work during synchronous meeting sessions. Expert instructors must have management experience and be in possession of at least a master's level qualification. Expert instructors are under the direct authority of the Faculty Members and must be trained in Woolf's pedagogical methods.

Faculty Advisors

Colleges at Woolf exist to support their members and provide helpful resources to students.

In the tradition of Harvard's "Houses" and Oxford's "Colleges", Woolf provides every student with membership in a Woolf college for support during their academic journey. Every student should be assigned a Faculty Advisor, who is a faculty member from within the student's own college, and who acts as the first point of contact for non-technical academic issues related to the student's progress, particularly where these may benefit from an independent point of view. Students are strongly encouraged to meet with their advisors at least once each semester.

Thus every faculty member oversees their own registered students through the normal synchronous teaching sessions, and office hours, and additionally provides availability that can be booked for advisees, should the need arise.

Program Outline

Outline of Program		
Course Title	**Credits**	**Course Description**
1. Data Structures	2.5	This course is aimed to build a strong foundational knowledge of data structures (DS) used extensively in computing.

2. Design and Analysis of Algorithms	2.5	This is a foundational and mandatory course which aims to build student's ability to apply various algorithmic design methods to provide an optimal solution to computational problems.
3. Relational Databases	2.5	This is a core and foundational course which aims to equip the student with the ability to model, design, implement and query relational database systems for real-world data storage & processing needs.
4. Numerical Programming in Python	2.5	This course helps students translate mathematical/statistical/scientific concepts into code. This is a foundational course for writing code to solve Data Science ML & AI problems.

5. Applied Statistics	2.5	This course introduces basic probability theory , statistical methods and computational algorithms to perform mathematically rigorous data analysis.
6. Introduction to Machine Learning	2.5	This course focuses on building basic classification and regression models and understanding these models rigorously both with a mathematical and an applicative focus.
7. High Dimensional Data Analysis	2.5	This course is aimed to help learners understand various techniques and algorithms to visualize, analyze and understand high dimensional data which is very common in Data Science and ML.

8. Advanced Machine Learning	2.5	This course introduces more advanced ML techniques like ensembles: bagging, boosting, cascading and stacking classifiers and regressors.
9. Distributed Machine Learning	2.5	This course provides an in-depth understanding of distributed systems for ML and Deep Learning using CPU,GPU and TPU clusters.
10. Introduction to Deep Learning	2.5	This course provides a strong mathematical and applicative introduction to Deep Learning.

11. Deep Learning for Computer Vision	2.5	This course provides a comprehensive overview of Computer vision problems and how they can be tackled using various Convolutional Neural networks (CNNs).
12. Deep Learning for Natural Language Processing (NLP)	2.5	This course focuses on modeling sequences (text, music, time-series, genes) using deep-learning models.
13. Productionisation of Machine Learning Systems	2.5	This course aims to build the core competency of building real world end-to-end ML systems and deploy them into production for a variety of problems and scenarios.

14. System Design	2.5	This course is aimed at equipping students with skills to architect the high level design (a.k.a. system design) of software and data systems.
15. DevOps	2.5	This course provides students with hands-on experience on deploying high velocity applications and services reliably on complex and distributed infrastructure.
16. Front End UI/UX Development	2.5	This is a hands-on course on designing responsive, modern and light-weight UI for web, mobile and desktop applications using HTML5, CSS and Frameworks like Bootstrap 4.

17. JavaScript	2.5	This course is a hands-on course covering JavaScript from basics to advanced concepts in detail using multiple examples.
18. Front End Development	2.5	This course builds upon the introductory JavaScript course to acquaint students of popular and modern frameworks to build the front end.
19. Back End Development	2.5	This is a foundational course on building server-side (or backend) applications using popular JavaScript runtime environments like Node.js.

20. Foundations of Cloud Computing	2.5	This is a course that focuses both on architectural design and practical hands-on learning of the most used cloud services.
21. Advanced Back End Development	2.5	This course provides a dive deep into more advanced concepts in server-side programming using Node.js to enable initiative, real-time and scalable web applications.
Distributed Cloud Computing	2.5	This course provides an in-depth architectural overview and hands- on experience with building scalable data processing and distributed computing via various cloud systems.

23. Advanced Cloud Computing	2.5	This is a course that focuses both on architectural design and practical hands-on learning of advanced cloud-based services.
24. NoSQL Cloud Datastores	2.5	This course provides a comprehensive overview and practical knowledge of various NoSQL data stores and how they can be used on the Cloud (AWS).
25. Design Patterns	2.5	This course provides a practical understanding of popular object-oriented design patterns so that students can reuse design strategies developed for commonly occurring problems in software development.

26. Advanced Applied Computer Science	15	Advanced Applied Computer Science is a capstone project, an end-to-end deployable solution to a real-world computational problem that students build in the last phase of the program.
27. Introduction to Computer Programming: Part 1	2.5	This course helps students translate advanced mathematical/statistical/scientific concepts into code. This is a course for writing code to solve real-world problems.
28. Introduction to Problem-Solving Techniques: Part 1	2.5	Building a toolbox of problem-solving strategies will improve problem solving skills. With practice, students will be able to recognize and choose among multiple strategies to find the most appropriate one to solve complex problems. The course will focus on developing problem-solving strategies such as abstraction, modularity, recursion, iteration, bisection, and exhaustive enumeration.

29. Introduction to Problem-Solving Techniques: Part 2	2.5	This course is a follow-up to Introduction to Problem-Solving Techniques: Part 1, and as part of their academic planning process with Woolf staff, students will ordinarily take that course first.
30. Mathematics for Computer Science	2.5	This course covers discrete mathematics for computer science and engineering. Topics may include asymptotic notation and growth of functions; permutations and combinations; counting principles; discrete probability.
31. Advanced Algorithms	2.5	This course covers general approaches to the construction of efficient solutions to problems.

32. Computer Systems and Their Fundamentals	2.5	This core course equips the student with knowledge of database management systems, operating systems and computer networks.
33. Low-Level Design and Design Patterns	2.5	Low-Level Design & Design Patterns focuses on modularity and reusability in software design, common design vocabularies, refactoring and how to reduce it, and how to incorporate design patterns into iterative development processes. The course pays significant attention to the interaction between system architecture and components, including data organization.
34. Practical Software Engineering	2.5	This course gives the detailed overview on how to approach Low Level Design problems with real-world case studies discussed such as Designing a Pen (Mac/Windows), TicTacToe, BookMyShow (most used event booking app, manages millions of users), Email campaign Management System and detailed design of Splitwise.

35. Distributed Systems with High-Level System Design	2.5	In this course, students will learn to execute a collection of protocols to coordinate the actions of multiple processes on a network, such that all components cooperate together to perform a single or small set of related tasks.
36. Data Visualization Tools	2.5	This course is aimed to build a strong foundational knowledge of Data Analytics tools used extensively in the Data Science field.
37. Power BI for Data Analysis and Exploration	2.5	Students will learn how to handle data sources in Power BI, connecting to various data sources using Power BI, query editors, managing data relationships, and cross filter direction.

38. Statistical Programming	2.5	This course focuses on representing statistical techniques in code, and may be conducted in Python, R, or another relevant language.
39. Spreadsheets for Data Understanding	2.5	Spreadsheets for Data Understanding introduces students to the principles and techniques of data cleaning, handling data sets of varying sizes, and visualizing data/data storytelling.
40. Advanced Python Programming	2.5	Advanced Python Programming builds on introductory programming courses to illustrate object-oriented programming concepts, database design in Python, and the basics of Machine Learning with Python libraries.

41. Foundations of Machine Learning	2.5	This course focuses on building basic classification and regression models and understanding these models rigorously both with a mathematical and an applicative focus.
42. Business Case Studies	2.5	A business case study is a course designed for the learner to identify a business real world problem and its objective is to help students rigorously solve a real-world, technically-challenging business problem where they would apply all of the concepts, techniques and tools learnt in the program. Students typically pick a problem from a known business problem or identify business cases where data analytics can be used to solve a problem.
43. Studies in Data Science and Data Analytics	2.5	This advanced graduate class addresses a unique topic on a rotating basis in order to keep the program at the forefront of scholarly research and industry practice. Every year the academic staff member will approve of a new topic to be covered. The bibliography will contain not less than 8 peer-reviewed articles or scholarly publications reflecting the current topic.

44. Further Studies in Data Science and Data Analytics	2.5	This advanced graduate class addresses a unique topic on a rotating basis in order to keep the program at the forefront of scholarly research and industry practice. Every year the academic staff member will approve of a new topic to be covered. The bibliography will contain not less than 8 peer-reviewed articles or scholarly publications reflecting the current topic.
45. SQL for Data Analytics	2.5	Structured Query Language (SQL) is key to working with data in relational databases, a task at the core of data science and analytics. In this course, students will learn all the major keywords and clauses used to extract data, best practices for formatting SQL queries, and how to generate meaningful insights from the results.
46. Product Analytics	2.5	This course teaches students how to analyze the ways users engage with a service. This method, called product analytics, helps businesses track and analyze user data. Students will learn more deeply what is required to move a product from idea to implementation, through to launch, and then on to iterative improvements.

47. Data Engineering	2.5	Students will learn a comprehensive view of the complete Data Engineering lifecycle.
48. Product Management for Software Engineers	2.5	In this course, students will get a fundamental understanding of product management practices.
49. Applied Computer Science Project	5	This is a project-based course, with the aim of building the required skills for creating web-based software systems. The course covers the entire lifecycle of building software projects, from requirement gathering and scope definition from a product document, to designing the architecture of the system, and all the way to delivery and maintenance of the software system.

50. Introduction to Computer Programming: Part 2	2.5	This course provides a practical and detailed understanding of popular programming paradigms and data storage types. Students learning this will be able to write and solve programming problems.

Assessment and Grading

General Procedures

Academic assessment at Woolf is of two kinds: regular and cumulative. Regular assessment applies to the continuous evaluation of student progress, concentrating on the proficiency of submitted assignments, and the ability of the student to respond to issues raised by the instructor during an instructional session. Cumulative assessment applies to the final project assignment. This requires the students to deepen and extend the scholarly engagements initiated in their prior work.

Students who fail any one course of the degree, cannot progress to complete the degree, except by approval of the College Dean or College Academic Committee. Failed courses may be retaken at the approval of the College Dean or College Academic Committee, or by appeal, at the discretion of the Quality Assurance, Enhancement, and Technology Alignment Committee (QAETAC). For more information about QAETAC please see the Woolf Academic Handbook.

Cumulative Examination of Courses

Traditionally, cumulative examination of courses is by a submitted final project in the form of a long assignment.

The long assignment is meant to synthesize, deepen, and extend the learning outcomes of the regular lessons while introducing new material and insights. Not more than 50% of the long assignment may be material taken from other assignments. The topic of the assignment must be agreed in advance with the instructor. Examination assignments are expected to be completed at a high research standard, and must be well-structured, well-crafted, and contain appropriate citations to the primary and secondary literature of the course.

Mode of Teaching and Assessment

The Online Campus

Woolf University's courses are offered almost exclusively through its proprietary learning platform. The platform supports both asynchronous and synchronous modes of learning. The asynchronous portion of programs includes structured course materials that the course lead and course instructors prepare ahead of time. These courses are done independently of students' classmates and according to the student's own schedule, but prior to the synchronous sessions. Synchronous sessions are held in the "virtual classroom," where students and faculty use internet technology such as video conferencing and web cameras to ensure they are actively engaged in the learning process. It is essential for students to connect with each other, share information, and create professional networks and relationships as they would in a traditional program or within a professional setting. For information about the technical specific requirements please see the Technical Requirements section within the Woolf Academic Handbook.

Structure of the Courses

The MS in CS combines asynchronous components (lecture videos, readings, and written assignments) and synchronous meetings attended by students and an instructor or faculty member during a video call.

Asynchronous components support the schedules of students from diverse work-life situations, and synchronous meetings provide accountability and motivation for students.

The program is composed of multiple short foundation courses, extended specialist courses, and a capstone project – the Digital Action Program for Business Administration.

Each short foundation course, and the extended specialist courses, consists of regular lessons and cumulative lessons devoted to summative examination. Each short foundation course requires 75 hours of learner time to complete, and each extended specialist course requires 250 hours to complete.

As is typical for synchronous teaching, the student will compose one assignment (such as a report, 1,000 word essay, financial model, or presentation) per lesson, which is the topic of meeting discussion. A full-time student completes two lessons per week with an assignment submitted for each lesson; this pattern continues for each regular lesson in the course.

Summative examination lessons allow an appropriate amount of time for the student to review and revise his or her prior work and deepen their synthetic grasp of the materials in preparation for cumulative examination or project.

Contact Hours

For the breakdown of hours, consult the Pedagogical Procedures and Assessment sections.

Students engage in 8 synchronous meeting sessions in which questions and answers about asynchronous study materials are addressed.

Synchronous meeting engagements include not only 60-75 minutes of intensive contact time between the students and faculty member in every lesson (up to twice per week), but also extends beyond the synchronous meeting session itself to include ongoing supervisory support on an ad hoc basis (typically by email or brief virtual meeting). Students are closely supervised by asynchronous direction, oversight, feedback, and guidance; and occasionally new handouts or other scholarly materials are provided to follow up on issues raised in a synchronous meeting discussion. Thus, on our calculation, we allocate four further hours of contact time beyond the synchronous session to capture the individual, personalized, intensive, bespoke form of guidance that a student receives. We calculate all other forms of contact time at a 1:1 ratio, including lectures, whether delivered synchronously or as pre-recorded videos or podcasts.

Example regular lesson Breakdown

* = contact hours = 66

† = assessment hours = 1.25

Hours	**Activity**
1.25*†	synchronous session
4*	Time under the direction and control of a tutor
1.5*	Lecture videos or podcasts
8.25	Independent reading & note-taking
7.5	Assignment composition
22.5	**Total**

Pedagogical Procedures

The MS in CS will be delivered using online and blended learning techniques, which support a variety of teaching and learning methods, including the following:

- synchronous meetings;
- assigned lectures by video or podcast;
- assigned readings;
- handouts delivered electronically;
- digital material, including slideshow presentations and other assigned media provided in course packets and by weblink.

The core pedagogical method used in this course will include synchronous meetings between a faculty member, or a subject expert instructor under the oversight of a faculty

member, and a small group of students. Student interaction plays a key role in the organization of each synchronous meeting, which focuses on a discussion of a student's pre-submitted assignment.

Online delivery, although identical in content for an in-person session, provides significant advantages to students in terms of accessibility – students can more easily reach academic experts across borders and more easily integrate study within the pattern of their own life or career. Further advantages of the online delivery include the digital quality assurance techniques outlined within the Academic Handbook.

Preparing for a single synchronous meeting requires about 21.25 hours. A representative workload consists of the following: students must review about 100 pages of reading material (or equivalent video content, audio content, or interactive content) and prepare a piece of written work of 2-4 pages in response to a specific set assignment question. Before the start of the synchronous session, this work is submitted to the instructor for review.

Every student must then be prepared to discuss and defend his or her written work directly with the instructor (who is an expert in the field) and the other students for up to 75 continuous minutes. Faculty members and subject experts seek to deepen the students' understanding of the material and probe aspects of the written assignment that may benefit from clarification, revision, or further exploration.

At the end of the synchronous session, the instructor provides the student with feedback on the meeting assignment, including a mark, and provides bespoke guidance for the next assignment. Students are provided with a curated reading list from the instructors, assigned pre-recorded lectures, and a research question to guide the organization of their next synchronous meeting assignment or assignment. Engaging in this activity twice per week is a full workload of about 45 hours.

The synchronous meeting system is designed to be mentally demanding and personally engaging. The pedagogical style is known for producing high-quality domain-specific learning outcomes because students must learn assigned materials and related case studies for themselves, before presenting their work to an instructor in their own words for discussion twice per week. By requiring students to describe and analyze topics in their own words, synchronous meetings engage and extend a student's existing range of abilities.

The synchronous method is also known for producing high-quality domain-agnostic learning outcomes because students must be prepared to organize and present their perspective on an assignment twice per week, and be prepared to think analytically and creatively about what they have done. Students must learn to present their viewpoint, even while being prepared to adopt a new position in light of the evidence and under the questioning of the teacher.

Assessment

General Procedures

For the MS in CS, assessment is of two kinds: regular assessment and summative assessment.

Regular assessment applies to the continuous evaluation of student progress, concentrating on the proficiency of submitted assignments, and the ability of the student to respond to issues raised by the instructor during a synchronous meeting session.

Cumulative assessment applies to the final project assignment. This requires the students to deepen and extend the scholarly engagements initiated in their prior work.

Students who fail any one course of the degree, cannot progress to complete the degree, and will by default fail the MS in CS. Failed courses may be re-taken at the discretion of Woolf's Faculty Members.

Cumulative Examination of courses

For each course, a percentage of the grade derives from the average of the regular assignments, and a larger percentage of the grade derives from the cumulative examination. The cumulative examination of courses is by a submitted final project in the form of a long assignment.

The cumulative examination/long assignment is by summative assignment (3,000 word essay, or similarly-sized financial model, or presentation), which must synthesize, deepen, and extend the learning outcomes of the regular units while introducing new material and insights. Not more than 50% of the long assignment may be material taken from synchronous meeting assignments. The topic of the assignment must be agreed in advance with the faculty member and subject matter experts. Examination assignments are expected to be completed at a high research standard, and must be well-structured, well-crafted, and contain appropriate citations to the primary and secondary literature of the course.

Grading Progress

Students receive grades and feedback on each assignment throughout a course. Depending on the specific course, students may receive both a grade and a written or audio comment from an instructor. Courses display the weight assigned to each grade-bearing category (such as regular assignments, attendance, and/or final projects). Students have access to their grade book at all times and can see a record of all grades, attendance records, and assignment submissions.

The grade book displays the current running average for the grades in the course in accordance to the grade weights, inclusive of all those assignments which the student has submitted and on which the instructor has provided grades. At the end of the course, grades are finalized and added to the student's transcript, which is accessible at all times for students enrolled in credit-bearing programs.

Grading System

The final grade for a course is determined by the weighting rules stated in the course offering. Unless otherwise stated, all courses are weighted as follows: 30% of the grade derives from the average of the instructional assignment session, and 70% of the grade derives from the cumulative examination.

The final grade on a degree is weighted in proportion to the credits of individual courses. For example, a degree composed of a 3 credit course and a 6 credit course will weigh the 6 credit courses proportionately more, according to the number of credits.

Woolf's International Grade Classification

Woolf's teachers are trained in a number of different grading scales; these scales are cross-referenced. This handbook employs the American grading system and classification,

with US grades as the default.[1] US grades are the most granular and distributed with the least number of gaps, which is why we have selected them as a default marking scheme for transcripts. Woolf's international conversion scheme is as follows:

US GPA	US Grade	US Per Cent	UK Mark	UK Classification	Malta Grade	Malta Mark	Malta Classification
4	A+	97 - 100	70+	First class honors	A	80-100%	First class honors
3.8-4.0	A	94-96	67-69	Upper-second class honors	B	70-79%	Upper-second class honors
3.7	A-	90-93	65-67	Upper-second class honors			
3.3	B+	87-89	60-64	Lower-second class honors	C	55-69%	Lower-second class honors
3	B	84-86					
2.7	B-	80-83	55-59	Lower-second class honors			
2.3	C+	77-79	50-54	Third class honors	D	50-54%	Third-class honors
2	C	74–76					
1.7	C-	70–73	45-49	Third class honors			
1.3	D+	67–69	40-44	Ordinary/Unclassified			
1	D	64–66	35-39	Ordinary/Unclassified			
0.7	D-	60–63					
0	F	Below 60	Below 35		F	45-54%	

Woolf Grading Criteria, Definition of Grades, and Classification

Grading of student work keeps in view the scale of work that the student can reasonably be expected to have undertaken in order to complete the task. The Woolf grading scheme draws heavily from the marking scheme set out by the University of Oxford (cf. History Faculty Course Handbook 2016-2018).

a. The assessment of work for the course is defined according to the following rubric of general criteria:

i. i. Engagement:

- Directness of engagement with the question or task
- Range of issues addressed or problems solved

[1] Cf. the Fulbright Commission (http://www.fulbright.org.uk/going-to-the-usa/pre-departure/academics), Princeton Review (https://www.princetonreview.com/college-advice/gpa-college-admissions), European Commission (https://eacea.ec.europa.eu/national-policies/eurydice/content/second-cycle-programmes-49_en), and University of Malta (https://www.um.edu.mt/__data/assets/pdf_file/0005/47390/harmonisedregs-09.pdf).

- Depth, complexity, and sophistication of comprehension of issues and implications of the question or task
- Effective and appropriate use of imagination and intellectual curiosity

ii. Argument or solution:
- Coherence, mastery, control, and independence of work
- Conceptual and analytical precision
- Flexibility, e.g. discussion of a variety of views, ability to navigate through challenges in creative ways

iii. Evidence (as relevant):
- Depth, precision, detail, range and relevance of evidence cited
- Accuracy of facts
- Knowledge of first principles and demonstrated ability reason from them
- Understanding of theoretical principles and/or historical debate
- Critical engagement with primary and/or secondary sources

iv. Organization and presentation:
- Clarity and coherence of structure
- Clarity and fluency of writing, code, prose, or presentation (as relevant)
- Correctness of conformity to conventions (code, grammar, spelling, punctuation or similar relevant conventions)

b. US grades for courses are defined according to the following rubric:
97-100

Work will be so outstanding that it could not be better within the scope of the assignment. These grades will be used for work that shows exceptional excellence in the relevant domain; including (as relevant to the domain): remarkable sophistication and mastery, originality or creativity, persuasive and well-grounded new ideas or methods, or making unexpected connections or solutions to problems.

94-96

Work will excel against each of the General Criteria. In at least one area, the work will be merely highly competent.

90-93

Work will excel in more than one area, and be at least highly competent in other respects. It must be excellent and contain: a combination of sophisticated engagement with the issues; analytical precision and independence of solution; go beyond paraphrasing or boilerplate code techniques; demonstrating quality of awareness and analysis of both first principles or primary evidence and scholarly debate or practical tradeoffs; and clarity and coherence of presentation. Truly outstanding work measured against some of these criteria may compensate for mere high competence against others.

87-89

Work will be at least very highly competent across the board, and excel in at least one group of the General Criteria. Relative weaknesses in some areas may be compensated by conspicuous strengths in others.

84-86

Work will demonstrate considerable competence across the General Criteria. They must exhibit some essential features addressing the issue directly and relevantly across a good range of aspects; offer a coherent solution or argument involving (where relevant) consideration of alternative approaches; be substantiated with accurate use of resources (including if relevant, primary evidence) and contextualization in debate (if relevant); and be clearly presented. Nevertheless, additional strengths (for instance, the range of problems addressed, the sophistication of the arguments or solutions, or the use of first principles) may compensate for other weaknesses.

80-83

Work will be competent and should manifest the essential features described above, in that they must offer direct, coherent, substantiated and clear arguments; but they will do so with less range, depth, precision and perhaps clarity. Again, qualities of a higher order may compensate for some weaknesses.

77-79

Work will show solid competence in solving problems or providing analysis. But it will be marred by weakness under one or more criteria: failure to fully solve the problem or discuss the question directly; some irrelevant use of technologies or citing of information; factual error, or error in selection of technologies; narrowness in the scope of solution or range of issues addressed or evidence adduced; shortage of detailed evidence or engagement with the problem; poor organization or presentation, including incorrect conformity to convention or written formatting. They may be characterized by unsubstantiated assertion rather than argument, or by unresolved contradictions in the argument or solution.

74-76

Work will show evidence of some competence in solving problems or providing analysis. It will also be clearly marred by weakness in multiple General Criteria, including: failure to solve the problem or discuss the question directly; irrelevant use of technologies or citing of information; factual errors or multiple errors in selection of technologies; narrowness in the scope of solution or range of issues addressed or evidence adduced; shortage of detailed evidence or engagement with the problem; poor organization or presentation, including incorrect conformity to convention or written formatting. They may be characterized by unsubstantiated assertion rather than argument, or by unresolved contradictions in the argument or solution.

70-73

Work will show evidence of competence in solving problems or providing analysis, but this evidence will be limited. It will be clearly marred by weakness in multiple General Criteria. It will still make substantive progress in addressing the primary task or question, but the work will lack a full solution or directly address the task; the work will contain irrelevant material; the work will show multiple errors of fact or judgment; and the work may fail to conform to conventions.

67-69

Work will fall down on a number of criteria, but will exhibit some of the qualities required, such as the ability to grasp the purpose of the assignment, to deploy substantive information or solutions in an effort to complete the assignment; or to offer some coherent analysis or work towards the assignment. Such qualities will not be displayed at a high level,

and may be marred by irrelevance, incoherence, error and poor organization and presentation.

64-66

Work will fall down on multiple General Criteria, but will exhibit some vestiges of the qualities required, such as the ability to see the point of the question, to deploy information, or to offer some coherent work. Such qualities will be substantially marred by irrelevance, incoherence, error and poor organization and presentation.

60-63

Work will display a modicum of knowledge or understanding of some points, but will display almost none of the higher qualities described in the criteria. They will be marred by high levels of factual or technology error and irrelevance, generalization or boilerplate code and lack of information, and poor organization and presentation.

0-60

Work will fail to exhibit any of the required qualities. Candidates who fail to observe rubrics and rules beyond what the grading schemes allow for may also be failed.

c. Synchronous Meeting Discussions and *Viva Voce* Examination Template

Synchronous meeting discussions and *viva voce* examinations are conducted on the same format: written work is submitted in advance, and a discussion follows. This provides students an opportunity to clarify and explain their written claims, and it also tests whether the work is a product of the student's own research or has been plagiarized.

For the *viva voce* examination, the submitted work is graded, and the grade is recorded prior to the oral examination.

The synchronous discussion and *viva voce* examination acts to shift the recorded grade on the submitted essay according to the following rubric:

+3

Up to three points are added for excellent performance; the student displays a high degree of competence across the range of questions, and excels in at least one group of criteria. Relative weaknesses in some areas may be compensated by conspicuous strengths in others.

+/- 0

The marked script is unchanged for fair performance. Answers to questions must show evidence of some solid competence in expounding evidence and analysis. But they will be marred by some weakness under one or more criteria: failure to discuss the question directly; appeal to irrelevant information; factual error; narrowness in the range of issues addressed or evidence adduced; shortage of detailed evidence; or poor organization and presentation, including consistently incorrect grammar. Answers may be characterized by unsubstantiated assertion rather than argument, or by unresolved contradictions in the argument.

-3 (up to three points)

Up to three are subtracted points for an inability to answer multiple basic questions about themes in the written work. Answers to questions will fall down on a number of criteria, but will exhibit some vestiges of the qualities required, such as the ability to see the point of the question, to deploy information, or to offer some coherent analysis towards an argument.

Such qualities will not be displayed at a high level or consistently, and will be marred by irrelevance, incoherence, error and poor organization and presentation.

0

Written work and the oral examination will both be failed if the oral examination clearly demonstrates that the work was plagiarized. The student is unfamiliar with the arguments of the essay or the sources used for those arguments.

Curriculum

Advanced Algorithms

Course Description

This course covers general approaches to the construction of efficient solutions to problems.

Such methods are of interest because:

1. They provide templates suited to solving a broad range of diverse problems.
2. They can be translated into common control and data structures provided by most high-level languages.
3. The temporal and spatial requirements of the algorithms which result can be precisely analyzed.

This course will provide a solid foundation and background to design and analysis of algorithms. In particular, upon successful completion of this course, students will be able to understand, explain and apply key algorithmic concepts and principles, which might include:

1. Greedy algorithms (Activity Selection, 0-1 Knapsack Problem, Fractional Knapsack Problem)
2. Dynamic programming (Longest Common Subsequence, 0-1 Knapsack Problem)
3. Minimum Spanning Trees (Prim's Algorithm, Kruskal's Algorithm)
4. Graph Algorithms (Dijkstra's Shortest Path Algorithm, Bipartite Graphs, Minimum Vertex Cover)

Although more than one technique may be applicable to a specific problem, it is often the case that an algorithm constructed by one approach is clearly superior to equivalent solutions built using alternative techniques. This course will help students assess these choices.

Advanced Applied Computer Science

Course Description

Advanced Applied Computer Science is a capstone project, an end-to-end deployable solution to a real-world computational problem that students build in the last

phase of the programme. Its objective is to help students rigorously solve a technically challenging problem where they would apply all of the concepts, techniques and tools learned in the programme. Students typically pick a problem from their specialization after discussing it with the course instructor(s). Students also have the option of working on a real-world problem in their company/organization/institution. They can be mentored by an expert supervisor from their organization along with an academic supervisor from Woolf. All external expert-supervisors and projects need to be approved by the instructor(s) to ensure that the project is technically challenging and the solution being built is rigorous and of high quality. Students start with identifying a technically challenging problem. Once approved by the instructor(s), they start the literature survey to read research papers and technical reports of prior related work. Then, they build the system design and write a design document to solve the problem. This would be followed by designing and implementing individual courses and testing them. This would be followed by deploying the solution and making it available to end users while satisfying the problem's real-world constraints and objectives. Students then document their work into a detailed technical report.

Advanced Back End Development

Course Description

This course provides a dive deep into more advanced concepts in server-side programming using Node.js to enable initiative, real-time and scalable web applications. We dive into threading and thread pools in Node.js and how they can be leveraged to build more responsive web apps. We learn socket programming using socket.io and Node.js for instant messaging, document collaboration, real time analytics and streaming applications. Students also learn to use Caching using distributed in-memory key-value stores (like Redis) to rescue latency while serving web-apps. Students also learn how to use Node.js with popular NoSQL data stores like MongoDB for storing unstructured data. We also cover GraphQL which is an open source data query and manipulation language for APIs, which is gaining popularity more recently. We learn popular protocols like OAuth to enable cross platform logins. Students also learn the architecture and practical aspects of Web-RTC to enable multimedia applications like video-chat, live-streaming, music-streaming etc.

Advanced Cloud Computing

Course Description

This is a course that focuses both on architectural design and practical hands-on learning of advanced cloud-based services. We begin with the serverless computing model and how it is achieved by most cloud providers. We learn to use it for building web applications, data and file processing and analytics applications. We then learn of the architecture of distributed messaging queues and how they can be used for plumbing complex cloud systems with many components and services. Monitoring the resources in your cloud setup is a key to ensure low costs and high availability and the smooth functioning of your overall setup. We learn to use AWS CloudWatch to track various key metrics, trigger alarms, detect anomalous behavior and act upon them in near real-time. We

learn the architecture and design of load balancers and how they play a key role in most horizontally scalable web-applications. Students also learn of the architecture and design of Content delivery networks (CDNs) from Akamai and Amazon. We learn how CDNs can be used to deliver live streaming and website content fast using globally distributed servers and caching. Most of this course involves learning the internal architecture of various cloud systems and using them to solve real world engineering problems.

Advanced Machine Learning

Course Description

This course introduces more advanced ML techniques like ensembles: bagging, boosting, cascading and stacking classifiers and regressors. It covers both the theoretical foundations and applicative details of these techniques along with popular implementations of boosting like LightGBM, CatBoost and XGBoost. Students also delve into kernel methods with specific focus on SVMs for classification and regression. Students will study state of the art model agnostic feature importance and model-interpretability techniques like LIME and SHAP. Students also study classical NLP based text encoding methods like Bag-of-words, TF-IDF etc. The course teaches various classical methods in time series analysis and forecasting like ARMA, ARIMA etc. Students also learn how to pose time series forecasting problems as regression and classification problems to leverage well studied ML techniques. This is followed by various domain and problem specific Feature engineering techniques that are often helpful in real world problem solving. Students will study methods like error analysis, ablative analysis etc., to debug and understand why and where a model is performing well and where it is not performing well. This will further help us in designing appropriate features. Students study model calibration techniques like Platt Scaling, Isotonic Regression etc. Later in this course, we cover how to build recommender systems using content-based and collaborative filtering methods. The course also teaches the detailed solution of the Netflix prize (2009) and various recent advances in RecSys.

Advanced Python Programming

Course Description

Advanced Python Programming builds on introductory programming courses to illustrate object-oriented programming concepts, database design in Python, and the basics of Machine Learning with Python libraries. Students will learn how to solve problems in Python, develop design patterns in Python code, develop internet applications with Python, and collaborate with other students to implement projects. The course introduces advanced features such as decorators and generators, as well as a thorough exploration of the Python development environment.

This course is designed to prepare students for an entry-level developer position.

Applied Computer Science Project

Course Description

This is a project-based course, with the aim of building the required skills for creating web-based software systems. The course covers the entire lifecycle of building software projects, from requirement gathering and scope definition from a product document, to designing the architecture of the system, and all the way to delivery and maintenance of the software system.

The course covers both frontend, which is, building browser-based interfaces for users, using frontend web frameworks, and also building the backend, which is the server running an API to serve the information to the frontend, and running on an SQL or similar database management system for storage.

All aspects of delivering a software project, including security, user authentication and authorisation, monitoring and analytics, and maintaining the project are covered. The course also covers the aspects of project maintenance, like using a version control system, setting up continuous integration and deployment pipelines and bug trackers.

Applied Statistics

Course Description

This course introduces basic probability theory , statistical methods and computational algorithms to perform mathematically rigorous data analysis. The course starts with basic foundational concepts of random variables, histograms, and various plots (PMF, PDF and CDF). Students learn various popular discrete and continuous distributions like Bernoulli, Binomial, Poisson, Gaussian, Exponential, Pareto, log-normal etc., both mathematically and from an applicative perspective. Students learn various measures like mean, median, percentiles, quantiles, variance and interquartile-range. Students learn the pros and cons of each metric and understand when and how to use them in practice. Students will learn conditional probability and Bayes theorem in the applied context of real-world problems in medicine and healthcare. The course teaches the foundations of non-parametric statistics and applies them to solve problems using computational tools. Students learn various methods to determine correlations rigorously in data. This is followed by applied and mathematical understanding of the statistics underlying control-treatment (A/B) experiments and hypothesis testing. The course engages computation tools in modern statics like Bootstrapping, Monte-Carlo methods, RANSAC etc.

Back End Development

Course Description

This is a foundational course on building server-side (or backend) applications using popular JavaScript runtime environments like Node.js. Students will learn event driven programming for building scalable backend for web applications. The course teaches various

aspects of Node.js like setup, package manager, client-server programming and connecting to various databases and REST APIs. Most of these concepts would be covered in a hands-on manner with real world examples and applications built from scratch using Node.js on Linux servers. This course also provides an introduction to Linux server administration and scripting with special focus on web-development and networking. Students learn to use Linux monitoring tools (like Monit) to track the health of the servers. The course also provides an introduction to Express.js which is a popular light-weight framework for Node.js applications. Given the practical nature of this course, this would involve building actual website backends via assignments/projects for ecommerce, online learning and/or photo-sharing.

Business Case Studies

Course Description

A business case study is a course designed for the learner to identify a business real world problem and its objective is to help students rigorously solve a real-world, technically-challenging business problem where they would apply all of the concepts, techniques and tools learnt in the program. Students typically pick a problem from a known business problem or identify business cases where data analytics can be used to solve a problem. The choosing of a topic can be done after discussing it with the course instructor(s). Students also have an option of choosing a business problem in their professional organization but the external supervisors should be approved by the instructor(s). Students start by identifying a business problem and proposing a methodology to solve the said business problem. Students then decide what technical and business tools will be used for the solution methodology. Students will first work on the real-world data, clean and process it using techniques learnt in this program. Students then will use algorithms and approach with a coding language and tool they think will get the best results. At the end of the case study student should be able to present the business problem and solution either via Jupyter notebooks or via a blog.

Computer Systems and Their Fundamentals

Course Description

This core course equips the student with knowledge of database management systems, operating systems and computer networks. At the end of the course, students will have a critical understanding of the architecture of computers and networks, as well as how programs interact with these. Students begin with mapping data storage problems (as they had done in Relational Databases) to understand how data is stored in a distributed network, and related issues such as concurrency. Subsequently, students cover operating systems with an overview of process scheduling, process synchronization and memory management techniques with disk scheduling. The course concludes with computer networks, where we will be discussing all of the computer network layers and their protocols in detail.

Data Engineering

Course Description

Data is the fuel driving all major organizations. This course helps you understand how to process data at scale.

From understanding the fundamentals of distributed processing to designing data warehousing and writing ETL (Extract Transform Load) pipelines to process batch and streaming data.

Students will learn a comprehensive view of the complete Data Engineering lifecycle.

Data Structures

Course Description

This course is aimed to build a strong foundational knowledge of data structures (DS) used extensively in computing. The course starts with introducing time and space complexity notations and estimation for code snippets. This helps students be able to make trade-offs between various Data Structures while solving real world computational problems. The course introduces most widely used basic data structures like Dynamic arrays, multi-dimensional arrays, Lists, Strings, Hash Tables, Binary Trees, Balanced Binary Trees, Priority Queues and Graphs. The course discusses multiple implementation variations for each of the above data-structures along with trade-offs in space and time for each implementation. In this course, students implement these data-structures from scratch to gain a solid understanding of their inner workings. Students are also introduced to how to use the built-in data-structures available in various programming languages/libraries like Python/NumPy/C++ STL/Java/JavaScript. Students solve real-world problems where they must use an optimal DS to solve a computational problem at hand.

Data Visualization Tools

Course Description

This course is aimed to build a strong foundational knowledge of Data Analytics tools used extensively in the Data Science field. There are now powerful data visualization tools used in the business analytics industry to process and visualize raw business data in a very presentable and understandable format. A good example is Tableau, used by all data analytics departments of companies and in data analytics companies in various fields for its ease of use and efficiency. Tableau uses relational databases, Online Analytical Processing Cubes, Spreadsheets, cloud databases to generate graphical type visualizations. Course starts with visualizations and moves to an in-depth look at the different chart and graph functions, calculations, mapping and other functionality. Students will be taught quick table calculations, reference lines, different types of visualizations, bands and distributions, parameters, motion charts, trends and forecasting, formatting, stories, performance recording and advanced mapping.

At the end of this course, students will be prepared, if they desire, to earn such industry desktop certifications as a Tableau Desktop Specialist, a Tableau Certified Associate, or a Tableau Certified Professional.

Deep Learning for Computers

Course Description

This course provides a comprehensive overview of Computer vision problems and how they can be tackled using various Convolutional Neural networks (CNNs). Students start with classical image processing operations like edge detection, convolution, shape detectors and color space conversions. This is followed by a foundational understanding of Deep-Convolutional Neural networks and how their training and evaluation works. We introduce various CNN specific layers like pooling-layers and upsampling layers. We also introduce various Data Augmentation techniques that are very helpful for image-related problems. This is followed by a dive deep into the internals of popular CNN architectures like: AlexNet, VGGNet, ResNet etc. Students also learn how to use these methods practically for transfer learning. Students will study how various computer-vision related tasks like image segmentation, image-generation, object detection and localization, contrastive learning etc., can be performed using state of the art algorithms for each of these tasks. Most of these techniques would be studied directly from the original research papers and open-source code provided by the authors. Students would also implement some of these algorithms from scratch in this course.

Deep Learning for Natural Language Processing (NLP)

Course Description

This course focuses on modeling sequences (text, music, time-series, genes) using deep-learning models. We start with a simple Recurrent Neural Network and its limitations with long-sequences. Students learn LSTMs and GRUs which can handle significantly longer sequences to model sequence data like text, music, gene-sequences and time-series data. We study variations of LSTM like bi-directional LSTMs and encoder-decoder architectures. This is followed by a detailed study of attention mechanism and Transformer based models which are currently the state-of-the-art for NLP and sequence modeling. The course teaches encoder-decoder Transformers, BERT, BERT-variations, GPT-1,2 & 3 models from both the architectural and mathematical viewpoints and also a practical viewpoint. Students learn to implement many of these complex models from scratch (using TensorFlow 2 and Keras) to gain a deeper understanding of how they work internally. Students will study popular applications of deep-learning in NLP like parts-of-speech tagging, question-answering systems, conversational engines (chatbots), Semantic search with low-latency etc. For each of these problems, Students will study cutting edge deep-learning models along with code implementations.

Design and Analysis of Algorithms

Course Description

This is a foundational and mandatory course which aims to build student's ability to apply various algorithmic design methods to provide an optimal solution to computational problems. This course starts with time and space complexity analysis of divide and conquer algorithms using recursion-tree based methods and Master's theorem. Students would also learn about amortized time and space complexity analysis for randomized/probabilistic algorithms. Various algorithmic design strategies would be introduced via real world examples and problems. Students would learn when, where and how to optimally use Divide and Conquer, Dynamic programming (top-down and button-up), Greedy, Backtracking and Randomization strategies with examples. The course uses various practical examples from Array manipulations, Sorting, Searching, String manipulations, Tree & Graphs traversals, Graph path-finding, Spanning Trees etc., to introduce the above algorithmic strategies in action. Students would implement many of the above algorithmic design methods from scratch as part of the assignments. The course also introduces how some of these popular algorithms are readily available via popular libraries in various programming languages.

Design Patterns

Course Description

This course provides a practical understanding of popular object-oriented design patterns so that students can reuse design strategies developed for commonly occurring problems in software development. We begin the course with a revision of object-oriented programming and an overview of UML (unified modeling language) diagrams to represent software design diagrammatically. We then dive into 10-12 most popular design patterns motivating each of them from real world scenarios. We would also showcase multiple open source code bases which use the specific design pattern to solve a real-world design problem. This would help students gain an appreciation of how each of the theoretical patterns they learn actually translate to code. We also take up real world cases and dive into various design patterns that can be used to solve the problem. Sometimes, there could be multiple valid designs. We would five into the pros and cons of each design decision and trade-offs involved. Our objective is to build the problem-solving ability amongst students to recognize the appropriate design pattern to tackle a real-world problem. The course briefly discusses domain specific design patterns in their respective contexts.

DevOps

Course Description

This course provides students with hands-on experience on deploying high velocity applications and services reliably on complex and distributed infrastructure. DevOps as a philosophy is a key driver of the modern software life cycle which prefers rapid and reliable delivery of functionality and features via code. We start with a solid introduction to Linux scripting and networking. Then, we learn popular methodologies to deploy complex and

distributed software like microservices, containerization (Docker) and orchestration (Kubernetes). All of this would be introduced with real world examples from the industry. We also focus on Continuous Integration and Continuous Delivery (CI/CD) methodology and how it can be achieved using popular toolchains like Jenkins. We dive into how automated testing of software can be achieved using libraries like Selenium. This shall be followed by more advanced techniques like serverless-compute, Platform as a service model and Cloud-DevOps. Students would learn to monitor and log key data points to ensure they maintain a healthy system and adapt it as needed. Infrastructure-as-code is a key component of modern DevOps especially on cloud and containerized applications which would also be covered with real-world examples.

Distributed Cloud Computing

Course Description

This course provides an in-depth architectural overview and hands- on experience with building scalable data processing and distributed computing via various cloud systems. We focus a lot on Spark which is one of the most popular and powerful distributed systems to perform petabyte scale data processing. We learn various components of Spark like HDFS, Resilient Distributed Datasets (RDDs), Programming models like Map-reduce. Students also learn SparkSQL and Hive and how they can be used for querying large datastores. We focus on how various services in a cloud (like AWS) can be used together to build scalable data-pipelines for both batch and near real-time processing. We show various examples of real world systems and their architectures from various companies and organizations. We learn how graphX can be used to process large graphs using Spark. Students use AWS Elastic Map Reduce (EMR) for cloud based Spark clusters. We learn the design and architecture of distributed inverted indices and how they can be used for implementing search scalably. Students learn to use ElasticSearch, a very popular distributed inverted index for implementing search functionality on websites and on unstructured data.

Distributed Machine Learning

Course Description

This course provides an in-depth understanding of distributed systems for ML and Deep Learning using CPU,GPU and TPU clusters. It starts with foundations of Map-reduce framework and in-memory distributed and resilient data structures that form the backbone of Spark. Students will learn the architectural details of these distributed system platforms and how they can be leveraged to perform data analysis and model training on petabyte scale datasets. We cover how distributed training is achieved for popular ML algorithms on Spark by understanding the internal working of SparkMLLib. The course then focuses on understanding distributed graph processing using GraphX. Students move on to Deep-Learning algorithms and how distributed algorithms can be designed for them when we have GPU or TPU clusters at our disposal. We also dive deep into how TensorFlow archives distributed computing for popular Deep Learning algorithms. Students will study

distributed data stores and how they can be used for ML using popular datastore systems like Hive and SparkSQL. The course concludes by discussing state of the art distributed, low-latency approximate nearest neighbor algorithms along with their implementations in ElasticSearch.

Distributed Systems with High-Level Design

Course Description

A distributed system is an application that executes a collection of protocols to coordinate the actions of multiple processes on a network, such that all components cooperate together to perform a single or small set of related tasks.

Goals of a Distributed System:

- Transparency -> End user does not know what lies behind and how the system is working internally.
- Scalability - > Refers to the growth of the system.
- Availability -> Refers to the system's uptime.

The course will carefully examine three case studies, with attention to such topics as:

- Basics of High Level System Design and consistent Hashing
- Caching
- CAP Theorem
- Replication and Master-Slave
- NoSQL
- Differences between SQL and NoSQL
- Multi Master
- Apache Zookeeper & Apache Kafka
- Case Study on ElasticSearch
- AWS S3 and Quad Trees
- Design Distributed Crawler
- Microservices and Containerisation
- Hotstar & IRCTC System design

Foundations of Cloud Computing

Course Description

This is a course that focuses both on architectural design and practical hands-on learning of the most used cloud services. The course extensively uses Amazon Web services (AWS) to show real world code examples of various cloud services. It also covers the core concepts and architectures in a platform agnostic manner so that students can easily translate these learnings to other cloud platforms (like Azure, GCP etc.). The course starts with virtualization and how virtualized computer instances are created and configured. Students also learn how to auto-scale applications using load balancers and build fault tolerant applications across a geographically distributed cloud. As relational databases are widely used in most enterprises, students learn how to migrate and scale (both vertically and horizontally) these databases on the cloud while ensuring enterprise grade security. Virtual

private clouds enable us to create a logically isolated virtual network of compute resources. Students learn to set up a VPC using virtualized-compute-servers on AWS. The course also covers the basics of networking while setting up a VPC. Students learn of the architecture and practical aspects of distributed object storage and how it enables low latency and high availability data storage on the cloud.

Foundations of Machine Learning

Course Description

This course focuses on building basic classification and regression models and understanding these models rigorously both with a mathematical and an applicative focus. It opens with a basic introduction to high dimensional geometry of points, distance-metrics, hyperplanes and hyperspheres. Then, it introduces the mathematical formulation of logistic regression to find a separating hyperplane. Vector calculus and gradient descent (GD)-based algorithms are explored to learn to solve the optimization problem, including computational variations of GD like mini-batch and stochastic gradient descent. The course also covers other popular classification and regression methods like k-Nearest Neighbours, Naive Bayes, Decision Trees, Linear Regression etc, to show how each of these techniques performs under various real-world situations like the presence of outliers, imbalanced data, multi class classification etc. Lectures on bias and variance tradeoff and various techniques to avoid overfitting and underfitting are incorporated. Algorithms are taught from a Bayesian viewpoint along with geometric intuition. This course would be heavily hands-on where students apply all these classical techniques to real world problems.

Front End Development

Course Description

This course builds upon the introductory JavaScript course to acquaint students of popular and modern frameworks to build the front end. We focus on three very popular frameworks/libraries in use: React.js, jQuery and AngularJS. We start with React.js, one of the most popular and advanced ones amongst the three. students learn various components and data flow to learn to architect real world front end using React.js. This would be achieved via multiple code examples and code-walkthroughs from scratch. We would also dive into React Native which is a cross platform Framework to build native mobile and smart-TV apps using JavaScript. This helps students to build applications for various platforms using only JavaScript. jQuery is one of the oldest and most widely used JavaScript libraries, which students cover in detail. Students specifically focus on how jQuery can simplify event handling, AJAX, HTML DOM tree manipulation and create CSS animations. We also provide a hands-on introduction to AngularJS to architect model-view-controller (MVC) based dynamic web pages.

Front End UI/UX Development

Course Description

This is a hands-on course on designing responsive, modern and light-weight UI for web, mobile and desktop applications using HTML5, CSS and Frameworks like Bootstrap 4. This course starts with an introduction on how web browsers, mobile apps and web servers work. We then dive into each of the nitty gritty details of HTML5 to build webpages. We would start with simple web pages and then graduate to more complex layouts and features in HTML like forms, iFrames, multimedia-playback and using web-APIs. We then go on to learn stylesheets based on CSS 4 and how browsers interpret CSS files to render web pages. Once again, we use multiple real world example web pages to learn the internals of CSS4. We learn popular good practices on writing responsive HTML and CSS code which is also interoperable on mobile browsers, apps and desktop apps. We would introduce students to building desktop apps using HTML and CSS using toolkits like Electron. We would also study popular frameworks for front end development like Bootstrap 4 which can speed up UI development significantly.

Further Studies in Data Science and Data Analytics

Course Description

This advanced graduate class addresses a unique topic on a rotating basis in order to keep the program at the forefront of scholarly research and industry practice. Every year the academic staff member will approve of a new topic to be covered. The bibliography will contain not less than 8 peer-reviewed articles or scholarly publications reflecting the current topic.

Though the exact topic will vary, the emphasis of this course is practical, domain-specific issues in data science. Topics might include data handling, big data management systems, optimization, sparse signal recovery, principal component analysis, or deeper explorations of text mining, natural language processing, computer vision, or other topics introduced in other courses.

Often, Further Studies in Data Science and Data Analytics will extend, complicate, or otherwise deepen the topic taken on in its predecessor course, Studies in Data Science and Data Analytics, giving students who elect this sequence to develop genuine expertise in a specific domain.

High Dimensional Data Analysis

Course Description

This course is aimed to help learners understand various techniques and algorithms to visualize, analyze and understand high dimensional data which is very common in Data Science and ML. The course starts with linear algebraic methods like Principal Component Analysis (PCA) and SVD (Singular Value Decomposition) for obtaining linear projection of high dimensional data. This is followed by more advanced nonlinear and state of the art techniques like t-SNE and UMAP for visualizing high dimensional data. Each of these

techniques would be covered in full mathematical detail from first principles along with applying them to real world datasets in NLP, Genomics and internet-datasets. Students will also study how PCA and SVD are related to general Matrix Factorization techniques. To analyze and understand high dimensional un-labelled data, students learn clustering techniques like K-Means, Gaussian Mixture models, Hierarchical Clustering and DBSCAN. The course shows how some of the techniques are mathematically related to Matrix Factorization. Students study various outlier detection techniques based on density, proximity, factorization and cluster analysis.

Introduction to Computer Programming: Part 1

Course Description

This course helps students translate advanced mathematical/statistical/scientific concepts into code. This is a course for writing code to solve real-world problems. It introduces programming concepts (such as control structures, recursion, classes and objects) assuming no prior programming knowledge, to make this course accessible to advanced professionals from scientific fields like Biology, Physics, Medicine, Chemistry, Civil & Mechanical Engineering etc. After building a strong foundation for converting scientific knowledge into programming concepts, the course advances to dive deeply into Object-Oriented Programming and its methodologies. It also covers when and how to use inbuilt-data structures like 1-Dimensional and 2-Dimensional Arrays before introducing the concepts of computational complexity to help students write optimized code using appropriate data structures and algorithmic design methods.

The course can be taught to allow students to learn these concepts using a modern programming language such as Java or Python. The course offers students the ability to identify and solve computer programming problems in scientific fields at a graduate level.

The course prepares students to handle advanced data structures and algorithm design methods in the separate course, ‘Data Structures’.

Introduction to Computer Programming: Part 2

Course Description

This course provides a practical and detailed understanding of popular programming paradigms and data storage types. Students learning this will be able to write and solve programming problems. The course starts from the basics about functions, various built in functions and how to code user defined functions. Then students will learn about various data type storages and learn about lists and how various manipulations can be done lists like list slicing and also go through examples of 2D Lists.

While learning how to create functions students have to learn how various results and inputs can be stored using different data types after the introduction and discussion on Lists, students will go through sets, tuples, Dictionaries and Strings.

The student should be well prepared to apply these concepts and build algorithms and software using what they learnt in this course.

Introduction to Deep Learning

Course Description

This course provides a strong mathematical and applicative introduction to Deep Learning. The course starts with the perceptron model as an over simplified approximation to a biological neuron. We motivate the need for a network of neurons and how they can be connected to form a Multi Layered Perceptron (MLPs). This is followed by a rigorous understanding of back-propagation algorithms and its limitations from the 1980s. Students study how modern deep learning took off with improved computational tools and data sets. We teach more modern activation units (like ReLU and SeLU) and how they overcome problems with the more classical Sigmoid and Tanh units. Students learn weight initialization methods, regularization by dropouts, batch normalization etc., to ensure that deep MLPs can be successfully trained. The course teaches variants of Gradient Descent that have been specifically designed to work well for deep learning systems like ADAM, AdaGrad, RMSProp etc. Students also learn AutoEncoders, VAEs and Word2Vec as unsupervised, encoding deep-learning architectures. We apply all of the foundational theory learned to various real world problems using TensorFlow 2 and Keras. Students also understand how TensorFlow 2 works internally with specific focus on computational graph processing.

Introduction to Machine Learning

Course Description

This course focuses on building basic classification and regression models and understanding these models rigorously both with a mathematical and an applicative focus. The course starts with a basic introduction to high dimensional geometry of points, distance-metrics, hyperplanes and hyperspheres. We build on top this to introduce the mathematical formulation of logistic regression to find a separating hyperplane. Students learn to solve the optimization problem using vector calculus and gradient descent (GD) based algorithms. The course introduces computational variations of GD like mini-batch and stochastic gradient descent. Students also learn other popular classification and regression methods like k-Nearest Neighbours, Naive Bayes, Decision Trees, Linear Regression etc. Students also learn how each of these techniques under various real world situations like the presence of outliers, imbalanced data, multi class classification etc. Students learn bias and variance trade-off and various techniques to avoid overfitting and underfitting. Students also study these algorithms from a Bayesian viewpoint along with geometric intuition. This course is hands-on and students apply all these classical techniques to real world problems.

Introduction to Problem-Solving Techniques: Part 1

Course Description

The ability to solve problems is a skill, and just like any other skill, the more one practices, the better one gets. So how exactly does one practice problem solving? Learning about different problem-solving strategies and when to use them will give a good start. Problem solving is a process. Most strategies provide steps that help you identify the problem and choose the best solution.

Building a toolbox of problem-solving strategies will improve problem solving skills. With practice, students will be able to recognize and choose among multiple strategies to find the most appropriate one to solve complex problems. The course will focus on developing problem-solving strategies such as abstraction, modularity, recursion, iteration, bisection, and exhaustive enumeration.

The course will also introduce arrays and some of their real-world applications, such as prefix sum, carry forward, subarrays, and 2-dimensional matrices. Examples will include industry-relevant problems and dive deeply into building their solutions with various approaches, recognizing each's limitations (i.e when to use a data structure and when not to use a data structure).

By the end of this course a student can come up with the best strategy which can optimize both time and space complexities by choosing the best data structure suitable for a given problem.

Introduction to Problem-Solving Techniques: Part 2

Course Description

This course is a follow-up to Introduction to Problem-Solving Techniques: Part 1, and as part of their academic planning process with Woolf staff, students will ordinarily take that course first.

Part 2 deepens the approach to data structures by including such topics as stacks, queues, linked lists, and trees, and discussing in detail real world applications of each approach and their comparative strengths and limitations (i.e when to use a data structure and when not to use a data structure). This course will also include hashing techniques along with recursion and subset problems. This course will have rigorous homework and assignments to support the introduction of more than 4 data structures.

By the end of this course a student can come up with the best strategy which can optimize both time and space complexities by choosing the best data structure suitable for a given problem.

JavaScript

Course Description

This course is a hands-on course covering JavaScript from basics to advanced concepts in detail using multiple examples. We start with basic programming concepts like variables, control statements, loops, classes and objects. Students also learn basic data-structures like Strings, Arrays and dates. Students also learn to debug our code and handle errors gracefully in code. We learn popular style guides and good coding practices to build readable and reusable code which is also highly performant. We then learn how web browsers execute JavaScript code using V8 engine as an example. We also cover concepts like JIT-compiling which helps JS code to run faster. This is followed by slightly advanced concepts like DOM, Async-functions, Web APIs and AJAX which are very popularly used in modern front end development. We learn how to optimize JavaScript code to run on both mobile apps and mobile browsers along with Desktop browsers and as desktop apps via ElectronJS. Most of this course would be covered via real world examples and by learning from JS code of popular open-source websites and libraries.

Low-Level design & Design Patterns

Course Description

Low-Level Design & Design Patterns focuses on modularity and reusability in software design, common design vocabularies, refactoring and how to reduce it, and how to incorporate design patterns into iterative development processes. The course pays significant attention to the interaction between system architecture and components, including data organization.

The course begins with Object-Oriented Analysis (OOA), which is a problems-solving technique that includes: modeling an information design; representing behavior; describing functions; dividing data, functional, and behavioral models to uncover detail; moving from abstraction to implementation details. The course then turns to Object-Oriented Design (OOD), which reduces the analysis model into a modular design for software creation, with subsystems, components, and objects.

The iteration of analysis and implementation will be covered in detail with real-world industry examples.

Mathematics for Computer Science

Course Description

Mathematics and computer science are closely related fields. Problems in computer science are often formalized and solved with mathematical methods. It is likely that many important problems currently facing computer scientists will be solved by researchers skilled in algebra, analysis, combinatorics, logic and/or probability theory, as well as computer science.

This course covers discrete mathematics for computer science and engineering. Topics may include asymptotic notation and growth of functions; permutations and combinations; counting principles; discrete probability. Further selected topics may also be covered, such as recursive definition and structural induction; state machines and invariants; recurrences; generating functions.

Students will be able to explain and apply the basic methods of discrete (noncontinuous) mathematics in computer science. They will be able to use these methods in subsequent courses in the design and analysis of algorithms, computability theory, software engineering, and computer systems. The focus of the course is real-world problems and applications often found in business and industry.

NoSQL Cloud Computing

Course Description

This course provides a comprehensive overview and practical knowledge of various NoSQL data stores and how they can be used on the Cloud (AWS). We focus on three NoSQL datastores in this course: MongoDB, DynamoDB and Redis. For each of them, we first understand the design and architecture in depth. We compare and contrast each of them with traditional relational databases and other NoSQL databases so that students understand the engineering trade-offs when using them. We take multiple real-world case-studies from various companies and organizations to discuss which datastore is more apt in each situation to help students better appreciate the differences and use-cases. We dive into the technical details from setting up and deploying each of these datastores on the cloud (AWS) with latency and scalability in mind. We also discuss various datastore specific optimizations and good practices to follow. The course also teaches students how to stress test each of these datastores under differing loads to compare and contrast which would be a better fit in a real world scenario. At the end of this course, students would be able to choose an optimal data store for their engineering needs to build websites or build data pipelines or deploy machine learning applications.

Numerical Programming in Python

Course Description

This course helps students translate mathematical/statistical/scientific concepts into code. This is a foundational course for writing code to solve Data Science ML & AI problems. It introduces basic programming concepts (like control structures, recursion, classes and objects) from scratch, assuming no prerequisites, to make this course accessible to students from non-computational scientific fields like Biology, Physics, Medicine, Chemistry, Civil & Mechanical Engineering etc. After building a strong foundation, the course advances to dive deep into core Mathematical libraries like NumPy, Scipy and Pandas. Students also learn when and how to use inbuilt-data structures like Lists, Dicts, Sets and Tuples. The course introduces the concepts of computational complexity to help students write optimized code using appropriate data structures and algorithmic design methods. The course does not dive

deep into the data structures and algorithm design methods in this course - that is available in the ‘Data Structures and Algorithms’ course. This course is valuable for all students specializing in mathematical sub-areas of CS like ML, Data Science, Scientific Computing etc.

Power BI for Data Analysis and Exploration

Course Description

Power BI is a Microsoft tool that works on turning unrelated sources of data into coherent, visually immersive, and interactive insights. Input data can be of various formats ranging from spreadsheets to JSON.

Learning this tool will help in working on real time data creating solutions for business with interactive solutions from very unstructured data and reporting with business insights. Students will learn how to handle data sources in Power BI, connecting to various data sources using Power BI, query editors, managing data relationships, and cross filter direction. In Power BI students will learn how to visualize data like map visualizations, funnel charts, waterfall charts. For Data Analysis students will learn different data types in DAX, Syntax used, DAX functions, operators, tables and filters used. Parameter Naming. Power BI is used extensively for report making so students will learn how to report basic servers, web portal, paginated reports, schedule refresh and how to configure schedule refresh, publish to web embedded code. Students will also learn how to use R language and Python on Power BI. Hands-on training with a project will also be dealt with where students will work on real-time industry data and provide reports.

Practical Software Engineering

Course Description

This course gives the detailed overview on how to approach Low Level Design problems with real-world case studies discussed such as Designing a Pen (Mac/Windows), TicTacToe, BookMyShow (most used event booking app, manages millions of users), Email campaign Management System and detailed design of Splitwise.

Product Analytics

Course Description

This course teaches students how to analyze the ways users engage with a service. This method, called product analytics, helps businesses track and analyze user data. Students will learn more deeply what is required to move a product from idea to implementation, through to launch, and then on to iterative improvements. The course teaches how to measure progress, validate or update product hypotheses, and present product learnings.

Also, students will gain experience in making informed decisions, as well as how to present findings and make an analytics-informed business case to win support for a product.

Productization of Machine Learning (ML) Systems

Course Description

This course aims to build the core competency of building real world end-to-end ML systems and deploy them into production for a variety of problems and scenarios. Students would learn a variety of ML systems ranging from high throughput and low latency internet scale systems to low compute power and energy constrained IoT devices like smart watches. Students will study the ML lifecycle and various components in detail. We also use real world ML platforms like Google's KubeFlow, TensorFlow Lite, and Amazon's SageMaker to implement real world systems and understand the engineering trade-offs and challenges. Students also learn relevant technologies and tools like Containerization (Docker) and Container Orchestration (Kubernetes) and Git which are often used extensively in real world scalable ML systems. This course is a hands-on course where we solve multiple real world cases and discuss solutions built by various companies and organizations to provide the students a comprehensive understanding of varied systems and design choices.

Product Management for Software Engineers

Course Description

Every organization is building products to solve the pain points of its customers. Product managers are a critical part of an organization, who make sure that evolving customer needs, and market trends are observed and converted into delightful solutions which help businesses get their outcomes.

In this course, students will get a fundamental understanding of product management practices.

This will give them a comprehensive view of the complete product management life cycle.

Relational Databases

Course Description

This is a core and foundational course which aims to equip the student with the ability to model, design, implement and query relational database systems for real-world data storage & processing needs. Students would start with diagrammatic tools (ER-diagram) to map a real world data storage problem into entities, relationships and keys. Then, they learn to translate the ER-diagram into a relational model with tables. SQL is then introduced as a de facto tool to create, modify, append, delete, query and manipulate data in a relational database. Due to SQL's popularity, the course spends considerable time building the ability

to write optimized and complex queries for various data manipulation tasks. The course exposes students to various real world SQL examples to build solid practical knowledge. Students then move on to understanding various trade-offs in modern relational databases like the ones between storage space and latency. Designing a database would need a solid understanding of normal forms to minimize data duplication, indexing for speedup and flattening tables to avoid complex joins in low-latency environments. These real-world database design strategies are discussed with practical examples from various domains. Most of this course uses the open source MySQL database and cloud-hosted relational databases (like Amazon RDS) to help students apply the concepts learned on real databases via assignments.

Spreadsheets for Data Understanding

Course Description

Spreadsheets for Data Understanding introduces students to the principles and techniques of data cleaning, handling data sets of varying sizes, and visualizing data/data storytelling. Students will also learn the basics of predictive modeling from data sets. These are all introduced through the means of Microsoft Excel, the industry-standard spreadsheet program. Students will learn how to use inbuilt functions, as well as techniques such as creating and modifying pivot tables.

SQL for Data Analytics

Course Description

Structured Query Language (SQL) is key to working with data in relational databases, a task at the core of data science and analytics. In this course, students will learn all the major keywords and clauses used to extract data, best practices for formatting SQL queries, and how to generate meaningful insights from the results.

The focus is at all times on real-world uses of SQL queries, syntax, and expression, to allow students to begin professional-level work as quickly as possible.

Statistical Programming

Course Description

This course focuses on representing statistical techniques in code, and may be conducted in Python, R, or another relevant language. Such languages provide libraries that can handle a wide variety of statistical techniques like linear and nonlinear modeling, classical statistical tests, time-series analysis, classification, clustering and graphical techniques, and are highly extensible.

Learning to work in statistically-oriented programming language environments can equip you with the following skills among many others:

1. An effective way of data handling (using arrays for example) and storing data in a structured manner.
2. Expertise in diverse tools and libraries for Data Analysis
3. Ability to present complex data in a graphical and visual format for easy understanding of the data and further solutions.

Studies in Data Science and Data Analytics

Course Description

This advanced graduate class addresses a unique topic on a rotating basis in order to keep the program at the forefront of scholarly research and industry practice. Every year the academic staff member will approve of a new topic to be covered. The bibliography will contain not less than 8 peer-reviewed articles or scholarly publications reflecting the current topic.

Though the exact topic will vary, the emphasis of this course is practical, domain-specific issues in data science. Topics might include data handling, big data management systems, optimization, sparse signal recovery, principal component analysis, or deeper explorations of text mining, natural language processing, computer vision, or other topics introduced in other courses.

System Design

Course Description

This course is aimed at equipping students with skills to architect the high level design (a.k.a. system design) of software and data systems. We start with some of the good to have properties of large complex software systems like scalability, reliability, availability, consistency etc. The course teaches various patterns and design choices we have to satisfy each of these good to have properties. We then go on to understand key components of system design like load-balancers, microservices, reverse-proxies, content-delivery networks etc. Students learn how each of them work internally along with real world implementations of each. We study various NoSQL data stores, their internal architectures and where to use which one with real-world examples. Students also learn popular data encoding schemes like XML and JSON. We learn how to build data pipelines using batch and stream processing systems. We also work on multiple real world cases on architecting on the cloud using popular open-source libraries and tools. Students will study design documents and high-level-design of popular internet applications and services like video-conferencing, recommender-systems, peer-to-peer chat, voice-assistants etc.

\WOOLF/

MBA Program Handbook

Date of Publication: August 2023

Foreword

This manual has been designed to familiarize you with the policies and procedures that shape the Woolf MBA Program. This manual should not be viewed as complete and is not designed to replace the Woolf Academic Handbook. It is intended to provide information you will need in order to make decisions about your graduate studies and to acquaint you with the administrative requirements, policies and procedures you will be expected to meet that are outside the scope of the Woolf Academic Handbook. This document should thus be used in tandem with the Woolf Academic handbook. Where either manual seems incomplete, you are encouraged to inquire with your Faculty Advisor. For questions beyond the domain of your Advisor you are encouraged to reach out to help@woolf.university.

We hope that your experience within Woolf's program will be fulfilling, stimulating, and engaging. We are excited to welcome you to the Woolf community.

The Mission of Woolf

Woolf exists to promote academic excellence, broaden access to higher education, and guard values that are humane, democratic, and international. Above all, Woolf values freedom of thought, freedom of inquiry, and freedom of expression.

We do this through our commitment to high-quality education and through widening the horizon of opportunity by connecting students with quality academics across the world.

Through Woolf's world-class platform and programs students gain exposure to new ideas, new ways of understanding, and new ways of learning. By uniting exceptional faculty with motivated students, Woolf is able to build an outstanding academic community leading to journeys of intellectual transformation. From this we hope that students will share their academic, intellectual and other talents in serving their communities across the world.

Woolf is guided by the following tenets:

Background. Talent may be evenly distributed but opportunity is not – we are working to widen the horizon of opportunity by connecting students and teachers across the world.

Education. Woolf prioritizes an education that will serve its students both in the near-term and in the long-term. Woolf seeks to provide a personalized, bespoke education. In all fields, Woolf seeks to instill values of curiosity, intellectual discipline, and clarity of expression.

Research. Woolf prioritizes research-driven teaching that uses the latest academic scholarship, and Woolf encourages its students to engage in groundbreaking research.

Society. Woolf encourages partnerships with governments, educational institutions, research centers, schools, and businesses of all kinds – provided these partnerships do not infringe on the values of Woolf.

Technology. To the extent that existing or new technologies can improve the educational outcomes for students, widen access to the Woolf global network, improve the career experience of academics, better secure credible governance, lower the costs of institutional management, and generally support the mission of Woolf – these are embraced.

In all things, Woolf values excellence and measures itself against the highest international standards. Woolf seeks to raise those standards further.

Academic Program Information

Program Description

The Masters in Business Administration (MBA) is a 45-credit program that includes 14 online courses. Students may choose to receive a general MBA or may specialize in one of the following areas: Data Analytics, Marketing, Finance, International Business, Executive Leadership, Product Management, Technology Leadership, Occupational Health and Safety. The program is an integrated, sequential course of study in which students obtain and demonstrate the knowledge and skills required to be business leaders. The program is broken down into three segments: short courses, long courses, and a capstone project - the Digital Action Program for Business Administration.

The MBA program is structured to include coursework which teaches students comprehensive and specialized subjects in business administration, with an emphasis on skills in critical thinking and strategic planning for changing and fast-paced environments. Graduates will leave the program with a deep understanding of financial and operational analysis and core competencies in decision making and communication techniques to interface and lead across a variety of business landscapes.

The curriculum emphasizes problem-solving skills, critical thinking and data-based decision making through analytics, computational methods, and modeling. Our graduates are prepared to lead through advanced knowledge in management techniques, execution of organizational strategy in both financial and non-financial objectives, and through formulating research-based solutions methodology in practical problems in incomplete environments.

Courses include instruction targeting the areas above as well as and other relevant learning goals, opportunities for repeated practice, and methods for students to demonstrate their accomplishment of the outcomes. Students demonstrate their competence by completing a culminating project capstone, in which students are grouped into cohorts and must work together on a real business problem.

The MBA is delivered completely digitally by combining asynchronous components (lecture videos, readings, and written assignments) and synchronous cohort meetings attended by students and an instructor or faculty member during a video call.

The asynchronous components support the schedules of students from diverse work-life situations, and synchronous meetings provide accountability, motivation, and a sense of community presence for students. The synchronous sessions allow unparalleled access to high quality instruction and enhanced collaboration among students through using face-to-face online interaction.

Faculty conduct live office hours with students and interaction between faculty members and students, both individually and as a group, is enhanced in the online environment by blending asynchronous content with real-time student responses. Faculty and enrolled students have 24/7/365 access to technical support through Woolf's support system.

Woolf's digital campus allows students to complete the program in as little as 50 weeks of continuous study or within 5 years as part of a part-time course of study. The

degree on the students' transcripts is a Master's in Business Administration, which attests to their completion of the requirements.

Admission Requirements

The Woolf MBA is a fast-paced, rigorous degree focused on teaching comprehensive and specialized subjects in business administration. Candidates should have a bachelor's degree and at least 3 years of post-graduation experience, including management or supervisory experience, or have at least 7 years of executive business management experience with at least some undergraduate level courses or an associate's.

English language competency at an IELTS 6.5 or equivalent is required of all applicants.

The program is suited for executives and general business managers in organizations of all sizes and types, or for those who will soon move into such management positions. It is designed for those that will have responsibility for planning, organizing, and directing business operations.

In all cases, the target group should be prepared to pursue substantial academic studies.

Curriculum Areas

The program is organized into a course structure of three tiered areas. Each tiered area sequentially builds off of the previous, so students must complete each tier before advancing to the next.

Each course consists of regular lessons and cumulative lessons devoted to cumulative examination. Each course requires about 75 hours to complete (see individual courses for details). A full-time student completes two lessons per week with an assignment submitted for each lesson; this pattern continues for each regular lesson in the class.

Summative examination lessons allow an appropriate amount of time for students to review and revise their prior work and deepen their synthetic grasp of the materials in preparation for cumulative examination or project.

The degree has a capstone project consisting of the Digital Action Program, in which students are grouped into cohorts and must work together on a real business problem. The capstone represents a synthesis of knowledge and skills gained throughout the graduate program. Over the course of the capstone, students use multidisciplinary approaches to perform critical analyses of real business issues in situations of uncertainty and incomplete information and develop an actionable solution, which is presented and assessed at the end of the capstone.

Short Course Foundational Learning (15 Credits): 10 short courses which provide fundamental business knowledge and understanding, including areas like creative innovation, business finance and economics, strategic thinking and business leadership and strategy.

Long Speciality Courses (15 Credits): 3 advanced long courses focused on methods and strategies for an advanced understanding of iterative product development, customer engagement and defining "product/market fit."

Digital Internships and Case Studies (15 Credits): The Digital Action Program culminating feature that provides students with hands-on learning in a real-world business

consultancy engagement and a focus on applying what they have learned earlier on in the program for real-world application among leading business professionals.

Learning Outcomes

The program teaches students comprehensive and specialized subjects in business administration; it develops skills in critical thinking and strategic planning for changing and fast-paced environments, including financial and operational analysis; and it develops competences in leadership, including autonomous decision-making, and communication with employees, stakeholders, and other members of a business.

Knowledge

- Students will have a comprehensive knowledge and understanding of organizational structures, management techniques, business models, and methods of market entry, and improving product metrics
- Students will gain specialized knowledge, including knowledge which is at the forefront of the field related to the above
- Students will be able to analyze the societal, regulatory, and political contexts in which business gets done from a local and global perspective.
- Students will be able to formulate and execute on organizational strategy to achieve financial and non-financial objectives.
- Students will be able to apply marketing methods used by businesses to create value for shareholders and selected customers and consumers.
- Students will display original thinking on the basis of the knowledge they gain in the course

Skills

- Develop advanced, innovative, and multi-disciplinary problem-solving skills
- Communicate business plans clearly and unambiguously to specialized and non-specialised audiences
- Develop advanced abilities related to operational procedures and implement them in response to changing environments
- Critically evaluate alternative approaches through analytics, computational methods, and modeling on the basis of academic scholarship and case studies, demonstrating reflection on social and ethical responsibilities
- Formulate business judgments and plans despite incomplete information by integrating knowledge and approaches from diverse domains including anthropology, ethnography, and sociology.
- Inquire critically into the theoretical strategies for executing a business plan
- Develop new skills in response to emerging knowledge and techniques and demonstrate leadership skills and innovation in complex and unpredictable contexts

Competences

- Formulate research-based solutions to practical problems in environments of incomplete information
- Manage decisions with autonomy in complex and unpredictable environments

- Organize projects and people in a way that is responsive to changes in the wider business environment
- Demonstrate learning skills needed to maintain continued, self-directed study

Faculty

All instruction is provided by competent academics with qualifications commensurate to their role. All teachers are also expected to have relevant teaching experience in the domain of their expertise. All faculty members at Woolf are expected to be in possession of a research doctorate in the domain of their teaching or supervision; moreover, they are expected to have a record of research or a research agenda reflecting the capacity for research.

Woolf uses clear, fair, and transparent processes for teaching recruitment, conditions of employment, and professional advancement. Notices of availability are publicly listed on the Woolf platform and, when available, other sites visited by academics. Criteria for teaching positions, including any associated conditions of ongoing employment, are clearly stated. Applications for teaching are reviewed by the Administrative Board, or a committee of the Board, until a position(s) is filled. Notices state the supporting documentation required as evidence for the review of an applicant. All applicants are required to demonstrate their competence for the teaching position by providing a copy of their credentials to be verified before the position is filled. This policy applies to all teaching roles of Woolf Education Ltd, including any teaching services provided by third party vendors, which are subject to the same process of review. In all cases, the final decision for filling a role in accordance with the criteria stated on the public notice is made by the Administrative Board.

Woolf's policies and procedures apply consistently to full-time, part-time, *ad hoc*, and third-party teaching activities. All teaching activities fall within the scope of Woolf policy. Teaching staff, including part-time or *ad hoc* teaching staff are directed towards updates and developments in their field as well as the methodological requirements for their programs.

All Faculty Members are encouraged to discuss innovative forms of teaching, formulate how these may be implemented, and propose those implementations in the Faculty Council. At the end of all courses, students provide feedback on their learning experience, and twice per year faculty provide feedback by survey. All teachers are expected to maintain a record of student outcomes, and teaching activities are periodically reviewed or observed. In cases of disagreement, or suspected misconduct, fraud, or prejudice, a Red Flag should be submitted under the Red Flag Procedure.

All courses and programs are subject to processes of quality enhancement to improve student outcomes, including the course's continued review to assess its scholastic rigor and value.

Faculty Requirements

Academic Staff are called Faculty members at Woolf. Faculty members at Woolf must possess a research doctorate and are expected to have a record of peer-reviewed research. All teaching is under the authority and oversight of a faculty member – including instructional design, synchronous meetings, and lectures. In cases where pre-recorded lectures or podcasts are provided that contain content from outside of Woolf, any such content is to be produced by lecturers who are experts with a research doctorate in the

relevant domain, or where relevant, by those with at least 7 years of industry-specific experience.

Teaching Staff are called Expert Instructors, Domain Experts, or simply Instructors. Expert instructors are used in courses to provide domain-specific industry insights, including insights and feedback on student work during synchronous meeting sessions. Expert instructors must have management experience and be in possession of at least a master's level qualification. Expert instructors are under the direct authority of the Faculty Members and must be trained in Woolf's pedagogical methods.

Faculty Advisors

Colleges at Woolf exist to support their members and provide helpful resources to students.

In the tradition of Harvard's "Houses" and Oxford's "Colleges", Woolf provides every student with membership in a Woolf college for support during their academic journey. Every student should be assigned a Faculty Advisor, who is a faculty member from within the student's own college, and who acts as the first point of contact for non-technical academic issues related to the student's progress, particularly where these may benefit from an independent point of view. Students are strongly encouraged to meet with their advisors at least once each semester.

Thus every faculty member oversees their own registered students through the normal synchronous teaching sessions, and office hours, and additionally provides availability that can be booked for advisees, should the need arise.

Program Outline

Outline of Program		
Course Title	**Credits**	**Course Description**

1. Business Accounting, Finance, and Economics	1.5	This course covers core concepts in accounting, finance, and microeconomics relevant to running a business.
2. Business Marketing and Operations	1.5	This course explores the key concepts of marketing and how they fit into the larger context of management strategy and operational decisions. It presents both the practical “how” and the fundamental “why” of marketing activities in the light of contributions from behavioral science, economics, and statistics.
3. Business Leadership and Strategy	1.5	This course examines how leaders can most effectively use the resources of their team members to achieve business outcomes. The course develops managerial and leadership competences, focused on how key improvements in the general strategy and techniques of managing people can produce outcomes more significant than isolated improvements to employee performance.

4. Business Negotiations	1.5	This course focuses on a broad array of negotiating skills to implement business solutions - including advanced knowledge of negotiation models, the competence to select the right strategy, and the tactical skills to achieve desired outcomes through negotiation.
5. Evidence-Based Decision-Making	1.5	In this course students will strengthen their capacity to lead individuals, teams, and organizations in processes that generate data-driven solutions to problems, data-driven insights into customer behavior, and data-driven decision-making.
6. Integrative and Strategic Thinking	1.5	In this course students will gain the capacity to understand how firms work in a global context, incorporating a broad, future-oriented, systems-based approach that incorporates data, information and insights from diverse perspectives and sources.

7. Effective Managerial Communication	1.5	The course scrutinizes and analyzes managerial communication skills required for leadership in a wide variety of industries. It considers the varied means of communications - writing, speaking, calling – and generally appearing professional. The communication requirements of different contexts are studied, including informational, persuasive, and relational forms of communication.
8. Reflective Leadership	1.5	In this course students will deepen and cultivate their capacity to reflect continually on their learning and growth; they will examine the ways in which one's behaviors and decision-making impact others, with a goal of leading with integrity.
9. Working with Others	1.5	This course teaches business managers and leaders to reflect critically on concepts from the behavioral sciences that can be applied to a fast changing business environment to improve their abilities to lead and manage in organizations.

10. Creativity and Innovation	1.5	In this course students will develop specialized and multidisciplinary capacities to generate creative solutions and to lead processes that stimulate and manage creativity in a business.
11. Leading People, Teams and Organizations: Organizational Theory	1.5	This course examines how leaders can most effectively use the resources of their team members to achieve business outcomes. The course develops managerial and leadership competencies, focusing on how key improvements in the general strategy and techniques of managing people can produce outcomes more significant than isolated improvements to employee performance. The course provides students with concepts to support them across their careers as they continue to develop effective delegation, management strategy, and engagement with people inside of an organization.
12. Ethical Issues for Managers	1.5	In this course, students examine how organizations, and individuals within them, can deal with ethical issues and dilemmas at the collective and personal levels. Throughout the course, students will gain skills related to elements of ethical decision-making, the psychological aspects related to business ethics, and ethics in the global marketplace. The course will focus on how business leaders can make ethical decisions, skilfully manage ethical issues in the workplace, and help encourage ethics in a variety of organizations.

13. Financial Accounting and Reporting	1.5	The objective of this course is to help students become intelligent readers of the financial reports of most publicly traded companies. Students will learn the development, analysis, and use of these reports by focusing on what these reports contain, what assumptions and concepts accountants use to prepare them, and why they use those assumptions and concepts. A solid understanding of the fundamentals covered in this course should enable students to do well in more advanced finance and accounting courses and to interview intelligently for jobs in finance, consulting, and general management.
14. Strategic Economics	1.5	This course explores basic economic principles (theories and applications) that are relevant to a variety of businesses. The course emphasizes an economist's mindset and amasses the tools necessary to do so, including the study of microeconomics and macroeconomics.
15. Marketing Strategy	1.5	This course addresses how to design and implement the best combination of marketing efforts to carry out a firm's strategy in its target markets. Specifically, this course helps to develop the student's understanding of how the firm can benefit by creating and delivering value to its customers, and stakeholders, and develop skills in applying the analytical concepts and tools of marketing to such decisions as segmentation and targeting, branding, pricing, distribution, and promotion.

16. Statistics and Data Analysis	1.5	The course addresses modern methods of data exploration (designed to reveal unusual or problematic aspects of databases), the uses and abuses of the basic techniques of inference, and the use of regression as a tool for management and for financial analysis. The potential ethical issues related to each topic will be reviewed. Socially and environmentally relevant data will be utilized throughout the course.
17. Technology and Operations Management	1.5	This course enables students to develop the skills and concepts needed to ensure the ongoing contribution of a firm's operations to its competitive position. It helps them to understand the complex processes underlying the development and manufacture of products as well as the creation and delivery of services. Throughout the course, students will receive a comprehensive overview of technology utilization to drive a competitive advantage for company operations. Students explore various technology solutions for business process automation, including value proposition analysis across organization functions.
18. Supply Chain Management	1.5	This course considers management of a supply chain in a global environment from a managerial perspective. The focus is on analysis, management, and improvement of supply chain processes and their adaptation to the electronic business environment. The course focuses on six topics: Inventory and Information Management; Distribution and Transportation; Global Operations; Supplier Management; Management of Product Variety; and Electronic Supply Chains. Several new concepts including Prognostic Supply Chains, Build-to-Order, Collaborative Forecasting, Delayed Differentiation, Cross Docking, Global Outsourcing, and Efficient Consumer Response will also be discussed. At the end of the course, a student will have the necessary tools and metrics to evaluate a current supply chain and recommend design changes to supply chain processes

19. Data Analytics and Modelling	5	The objective of this course is to provide students the basic data analysis and modeling concepts and methodologies using probability theory. Basic statistics concepts and probability concepts will be covered. Fundamental data analysis and hypothesis techniques will be covered. Further data modeling methodologies such as Hidden Markov Models and Bayesian networks will be introduced.
20. Marketing Analytics	5	Throughout the course, students will study various tools for generating marketing insights from data in such areas as segmentation, targeting and positioning, satisfaction management, customer lifetime analysis, customer choice, product and price decisions using conjoint analysis, and text analysis, and search analytics.
21. Python for Business Analytics	5	This course introduces students to one of the world's most widely used and in-demand programming languages and its specific applications to business analytics. Python is used in a wide range of fields, including web development, data science, fin-tech, health care, and more. With Python, business leaders can scrape online sources to determine consumer sentiment, automate tasks, run advanced models, and export code across different applications.

22. Decision Making with Business Analytics	5	Throughout the course, students will strengthen their capacity to lead individuals, teams, and organizations in processes that generate data-driven solutions to problems, data-driven insights into customer behavior, and data-driven decision-making. This course provides the foundations of probability and statistics required for a manager to interpret large quantities of data and to make informed decisions under conditions of uncertainty, with incomplete information, and in both structured and unstructured settings. Theoretical topics include decision trees, hypothesis testing, multiple regression, Monte Carlo simulation, and sampling and estimation.
23. Business-to-Business Marketing	5	This course provides a managerial introduction to the strategic and tactical aspects of business marketing decisions and marketing channel strategy. Students examine the strategic concepts and tools that guide market selection, successful differentiation in business markets, and supply chain management. Students will examine how product and service decisions are designed to deliver the B2B value proposition, how pricing captures customer value, how value is communicated to and among customers, and how marketing channels are used to make this value accessible to target customers. Additionally, students will compare and contrast how the strategic and tactical processes of developing and managing value-generating relationships differ between B2B and B2C markets. Moreover, students will also gain an understanding of how to manage channel power, conflict, and relationships.

24. Service Marketing and Management	5	Services marketing is often viewed in terms of outcomes, but services marketing is also an ongoing analytic process. In this course, students will learn how to properly analyze frameworks, tools, channels, data sets, customer behavioral data, decision-making factors, and strategies that support broader marketing decisions. Throughout the course, students will build on basic marketing concepts and apply them to service industry settings.
25. Global Brand Strategy	5	This course examines specific issues involved in building and managing global brands in such a way that they contribute to shareholder value. Throughout this course, students will develop skills related to building strong global brands; developing marketing mix strategies that are an effective combination of global standardization, local adaptation, and worldwide learning; and managing global brands.
26. Financial Statements Analysis	5	This course is designed to prepare students to interpret and analyze financial statements for tasks such as credit and security analyses, lending and investment decisions, and other decisions that rely on financial data. Throughout the course, students will explore in greater depth financial reporting from the perspective of financial statement users. Students will develop a sufficient understanding of the concepts and recording procedures and therefore will be able to interpret various disclosures in an informed manner. Additionally, students will learn how to compare companies financially, understand cash flow, and grasp basic profitability issues and risk analysis concepts.

27. Investment Strategies	5	Throughout this course, students will learn the basic concepts of needs analysis, investment policy, asset allocation, product selection, portfolio monitoring and rebalancing. Students will assess the various types of institutional investors, including pension funds and insurance companies and develop skills related to the client management life cycle and portfolio management as a process. The course will address the basic concepts, principles, and the major styles of investing in alternative assets. Additionally, students will learn about the impact of digitization on investment strategies and the issues related to performance measurement, transaction costs and liquidity risk, margin requirements, risk management, and portfolio construction.
28. Global Finance and Emerging Markets	5	This course develops the foundations for financial decisions in a global economic environment. It concentrates on four areas: markets, tools, investments, and corporations. Students will become familiar with the benefits of international diversification in investment strategies. Additional topics include the valuation of international investments and analysis of the functioning of international financial markets and institutions.
29. Financial Crisis and Risk Management	5	Throughout this course, students will develop the analytical tools necessary to understand crisis prevention and management, and risk management. The properties and characteristics of risk management techniques will be analyzed and related to corporate and sovereign default risk, hedging and trading strategies, regulation, and assessing financial stability and systemic risk. Emphasis will be put on applying these techniques to problems emerging in the marketplace.

30. International Business Environments	5	This course explores the international business environment in which organizations operate. Throughout the course, students will examine the structure and features of international markets, how organizations engage with these markets, and how they respond to their complexities. Students are introduced to useful theoretical and analytical frameworks that are crucial to understanding the opportunities and risks derived from the political, economic, social, technological, and institutional environment of countries.
31. Leadership and Corporate Accountability	5	In this course, students learn about the complex responsibilities facing business leaders today. Through cases about difficult managerial decisions, the course examines the legal, ethical, and economic responsibilities of corporate leaders. It also teaches students about management and governance systems leaders can use to promote responsible conduct by companies and their employees, and shows how personal values can play a critical role in effective leadership.
32. Social Entrepreneurship	5	This course provides students with the skills to develop in-depth insights into economic and social value creation across several areas, including poverty alleviation, energy, health, and sustainability. Through case studies, lectures, and discussions, students will learn to think strategically and act opportunistically with a socially-conscious business mindset.

33. Inclusive Leadership	5	This course addresses multiple aspects of team dynamics and structure, with a focus on the organizational intelligence needed to lead and manage diverse organizations in a varied marketplace. Theories of organizational behavior, social psychology, and anthropology are critically discussed in relation to real-world scenarios.
34. The Business of Social Change and Innovation	5	This course is designed to provide students with the skills and knowledge to influence and lead social impact in business and impact contexts. By the conclusion of this course, students should have a strong foundation in social impact and social change, including approaches to funding impact, scaling programmes, and interventions, public-private partnerships, corporate engagement, impact investment decision-making, blended capital, and approaches to intentional impact.
35. Inspiration and Product Creation	5	This course provides students with advanced methods and frameworks for understanding customer needs, and for translating those needs into a program of research and product development that can be used to create a successful new product or service. It equips students with skills to generate new product hypotheses, to research the potential of a new product or entrepreneurial venture, and to adjust the product offering to fit the needs of customers. This course instills the all-important distinction between a ‘bright idea’ and a ‘business opportunity’ in new product creation.

36. Implementation and Product Introduction	5	This course provides students with advanced methods needed to understand how a product will fit into a competitive market, and how to introduce the product into that market. This includes advanced research on the receptiveness of a market to the new product, as well as strategies for defining and finding the market that will be most receptive to the product.
37. Measurement and Product Adoption	5	This course examines iterative product development as a method for improving customer adoption and retention. Students will gain a mastery of iterative product development as a strategy for (a) transforming market research into potential solutions, (b) testing hypotheses about product improvements, and (c) gaining validation for product adjustments.
38. Enterprise Risk Management	5	This course provides an introduction to the main areas of Enterprise Risk Management. This course also covers Risk Management processes and strategies. Numerous case studies from various business sectors will illustrate the increasing importance of Enterprise Risk Management.

39. Health, Safety, and Leadership Essentials	5	This course has been designed to foster a strong safety culture by disseminating safe behaviors throughout the organization, with a strong focus on leadership development at all levels.
40. Strategic Project Management and Implementation	5	The purpose of this course is to give learners an opportunity to integrate all the knowledge from their programme of learning by developing a project in which they plan and implement a new product, service or process. Learners need to take a full and active role in all aspects of the project, and the selection of an appropriate management issue is crucial to success. Learners will cover a full range of management activities and roles, including resource and people management and implementation of change. The result needs to be a substantial report in a style appropriate for consideration by senior management.
41. Introduction to Strategic Healthcare Management	5	This course is aimed at providing business-related knowledge in healthcare management. The course prepares learners with a core understanding of the various issues of health programs and systems with good operative business processes along with a deep understanding of the quality leadership required in the healthcare industry and ensuring good healthcare financial management principles.

42. Operations Management in Global Healthcare	5	This course will help learners develop specialized knowledge and domain expertise in efficient management of a healthcare services center in a global context. The course also helps learners develop an awareness of problems confronted by organizations and businesses in the global healthcare sector and also equips learners with a definitive idea of change management and lean operational tools required for analyzing and improving healthcare processes.
43. Digital Action Program for Business Administration	15	The Digital Action Program for Business Administration provides a capstone course in which students deepen and apply their learning through a 'Digital Action Program' (DAP). In the DAP, students are grouped into cohorts (typically five students) and must work both individually and together on a specific, real, contemporary business consultancy problem, normally proposed by a cooperating organization (corporation or non-profit), which results in a comprehensive solution proposal. This provides students with a real world business consultancy engagement, and the opportunity to produce, both individually and as a team, a substantial piece of relevant, scholarly, and actionable research, to be presented directly to stakeholders in the cooperating organization.

Assessment and Grading

General Procedures

Academic assessment at Woolf is of two kinds: regular and cumulative. Regular assessment applies to the continuous evaluation of student progress, concentrating on the proficiency of submitted assignments, and the ability of the student to respond to issues raised by the instructor during an instructional session. Cumulative assessment applies to the final project assignment. This requires the students to deepen and extend the scholarly engagements initiated in their prior work.

Students who fail any one course of the degree, cannot progress to complete the degree, except by approval of the College Dean or College Academic Committee. Failed

courses may be retaken at the approval of the College Dean or College Academic Committee, or by appeal, at the discretion of the Quality Assurance, Enhancement, and Technology Alignment Committee (QAETAC). For more information about QAETAC please see the Woolf Academic Handbook.

Cumulative Examination of Courses

Traditionally, cumulative examination of courses is by a submitted final project in the form of a long assignment.

The long assignment is meant to synthesize, deepen, and extend the learning outcomes of the regular lessons while introducing new material and insights. Not more than 50% of the long assignment may be material taken from other assignments. The topic of the assignment must be agreed in advance with the instructor. Examination assignments are expected to be completed at a high research standard, and must be well-structured, well-crafted, and contain appropriate citations to the primary and secondary literature of the course.

Mode of Teaching and Assessment

The Online Campus

Woolf University's courses are offered almost exclusively through its proprietary learning platform. The platform supports both asynchronous and synchronous modes of learning. The asynchronous portion of programs includes structured course materials that the course lead and course instructors prepare ahead of time. These courses are done independently of students' classmates and according to the student's own schedule, but prior to the synchronous sessions. Synchronous sessions are held in the "virtual classroom," where students and faculty use internet technology such as video conferencing and web cameras to ensure they are actively engaged in the learning process. It is essential for students to connect with each other, share information, and create professional networks and relationships as they would in a traditional program or within a professional setting. For information about the technical specific requirements please see the Technical Requirements section within the Woolf Academic Handbook.

Structure of the Courses

The MBA combines asynchronous components (lecture videos, readings, and written assignments) and synchronous meetings attended by students and an instructor or faculty member during a video call.

Asynchronous components support the schedules of students from diverse work-life situations, and synchronous meetings provide accountability and motivation for students.

The program is composed of multiple short foundation courses, extended specialist courses, and a capstone project – the Digital Action Program for Business Administration.

Each short foundation course, and the extended specialist courses, consists of regular lessons and cumulative lessons devoted to summative examination. Each short

foundation course requires 75 hours of learner time to complete, and each extended specialist course requires 250 hours to complete.

As is typical for synchronous teaching, the student will compose one assignment (such as a report, 1,000 word essay, financial model, or presentation) per lesson, which is the topic of meeting discussion. A full-time student completes two lessons per week with an assignment submitted for each lesson; this pattern continues for each regular lesson in the course.

Summative examination lessons allow an appropriate amount of time for the student to review and revise his or her prior work and deepen their synthetic grasp of the materials in preparation for cumulative examination or project.

The degree has a capstone project consisting of the Digital Action Program, in which students are grouped into cohorts and must work together on a real business problem. Over the course of the capstone, students use multidisciplinary approaches to perform critical analyses of real business issues in situations of uncertainty and incomplete information and develop an actionable solution, which is presented and assessed at the end of the capstone.

Contact Hours

For the breakdown of hours, consult the Pedagogical Procedures and Assessment sections.

Students engage in 8 synchronous meeting sessions in which questions and answers about asynchronous study materials are addressed.

Synchronous meeting engagements include not only 60-75 minutes of intensive contact time between the students and faculty member in every lesson (up to twice per week), but also extends beyond the synchronous meeting session itself to include ongoing supervisory support on an ad hoc basis (typically by email or brief virtual meeting). Students are closely supervised by asynchronous direction, oversight, feedback, and guidance; and occasionally new handouts or other scholarly materials are provided to follow up on issues raised in a synchronous meeting discussion. Thus, on our calculation, we allocate four further hours of contact time beyond the synchronous session to capture the individual, personalized, intensive, bespoke form of guidance that a student receives. We calculate all other forms of contact time at a 1:1 ratio, including lectures, whether delivered synchronously or as pre-recorded videos or podcasts.

Example regular lesson Breakdown

* = contact hours = 66

† = assessment hours = 1.25

Hours	**Activity**
1.25*†	synchronous session
4*	Time under the direction and control of a tutor
1.5*	Lecture videos or podcasts

8.25	Independent reading & note-taking
7.5	Assignment composition
22.5	**Total**

Pedagogical Procedures

The MBA will be delivered using online and blended learning techniques, which support a variety of teaching and learning methods, including the following:

- synchronous meetings;
- assigned lectures by video or podcast;
- assigned readings;
- handouts delivered electronically;
- digital material, including slideshow presentations and other assigned media provided in course packets and by weblink.

The core pedagogical method used in this course will include synchronous meetings between a faculty member, or a subject expert instructor under the oversight of a faculty member, and a small group of students. Student interaction plays a key role in the organization of each synchronous meeting, which focuses on a discussion of a student's pre-submitted assignment.

Online delivery, although identical in content for an in-person session, provides significant advantages to students in terms of accessibility – students can more easily reach academic experts across borders and more easily integrate study within the pattern of their own life or career. Further advantages of the online delivery include the digital quality assurance techniques outlined within the Academic Handbook.

Preparing for a single synchronous meeting requires about 21.25 hours. A representative workload consists of the following: students must review about 100 pages of reading material (or equivalent video content, audio content, or interactive content) and prepare a piece of written work of 2-4 pages in response to a specific set assignment question. Before the start of the synchronous session, this work is submitted to the instructor for review.

Every student must then be prepared to discuss and defend his or her written work directly with the instructor (who is an expert in the field) and the other students for up to 75 continuous minutes. Faculty members and subject experts seek to deepen the students' understanding of the material and probe aspects of the written assignment that may benefit from clarification, revision, or further exploration.

At the end of the synchronous session, the instructor provides the student with feedback on the meeting assignment, including a mark, and provides bespoke guidance for the next assignment. Students are provided with a curated reading list from the instructors, assigned pre-recorded lectures, and a research question to guide the organization of their next synchronous meeting assignment or assignment. Engaging in this activity twice per week is a full workload of about 45 hours.

The synchronous meeting system is designed to be mentally demanding and personally engaging. The pedagogical style is known for producing high-quality domain-specific learning outcomes because students must learn assigned materials and related case studies for themselves, before presenting their work to an instructor in their own words for discussion twice per week. By requiring students to describe and analyze topics in their own words, synchronous meetings engage and extend a student's existing range of abilities.

The synchronous method is also known for producing high-quality domain-agnostic learning outcomes because students must be prepared to organize and present their perspective on an assignment twice per week, and be prepared to think analytically and creatively about what they have done. Students must learn to present their viewpoint, even while being prepared to adopt a new position in light of the evidence and under the questioning of the teacher.

Assessment

General Procedures

For the MBA, assessment is of two kinds: regular assessment and summative assessment.

Regular assessment applies to the continuous evaluation of student progress, concentrating on the proficiency of submitted assignments, and the ability of the student to respond to issues raised by the instructor during a synchronous meeting session.

Cumulative assessment applies to the final project assignment. This requires the students to deepen and extend the scholarly engagements initiated in their prior work.

Students who fail any one course of the degree, cannot progress to complete the degree, and will by default fail the MBA. Failed courses may be re-taken at the discretion of Woolf's Faculty Members.

Cumulative Examination of courses

For each course, a percentage of the grade derives from the average of the regular assignments, and a larger percentage of the grade derives from the cumulative examination. The cumulative examination of courses is by a submitted final project in the form of a long assignment.

The cumulative examination/long assignment is by summative assignment (3,000 word essay, or similarly-sized financial model, or presentation), which must synthesize, deepen, and extend the learning outcomes of the regular units while introducing new material and insights. Not more than 50% of the long assignment may be material taken from synchronous meeting assignments. The topic of the assignment must be agreed in advance with the faculty member and subject matter experts. Examination assignments are expected to be completed at a high research standard, and must be well-structured, well-crafted, and contain appropriate citations to the primary and secondary literature of the course.

Grading Progress

Students receive grades and feedback on each assignment throughout a course. Depending on the specific course, students may receive both a grade and a written or audio comment from an instructor. Courses display the weight assigned to each grade-bearing category (such as regular assignments, attendance, and/or final projects). Students have

access to their grade book at all times and can see a record of all grades, attendance records, and assignment submissions.

The grade book displays the current running average for the grades in the course in accordance to the grade weights, inclusive of all those assignments which the student has submitted and on which the instructor has provided grades. At the end of the course, grades are finalized and added to the student's transcript, which is accessible at all times for students enrolled in credit-bearing programs.

Grading System

The final grade for a course is determined by the weighting rules stated in the course offering. Unless otherwise stated, all courses are weighted as follows: 30% of the grade derives from the average of the instructional assignment session, and 70% of the grade derives from the cumulative examination.

The final grade on a degree is weighted in proportion to the credits of individual courses. For example, a degree composed of a 3 credit course and a 6 credit course will weigh the 6 credit courses proportionately more, according to the number of credits.

Woolf's International Grade Classification

Woolf's teachers are trained in a number of different grading scales; these scales are cross-referenced. This handbook employs the American grading system and classification, with US grades as the default.[1] US grades are the most granular and distributed with the least number of gaps, which is why we have selected them as a default marking scheme for transcripts. Woolf's international conversion scheme is as follows:

US GPA	US Grade	US Per Cent	UK Mark	UK Classification	Malta Grade	Malta Mark	Malta Classification
4	A+	97 - 100	70+	First class honors	A	80-100%	First class honors
3.8-4.0	A	94-96	67-69	Upper-second class honors	B	70-79%	Upper-second class honors
3.7	A-	90-93	65-67	Upper-second class honors			
3.3	B+	87-89	60-64	Lower-second class honors	C	55-69%	Lower-second class honors
3	B	84-86					
2.7	B-	80-83	55-59	Lower-second class honors			
2.3	C+	77-79	50-54	Third class honors	D	50-54%	Third-class honors
2	C	74–76					
1.7	C-	70–73	45-49	Third class honors			

[1] Cf. the Fulbright Commission (http://www.fulbright.org.uk/going-to-the-usa/pre-departure/academics), Princeton Review (https://www.princetonreview.com/college-advice/gpa-college-admissions), European Commission (https://eacea.ec.europa.eu/national-policies/eurydice/content/second-cycle-programmes-49_en), and University of Malta (https://www.um.edu.mt/__data/assets/pdf_file/0005/47390/harmonisedregs-09.pdf).

1.3	D+	67–69	40-44	Ordinary/Unclassified			
1	D	64–66	35-39	Ordinary/Unclassified			
0.7	D-	60–63					
0	F	Below 60	Below 35		F	45-54%	

Woolf Grading Criteria, Definition of Grades, and Classification

Grading of student work keeps in view the scale of work that the student can reasonably be expected to have undertaken in order to complete the task. The Woolf grading scheme draws heavily from the marking scheme set out by the University of Oxford (cf. History Faculty Course Handbook 2016-2018).

a. The assessment of work for the course is defined according to the following rubric of general criteria:

i. i. Engagement:

- Directness of engagement with the question or task
- Range of issues addressed or problems solved
- Depth, complexity, and sophistication of comprehension of issues and implications of the question or task
- Effective and appropriate use of imagination and intellectual curiosity

ii. Argument or solution:

- Coherence, mastery, control, and independence of work
- Conceptual and analytical precision
- Flexibility, e.g. discussion of a variety of views, ability to navigate through challenges in creative ways

iii. Evidence (as relevant):

- Depth, precision, detail, range and relevance of evidence cited
- Accuracy of facts
- Knowledge of first principles and demonstrated ability reason from them
- Understanding of theoretical principles and/or historical debate
- Critical engagement with primary and/or secondary sources

iv. Organization and presentation:

- Clarity and coherence of structure
- Clarity and fluency of writing, code, prose, or presentation (as relevant)
- Correctness of conformity to conventions (code, grammar, spelling, punctuation or similar relevant conventions)

b. US grades for courses are defined according to the following rubric:

97-100

Work will be so outstanding that it could not be better within the scope of the assignment. These grades will be used for work that shows exceptional excellence in the relevant domain; including (as relevant to the domain): remarkable sophistication and

mastery, originality or creativity, persuasive and well-grounded new ideas or methods, or making unexpected connections or solutions to problems.

94-96

Work will excel against each of the General Criteria. In at least one area, the work will be merely highly competent.

90-93

Work will excel in more than one area, and be at least highly competent in other respects. It must be excellent and contain: a combination of sophisticated engagement with the issues; analytical precision and independence of solution; go beyond paraphrasing or boilerplate code techniques; demonstrating quality of awareness and analysis of both first principles or primary evidence and scholarly debate or practical tradeoffs; and clarity and coherence of presentation. Truly outstanding work measured against some of these criteria may compensate for mere high competence against others.

87-89

Work will be at least very highly competent across the board, and excel in at least one group of the General Criteria. Relative weaknesses in some areas may be compensated by conspicuous strengths in others.

84-86

Work will demonstrate considerable competence across the General Criteria. They must exhibit some essential features addressing the issue directly and relevantly across a good range of aspects; offer a coherent solution or argument involving (where relevant) consideration of alternative approaches; be substantiated with accurate use of resources (including if relevant, primary evidence) and contextualization in debate (if relevant); and be clearly presented. Nevertheless, additional strengths (for instance, the range of problems addressed, the sophistication of the arguments or solutions, or the use of first principles) may compensate for other weaknesses.

80-83

Work will be competent and should manifest the essential features described above, in that they must offer direct, coherent, substantiated and clear arguments; but they will do so with less range, depth, precision and perhaps clarity. Again, qualities of a higher order may compensate for some weaknesses.

77-79

Work will show solid competence in solving problems or providing analysis. But it will be marred by weakness under one or more criteria: failure to fully solve the problem or discuss the question directly; some irrelevant use of technologies or citing of information; factual error, or error in selection of technologies; narrowness in the scope of solution or range of issues addressed or evidence adduced; shortage of detailed evidence or engagement with the problem; poor organization or presentation, including incorrect conformity to convention or written formatting. They may be characterized by unsubstantiated assertion rather than argument, or by unresolved contradictions in the argument or solution.

74-76

Work will show evidence of some competence in solving problems or providing analysis. It will also be clearly marred by weakness in multiple General Criteria, including: failure to solve the problem or discuss the question directly; irrelevant use of technologies or citing of information; factual errors or multiple errors in selection of technologies; narrowness in the scope of solution or range of issues addressed or evidence adduced; shortage of detailed evidence or engagement with the problem; poor organization or presentation, including incorrect conformity to convention or written formatting. They may be characterized by unsubstantiated assertion rather than argument, or by unresolved contradictions in the argument or solution.

70-73

Work will show evidence of competence in solving problems or providing analysis, but this evidence will be limited. It will be clearly marred by weakness in multiple General Criteria. It will still make substantive progress in addressing the primary task or question, but the work will lack a full solution or directly address the task; the work will contain irrelevant material; the work will show multiple errors of fact or judgment; and the work may fail to conform to conventions.

67-69

Work will fall down on a number of criteria, but will exhibit some of the qualities required, such as the ability to grasp the purpose of the assignment, to deploy substantive information or solutions in an effort to complete the assignment; or to offer some coherent analysis or work towards the assignment. Such qualities will not be displayed at a high level, and may be marred by irrelevance, incoherence, error and poor organization and presentation.

64-66

Work will fall down on multiple General Criteria, but will exhibit some vestiges of the qualities required, such as the ability to see the point of the question, to deploy information, or to offer some coherent work. Such qualities will be substantially marred by irrelevance, incoherence, error and poor organization and presentation.

60-63

Work will display a modicum of knowledge or understanding of some points, but will display almost none of the higher qualities described in the criteria. They will be marred by high levels of factual or technology error and irrelevance, generalization or boilerplate code and lack of information, and poor organization and presentation.

0-60

Work will fail to exhibit any of the required qualities. Candidates who fail to observe rubrics and rules beyond what the grading schemes allow for may also be failed.

c. Synchronous Meeting Discussions and *Viva Voce* Examination Template

Synchronous meeting discussions and *viva voce* examinations are conducted on the same format: written work is submitted in advance, and a discussion follows. This provides students an opportunity to clarify and explain their written claims, and it also tests whether the work is a product of the student's own research or has been plagiarized.

For the *viva voce* examination, the submitted work is graded, and the grade is recorded prior to the oral examination.

The synchronous discussion and *viva voce* examination acts to shift the recorded grade on the submitted essay according to the following rubric:

+3

Up to three points are added for excellent performance; the student displays a high degree of competence across the range of questions, and excels in at least one group of criteria. Relative weaknesses in some areas may be compensated by conspicuous strengths in others.

+/- 0

The marked script is unchanged for fair performance. Answers to questions must show evidence of some solid competence in expounding evidence and analysis. But they will be marred by some weakness under one or more criteria: failure to discuss the question directly; appeal to irrelevant information; factual error; narrowness in the range of issues addressed or evidence adduced; shortage of detailed evidence; or poor organization and presentation, including consistently incorrect grammar. Answers may be characterized by unsubstantiated assertion rather than argument, or by unresolved contradictions in the argument.

-3 (up to three points)

Up to three are subtracted points for an inability to answer multiple basic questions about themes in the written work. Answers to questions will fall down on a number of criteria, but will exhibit some vestiges of the qualities required, such as the ability to see the point of the question, to deploy information, or to offer some coherent analysis towards an argument. Such qualities will not be displayed at a high level or consistently, and will be marred by irrelevance, incoherence, error and poor organization and presentation.

0

Written work and the oral examination will both be failed if the oral examination clearly demonstrates that the work was plagiarized. The student is unfamiliar with the arguments of the essay or the sources used for those arguments.

Curriculum

Business Finance, Accounting, and Economics

Short Foundation Course Description

Business Finance, Accounting, and Economics covers core concepts in accounting, finance, and microeconomics relevant to running a business.

The course begins with finance for business, including the time value of money, the trade-off between risk and return, and arbitrage. It gives managers a strengthened knowledge in finance that can be applied in their professional careers. The topics covered include how to move cash flows in time, the methods and principles of capital budgeting,

valuation of bonds and stocks, how to characterize risk and return, and options pricing with applications to managerial decisions.

The course then builds on the student's knowledge of finance to introduce accounting and examines the subject from the viewpoint of users external to the organization. Topics include transaction analysis; the accounting cycle; financial-statement preparation, use, and analysis; revenue recognition and cost measurement; present value; and problems in financial-accounting disclosure.

This course concludes with microeconomic theory and its application to problems faced by managers. Topics include supply and demand, consumer behavior, pricing when a firm has market power, and the role of contracts.

Business Leadership and Strategy

Short Foundation Course Description

This course examines how leaders can most effectively use the resources of their team members to achieve business outcomes. The course develops managerial and leadership competencies, focusing on how key improvements in the general strategy and techniques of managing people can produce outcomes more significant than isolated improvements to employee performance.

The course provides students with concepts to support them across their careers as they continue to develop effective skills in delegation, management strategy, and engagement with people across an organization.

Business Marketing and Operations

Short Foundation Course Description

This course explores the key concepts of marketing and how they fit into the larger context of management strategy and operational decisions. It presents both the practical "how" and the fundamental "why" of marketing activities in the light of contributions from behavioral science, economics, and statistics. The course provides managers and business leaders with the understanding needed to manage and lead those who implement the marketing activities; the course provides concepts and processes for business leaders who seek to continue developing through future experiences or coursework in marketing.

The course then focuses on managing processes. Theoretically, it models business functions as a network of actions that convert inputs into outputs. Process design is considered, including the volume and variety of system inputs and outputs - especially with respect to goods and services. Different inventory management and logistic systems are explored. Finally, forecasting and process optimisation are explored, strengthening managers ability to operate with finite resources.

Business Negotiations

Short Foundation Course Description

Managers require a broad array of negotiating skills to implement business solutions — this requires an advanced knowledge of negotiation models, the competence to select the right strategy, and the tactical skills to achieve desired outcomes through negotiation.

In addition to studying key negotiation theories, the course develops skills in negotiation, providing participants with the opportunity to test and improve their abilities through group discussions that model negotiation scenarios, through the use of case studies, and through reflection and feedback.

Students will review and try out various approaches to negotiate conflict resolution (at small personal scales and large organizational scales). The course builds competencies in developing an effective professional and personal style of negotiation.

Creativity and Innovation

Short Foundation Course Description

In this course students will develop specialized and multidisciplinary capacities to generate creative solutions and alternatives to existing business issues. It is designed to introduce and deepen the student's ability to lead processes that stimulate and manage creativity in a business.

Students will reflect critically on templates and methods for designing, implementing, and assessing processes that introduce creativity to real work situations. The course will engage with both the theoretical frameworks and practical methods or tools for cultivating practices of creativity in response to real business challenges.

The course cultivates skills for autonomous managers to lead creative projects, people and ventures, and to oversee the processes that keep them on track.

Effective Managerial Communication

Short Foundation Course Description

In this course, students will gain the capacity to appropriately apply a broad repertoire of communication skills in business, professional, and social contexts.

The course scrutinizes and analyzes managerial communication skills required for leadership in a wide variety of industries. It considers the varied means of communications - writing, speaking, calling – and generally appearing professional. The communication

requirements of different contexts are studied, including informational, persuasive, and relational forms of communication.

Course videos, readings, and case studies prepare students for group discussion and assignments that support the learning outcomes.

Ethical Issues for Managers

Short Foundation Course Description

Ethical dilemmas are frequently encountered in the workplace, in every function of the organization, and at every level. Knowing how to deal with ethical issues is critical in being able to be an effective leader. Additionally, the range and complexity of ethical issues have increased in recent years, as well as expectations of responsible corporate conduct; knowing how to deal with such concerns is an important part of management today.

In this course, students examine how organizations, and individuals within them, can deal with ethical issues and dilemmas at the collective and personal levels. Throughout the course, students will gain skills related to elements of ethical decision-making, the psychological aspects related to business ethics, and ethics in the global marketplace. The course will focus on how business leaders can make ethical decisions, skilfully manage ethical issues in the workplace, and help encourage ethics in a variety of organizations.

Evidence-Based Decision-Making

Short Foundation Course Description

In this course students will strengthen their capacity to lead individuals, teams, and organizations in processes that generate data-driven solutions to problems and data-driven insights into customer behavior in order to facilitate data-driven decision making.

This course provides the foundations of probability and statistics required for a manager to interpret large quantities of data and to make informed decisions under conditions of uncertainty, with incomplete information, and in both structured and unstructured settings. Theoretical topics include decision trees, hypothesis testing, multiple regression, and sampling.

Financial Accounting and Reporting

Short Foundation Course Description

In general terms, financial accounting is the measurement of economic activity for decision-making. Financial statements are a key product of this measurement process and an important component of firms' financial reporting activities.

The objective of this course is to help students become intelligent readers of the financial reports of most publicly traded companies. Students will learn the development, analysis, and use of these reports by focusing on what these reports contain, what assumptions and concepts accountants use to prepare them, and why they use those assumptions and concepts. A solid understanding of the fundamentals covered in this course should enable students to do well in more advanced finance and accounting courses and to interview intelligently for jobs in finance, consulting, and general management.

The course begins with the basic concepts of accounting. Students will analyze the main financial statements: balance sheet, income statement, statement of cash flows, and statement of stockholders' equity. Particular attention is paid to how these four statements relate to each other and how they provide information about the operating performance and financial health of a company. The course also covers specific items from the financial statements and applies tools of analysis whenever possible.

Integrative and Strategic Thinking

Short Foundation Course Description

In this course students will gain the capacity to understand how firms work in a global context, incorporating a broad, future-oriented, systems-based approach that uses data, information and insights from diverse perspectives and sources. This course is designed to convey the key concepts of strategic thinking and how they fit into the larger context of management strategy and decisions. Students will be presented with both the practical "how" and the fundamental "why" in the light of contributions from behavioral science, economics, and statistics.

Leading People, Teams and Organizations: Organizational Theory

Short Foundation Course Description

This course will approach leadership by identifying practices that researchers and practitioners have shown to be the most effective. Through these processes, students will gain a broad range of skills.

This course examines how leaders can most effectively use the resources of their team members to achieve business outcomes. The course develops managerial and leadership competencies, focusing on how key improvements in the general strategy and techniques of managing people can produce outcomes more significant than isolated improvements to employee performance. The course provides students with concepts to support them across their careers as they continue to develop effective delegation, management strategy, and engagement with people inside of an organization.

Specific topics covered include managing a diverse workforce; self-leadership; perception pitfalls; decision making; conflict resolution; emotional intelligence; improving performance; team structure.

Marketing Strategy

Short Foundation Course Description

The role of marketing management in organizations is to identify and measure the needs and wants of consumers, to determine which targets the business can serve, to decide on the appropriate offerings to serve these markets, and to determine the optimal methods of pricing, promoting, and distributing the firm's offerings. Successful organizations are those that integrate the objectives and resources of the organization with the needs and opportunities of the marketplace. The goal of this course is to facilitate student achievement of these goals regardless of career path.

This course addresses how to design and implement the best combination of marketing efforts to carry out a firm's strategy in its target markets. Specifically, this course helps to develop the student's understanding of how the firm can benefit by creating and delivering value to its customers, and stakeholders, and develop skills in applying the analytical concepts and tools of marketing to such decisions as segmentation and targeting, branding, pricing, distribution, and promotion.

Reflective Leadership

Short Foundation Course Description

In this course students will cultivate and deepen their capacity to reflect continually on their learning and growth; they will examine the ways in which one's behaviors and decision-making impact others, with a goal of leading with integrity.

This course is designed to extend students' conceptual and practical understanding of leadership in organizations, reaching beyond the application of knowledge in practical judgements that achieve business outcomes, to embrace wider social and ethical considerations. The course is experiential and multidisciplinary, requiring participants to reflect on the social and ethical responsibilities of leaders in relation to their own experiences. It is designed to help students discover insights about themselves as leaders, fostering the development of a self-awareness, including strengths and opportunities for personal growth.

In addition, the course provides a context for enhancing the skills and competencies that enable a student to become an effective leader in today's highly dynamic, diverse and adaptive organizations.

Statistics and Data Analysis

Short Foundation Course Description

This course is designed to achieve an understanding of fundamental notions of data presentation and analysis and to use statistical thinking in the context of business problems.

The course addresses modern methods of data exploration (designed to reveal unusual or problematic aspects of databases), the uses and abuses of the basic techniques of inference, and the use of regression as a tool for management and for financial analysis. The potential ethical issues related to each topic will be reviewed. Socially and environmentally relevant data will be utilized throughout the course.

The goal of the course is not to turn students into statisticians but to enable them to appreciate the use of probability in assessing evidence and making decisions, and to be statistically literate consumers of quantitative information generated by economists, biomedical researchers, psychologists, statisticians, survey researchers, and other experts.

Strategic Economics

Short Foundation Course Description

This course explores basic economic principles (theories and applications) that are relevant to a variety of businesses. The course emphasizes an economist's mindset and amasses the tools necessary to do so, including the study of microeconomics and macroeconomics.

Throughout the course, students will examine the underlying economics of successful business strategy: the strategic imperatives of competitive markets, the sources and dynamics of competitive advantage, managing competitive interactions, and the organizational implementation of business strategy.

Additionally, the course focuses on case discussion and analysis and provides a foundation for consultants, managers, and corporate finance generalists.

Supply Chain Management

Short Foundation Course Description

Increases in product variety and customization in the past few years have posed challenges to firms in terms of delivering products to customers faster and more efficiently. With the prevalence of the usage of the Internet for business, electronic business transformations are occurring in every business. One of the fundamental enablers of electronic commerce is effective supply chain management. Thus, supply chain management has become the focus of attention of senior management in the industry today.

This course considers management of a supply chain in a global environment from a managerial perspective. The focus is on analysis, management, and improvement of supply chain processes and their adaptation to the electronic business environment. The course focuses on six topics: Inventory and Information Management; Distribution and Transportation; Global Operations; Supplier Management; Management of Product Variety; and Electronic Supply Chains. Several new concepts including Prognostic Supply Chains, Build-to-Order, Collaborative Forecasting, Delayed Differentiation, Cross Docking, Global Outsourcing, and Efficient Consumer Response will also be discussed. At the end of the course, a student will have the necessary tools and metrics to evaluate a current supply chain and recommend design changes to supply chain processes

Technology and Operations Management

Short Foundation Course Description

This course enables students to develop the skills and concepts needed to ensure the ongoing contribution of a firm's operations to its competitive position. It helps them to understand the complex processes underlying the development and manufacture of products as well as the creation and delivery of services. Throughout the course, students will receive a comprehensive overview of technology utilization to drive a competitive advantage for company operations. Students explore various technology solutions for business process automation, including value proposition analysis across organization functions.

Specific topics addressed include process analysis; cross-functional and cross-firm integration; product development; information technology; and technology and operations strategy.

Additionally, students will analyze how technology can be leveraged to improve product development during the four lifecycle phases. The course provides a detailed overview of the impact of technology on various operating models such as manufacturing, supply chain management, customer-facing, product development, and support functions.

Working with Others

Short Foundation Course Description

In this course students will deepen and extend their ability to create and maintain high-quality relationships with people who come from a wide range of backgrounds and possess different points of view in order to create and execute processes that produce successful outcomes and results.

This course teaches business managers and leaders to reflect critically on concepts from the behavioral sciences that can be applied to a fast changing business environment to improve their abilities to lead and manage in organizations.

Behavioral frameworks for individuals, teams, and organizations are evaluated critically and discussed in the context of real-world cases. Synchronous meeting groups provide practice in problem-based teamwork, communicating in specialist and non-specialist registers, and in applying the frameworks in practice.

The Business of Social Change

Extended Specialist Course Description

This course is designed to provide students with the skills and knowledge to influence and lead social impact in business and impact contexts. By the conclusion of this course, students should have a strong foundation in social impact and social change, including approaches to funding impact, scaling programmes, and interventions, public-private partnerships, corporate engagement, impact investment decision-making, blended capital, and approaches to intentional impact.

The course will pivot around multiple case studies addressing social issues through which students learn and test social impact frameworks and concepts. Once students have gained a mastery of perspectives and methodologies necessary to consider and address a social issue from the ground up, they will next learn to identify and utilize effective measures of outputs and progress and explore the core levers and potentials to change outcomes for people, communities and market systems.

Business-to-Business Marketing

Extended Specialist Course Description

The focus of this course is to introduce concepts, skills, and strategies for performing competitively in the business market where organizations rather than households are the customers.

This course provides a managerial introduction to the strategic and tactical aspects of business marketing decisions and marketing channel strategy. Students examine the strategic concepts and tools that guide market selection, successful differentiation in business markets, and supply chain management. Students will examine how product and service decisions are designed to deliver the B2B value proposition, how pricing captures customer value, how value is communicated to and among customers, and how marketing channels are used to make this value accessible to target customers. Additionally, students will compare and contrast how the strategic and tactical processes of developing and managing value-generating relationships differ between B2B and B2C markets. Moreover, students will also gain an understanding of how to manage channel power, conflict, and relationships.

Data Analytics and Modeling

Extended Specialist Course Description

The objective of this course is to provide students the basic data analysis and modeling concepts and methodologies using probability theory. Basic statistics concepts and probability concepts will be covered. Fundamental data analysis and hypothesis techniques will be covered. Further data modeling methodologies such as Hidden Markov Models and Bayesian networks will be introduced.

Students successfully completing this course will have gained a solid understanding of probabilistic data modeling, interpretation, and analysis and thus have formed an important basis to solve practical statistics and data analysis-related problems arising in real-world business situations. The techniques discussed are applied in all functional areas within business organizations including accounting, finance, human resource management, marketing, operations, and strategic planning.

Decision Making with Business Analytics

Extended Specialist Course Description

This course encompasses statistics, decision analysis, and simulation modeling.

Throughout the course, students will strengthen their capacity to lead individuals, teams, and organizations in processes that generate data-driven solutions to problems, data-driven insights into customer behavior, and data-driven decision-making. This course provides the foundations of probability and statistics required for a manager to interpret large quantities of data and to make informed decisions under conditions of uncertainty, with incomplete information, and in both structured and unstructured settings. Theoretical topics include decision trees, hypothesis testing, multiple regression, Monte Carlo simulation, and sampling and estimation.

Enterprise Risk Management

Extended Specialist Course Description

This course provides an introduction to the main areas of Enterprise Risk Management. This course also covers Risk Management processes and strategies. Numerous case studies from various business sectors will illustrate the increasing importance of Enterprise Risk Management.

Financial Crises and Risk Management

Extended Specialist Course Description

Throughout this course, students will develop the analytical tools necessary to understand crisis prevention and management, and risk management. The properties and characteristics of risk management techniques will be analyzed and related to corporate and sovereign default risk, hedging and trading strategies, regulation, and assessing financial

stability and systemic risk. Emphasis will be put on applying these techniques to problems emerging in the marketplace.

Additionally, this course addresses the ability of different risk management approaches to account for large market shocks. Students will study the effect of leverage, through borrowing or through the structuring of assets, in amplifying shocks and increasing risk, and the role of capital in mitigating them. The information learned in this course will help business leaders understand their role in regulatory compliance and participate constructively in these interactions.

Financial Statement Analysis

Extended Specialist Course Description

Financial reports contain important information about a company's past, present, and future. The ability to read these reports provides valuable insights into an organization's strengths and shortcomings.

This course is designed to prepare students to interpret and analyze financial statements for tasks such as credit and security analyses, lending and investment decisions, and other decisions that rely on financial data. Throughout the course, students will explore in greater depth financial reporting from the perspective of financial statement users. Students will develop a sufficient understanding of the concepts and recording procedures and therefore will be able to interpret various disclosures in an informed manner. Additionally, students will learn how to compare companies financially, understand cash flow, and grasp basic profitability issues and risk analysis concepts.

Global Brand Strategy

Extended Specialist Course Description

This course examines specific issues involved in building and managing global brands in such a way that they contribute to shareholder value. A global brand uses the same name and logo and has awareness, availability, and acceptance in multiple regions of the world. It shares the same strategic principles, values, positioning, and marketing throughout the world. Although the marketing mix can vary, it is managed in an internationally coordinated manner.

Throughout this course, students will develop skills related to building strong global brands; developing marketing mix strategies that are an effective combination of global standardization, local adaptation, and worldwide learning; and managing global brands.

Global Finance and Emerging Markets

Extended Specialist Course Description

This course develops the foundations for financial decisions in a global economic environment. It concentrates on four areas: markets, tools, investments, and corporations. Students will become familiar with the benefits of international diversification in investment strategies. Additional topics include the valuation of international investments and analysis of the functioning of international financial markets and institutions.

Throughout the courses, students will also develop skills related to the management of foreign exchange exposure in international corporations within the specific context of emerging markets.

Health, Safety, and Leadership Essentials

Extended Specialist Course Description

This course has been designed to foster a strong safety culture by disseminating safe behaviors throughout the organization, with a strong focus on leadership development at all levels.

Implementation and Product Introduction

Extended Specialist Course Description

This course provides students with advanced methods needed to understand how a product will fit into a competitive market, and how to introduce the product into that market. This includes advanced research on the receptiveness of a market to the new product, as well as strategies for defining and finding the market that will be most receptive to the product.

Students consider product introductions with the goal of what Marc Andreesen called “product/market fit” - a “good market with a product that can satisfy that market.”

The course trains students to reflect upon and analyze a company’s go-to-market strategy, and it provides students with sophisticated methods of calculating customer acquisition cost, determining customer break-even, and calculating customer lifetime value.

Inclusive Leadership

Extended Specialist Course Description

This course focuses on multiple aspects of team dynamics and structure, with a focus on the organizational intelligence needed to lead and manage diverse organizations in a varied marketplace. Theories of organizational behavior, social psychology, and anthropology are critically discussed in relation to real-world scenarios.

Additionally, this course introduces students to the challenges and opportunities faced in multifaceted workplaces and provides evidence-based insights and practical strategies for how to accelerate team engagement and belonging as a pathway to sustainability and competitive advantage. Ultimately, this course enables students to successfully build and lead organizations that are multifaceted, equitable, and engaging.

Inspiration and Product Creation

Extended Specialist Course Description

This course provides students with advanced methods and frameworks for understanding customer needs, and for translating those needs into a program of research and product development that can be used to create a successful new product or service. It equips students with skills to generate new product hypotheses, to research the potential of a new product or entrepreneurial venture, and to adjust the product offering to fit the needs of customers. This course instills the all-important distinction between a “bright idea” and a “business opportunity” in new product creation.

Using disciplined methods of customer and market analysis, students will gain advanced abilities in defining the core customers for a new product or entrepreneurial venture.

Students will study the complex combination of factors that influence customers to adopt a new product or service. They will gain a comprehensive understanding of what makes entrepreneurial selling unique, and why it is valuable to integrate key aspects of selling and marketing activities in a new venture. Students will learn how to select potential customers through data collection, including customer interviews, and students will learn how to analyze that data to refine a product offering.

International Business Environments

Extended Specialist Course Description

This course explores the international business environment in which organizations operate. Throughout the course, students will examine the structure and features of international markets, how organizations engage with these markets, and how they respond to their complexities. Students are introduced to useful theoretical and analytical frameworks that are crucial to understanding the opportunities and risks derived from the political, economic, social, technological, and institutional environment of countries.

The course also addresses aspects of global institutions, such as the World Trade organization (WTO) and the International Monetary Fund (IMF), which set global rules that affect business strategy and human welfare.

Introduction to Strategic Healthcare Management

Extended Specialist Course Description

This course is aimed at providing business-related knowledge in healthcare management. The course prepares learners with a core understanding of the various issues of health programs and systems with good operative business processes along with a deep understanding of the quality leadership required in the healthcare industry and ensuring good healthcare financial management principles.

Investment Strategies

Extended Specialist Course Description

Throughout this course, students will learn the basic concepts of needs analysis, investment policy, asset allocation, product selection, portfolio monitoring and rebalancing. Students will assess the various types of institutional investors, including pension funds and insurance companies and develop skills related to the client management life cycle and portfolio management as a process. The course will address the basic concepts, principles, and the major styles of investing in alternative assets. Additionally, students will learn about the impact of digitization on investment strategies and the issues related to performance measurement, transaction costs and liquidity risk, margin requirements, risk management, and portfolio construction. Other topics addressed in the course include quantitative investment strategies used by active traders and methodologies to analyze them. Through the use of case studies, students will learn to use real data to back-test or evaluate several of the most successful trading strategies used by active investment managers. As a result, students will learn to read and analyze academic research articles in search of profitable and implementable trading ideas.

Leadership and Corporate Accountability

Extended Specialist Course Description

In this course, students learn about the complex responsibilities facing business leaders today. Through cases about difficult managerial decisions, the course examines the legal, ethical, and economic responsibilities of corporate leaders. It also teaches students about management and governance systems leaders can use to promote responsible conduct by companies and their employees, and shows how personal values can play a critical role in effective leadership.

Additionally, this course is designed to deepen and extend students' conceptual and practical understanding of leadership in organizations, extending beyond the application of knowledge in practical judgements that achieve business outcomes, to embrace wider social and ethical considerations. The course is experiential and multidisciplinary, requiring participants to reflect on the social and ethical responsibilities of leaders in relation to their own experiences. It is designed to help students discover insights about themselves as

leaders, fostering the development of self-awareness, including strengths and opportunities for personal growth.

Marketing Analytics

Extended Specialist Course Description

The role of marketing management in organizations is to identify and measure the needs and wants of consumers, to determine which targets the business can serve, to decide on the appropriate offerings to serve these markets, and to determine the optimal methods of pricing, promoting, and distributing the firm's offerings. Successful organizations are those that integrate the objectives and resources of the organization with the needs and opportunities of the marketplace. The goal of this course is to facilitate student achievement of these goals regardless of career path.

Throughout the course, students will study various tools for generating marketing insights from data in such areas as segmentation, targeting and positioning, satisfaction management, customer lifetime analysis, customer choice, product and price decisions using conjoint analysis, and text analysis, and search analytics.

Measurement and Product Adoption

Extended Specialist Course Description

This course examines iterative product development as a method for improving customer adoption and retention. Students will gain a mastery of iterative product development as a strategy for (a) transforming market research into potential solutions, (b) testing hypotheses about product improvements, and (c) gaining validation for product adjustments.

Students will gain a comprehensive understanding of the concept of a minimum viable product, how to test the market in the early stages of product adoption, and the benefits and weaknesses of incremental product improvements. Students will gain an advanced understanding of concepts related to customer segmentation, cohort analysis, and churn in order to learn from market responses to product changes, increase customer retention, and expand customer adoption.

Operations Management in Global Healthcare

Extended Specialist Course Description

This course will help learners develop specialized knowledge and domain expertise in efficient management of a healthcare services center in a global context. The course also helps learners develop an awareness of problems confronted by organizations and businesses in the global healthcare sector and also equips learners with a definitive idea of

change management and lean operational tools required for analyzing and improving healthcare processes.

Python for Business Analytics

Extended Specialist Course Description

This course introduces students to one of the world's most widely used and in-demand programming languages and its specific applications to business analytics. Python is used in a wide range of fields, including web development, data science, fin-tech, health care, and more. With Python, business leaders can scrape online sources to determine consumer sentiment, automate tasks, run advanced models, and export code across different applications.

Throughout the course will develop the following skills: Apply programmatic logic to complex business problems in areas such as finance, operations, and marketing; Use technical knowledge to lead and manage teams in today's evolving digital economy; Leverage state-of-the-art tools and powerful, open-source Python libraries to clean, analyze and visualize data.

Services Marketing Management

Extended Specialist Course Description

Service organizations (e.g., hospitals, hotels, banks, insurance companies, professional services, educational institutions) require a different approach from that of goods and high-tech businesses. Additionally, many goods and high-tech businesses also use a strong service component as a source of competitive advantage.

Services marketing is often viewed in terms of outcomes, but services marketing is also an ongoing analytic process. In this course, students will learn how to properly analyze frameworks, tools, channels, data sets, customer behavioral data, decision-making factors, and strategies that support broader marketing decisions. Throughout the course, students will build on basic marketing concepts and apply them to service industry settings.

Social Entrepreneurship

Extended Specialist Course Description

Social Entrepreneurship is a dynamic business field that examines the practice of identifying, starting, and growing successful mission-driven for-profit and non-profit ventures. This course provides students with the skills to develop in-depth insights into economic and social value creation across several areas, including poverty alleviation, energy, health, and sustainability. Through case studies, lectures, and discussions, students will learn to think strategically and act opportunistically with a socially-conscious business mindset.

Topics addressed throughout this course include problem/opportunity assessment, resource acquisition, and social and financial returns on investments. Students will critically assess various social and organizational models that directly affect diverse populations throughout the world.

Strategic Project Management and Implementation

Extended Specialist Course Description

The purpose of this course is to give learners an opportunity to integrate all the knowledge from their programme of learning by developing a project in which they plan and implement a new product, service or process. Learners need to take a full and active role in all aspects of the project, and the selection of an appropriate management issue is crucial to success. Learners will cover a full range of management activities and roles, including resource and people management and implementation of change. The result needs to be a substantial report in a style appropriate for consideration by senior management

Digital Action Program for Business Administration

Course Description

The Digital Action Program for Business Administration provides a capstone course in which students deepen and apply their learning through a “Digital Action Program” (DAP). In the DAP, students are grouped into cohorts (typically five students) and must work both individually and together on a specific, real, contemporary business consultancy problem, normally proposed by a cooperating organization (corporation or non-profit), which results in a comprehensive solution proposal.

This provides students with a real world business consultancy engagement, and the opportunity to produce, both individually and as a team, a substantial piece of relevant, scholarly, and actionable research, to be presented directly to stakeholders in the cooperating organization.

Over the course of the DAP, students fulfill the learning objectives:

- each student demonstrates their comprehensive knowledge and understanding of key business processes;
- each student uses multidisciplinary approaches to perform critical analyses of real business issues in situations of uncertainty and incomplete information in order to develop an actionable solution;
- each student practices teamwork, exercises their leadership skills, and reflects on their own performance and the performance of their cohort; and
- each student communicates to members of their cohort, the cooperating organization, and faculty members from Woolf.

Students are required to demonstrate autonomy, individual scholarly acumen, self-reflection in their engagement with peers, role adaptability within their cohort, and teamwork while engaged in the DAP.

The goal of the DAP is to:

1. fulfill the learning objectives and
2. to produce a project portfolio containing an analysis of the business problem and the proposed solution.

DAP Roles and Responsibilities

Individual students

Students are required to take responsibility for their own work, they must act autonomously on the basis of their prior learning and experience, and they must individually generate key research results that contribute to the DAP.

Each student must individually contribute through assignment submissions, which are graded on their individual merits. The final grade for the course (as described below) consists of 50% for the individual research submissions, and 50% for the cohort's final project taken as a whole. The final project contains individual contributions, but requires teamwork, and is graded as whole in terms of its fulfillment of the learning objectives.

Cohorts

Cohorts are groups of about 5 students that are assigned to address a single business problem, on which they commit to working both individually and as a team. All cohorts must agree to a cohort charter, which outlines the roles and responsibilities of the team. The cohort charter must include the following topics: timeliness; comprehensive designation of areas of responsibility, including gathering meeting agenda items, chairing meetings, meeting note-taking, and being the point of contact for the cooperating organization; a schedule of rotating leadership positions across the courses, and a commitment to professional teamwork that prioritizes the goal of the DAP.

Instructors

All cohorts are assigned a Woolf instructor to facilitate three cohort synchronous meetings for each lesson, and all cohorts are assigned a designated contact person from a cooperating organization.

The role of the instructor in cohort synchronous meetings is to ensure that students are achieving the learning objectives, and that the cohort is on course with their program roadmap. As the DAP progresses, students are expected to increase their management over the synchronous meetings, including setting the meeting agenda.

Cooperating Organizations

Cooperating organizations must register and be verified with Woolf, provide an initial portfolio of basic information on the company, provide a designated contact person, and

agree to the standard 'cooperating organization framework' – which commits them to attending a minimum number of meetings with a cohort, and they are encouraged to provide students with access to the executive members of their organization.

In cases where relations with a cooperating organization become untenable for any reason, and the cohort is unable to continue with the relationship, then cohorts will be provided with the choice of (a) continuing their DAP without further input from the cooperating organization, (b) switching to a new cooperating organization, or (c) selecting a contemporary business problem on the basis of publicly available information and in agreement with their instructor.

DAP Timeline of Assignments

Each lesson of the course normally requires about 75 hours of work from each member of the cohort. Individuals must complete their projects on schedule – neither early nor late – and in response to the requirements of their project; cohorts have the opportunity to adjust the amount of time dedicated to each lesson.

The cohort meetings are an opportunity for the instructor to check in on the team progress; they are a key checkpoint for individual submissions, and they provide milestones in the progress of the DAP. Before every cohort meeting, each student is required to submit a status report on individual and team performance.

At the end of the DAP, every cohort submits a Final Report, Final Presentation, and the Final Reflection on their experience.

The Final Report consists of the following components:

1. Title, abstract, and table of contents
2. Industry and competition report
3. Report on the cooperating organization
4. Report on the business problem
5. Report on the potential solutions analyzing their merits and weakness
6. Recommended solution with implementation plan
7. Full financial model
8. Bibliography

Items 2-7 (which may be adjusted in coordination with the cohort instructor), each have a Directly Responsible Individual (the DRI), who undertakes all the research for the section of the Final Report. Each DRI must elicit feedback and review from other members of the cohort, who must contribute feedback to every other section of the report.

The Final Presentation is typically a slide deck between 20 and 40 slides, and it is a fully collaborative project.

The Final Reflection is a reflective analysis on the DAP experience, and it must contain an individual report from each member and a joint concluding statement.

The course concludes with each member providing a peer review of their cohort peers, including strengths and areas of improvement.

The timeline of the course assignments is set by the cohort at the start, and adjusted in consultation with the instructor as the DAP progresses. The outline of assignment submissions is as follows:

Lesson 1
• Standard cohort charter discussed, revised, and agreed
• Project timeline with designated areas of responsibility

Lessons 2-3
• Draft title and abstract for the final report
• Industry information gathering
• Draft report on the cooperating organization
• Draft report on the industry landscape

Lessons 4-5
• Problem and opportunity diagnoses
• Creative generation of varied potential solutions

Lessons 6
• Evaluation of potential solutions
• Preliminary financial models of potential solutions

Lessons 7-8
• Recommended solution
• Implementation plan

Lessons 9-10
• Final Report
• Final Presentation
• Final Reflection and cohort debrief
• Peer evaluation

Outcomes

The graduate will be able to:

- Showcase a culmination of all of the skills that they have learned and developed across the entire degree.
- Apply their learned knowledge, skills, and competencies to a real world business problem
- Balance working independently and collectively as a team to operate in a professional real-world environment

Graduates of the course will show competencies in:

- Leading discussions of key issues related to their contemporary business problem

- Applying professional and scholarly approaches to research problems pertaining to their contemporary business problem
- Efficiently managing interdisciplinary issues that arise in connection with analyzing and proposing a solution to their contemporary business problem
- Autonomous self-direction in research and originality in solutions developed over this course
- Identifying research problems and solutions related to their contemporary business problem; and acting as a professional team member
- Management and leadership decision-making as it relates to their contemporary business problem

Graduates of the course will show knowledge in:

- The presentation of issues and solutions related to their contemporary business problem
- Key strategies for assessing, operationalizing and executing on their contemporary business problem
- Any and all diverse scholarly views which relate to their contemporary business problem
- Applicable business theories even tangentially related to the and solution of their contemporary business problem
- Interpersonal team dynamics to maximizing individual contributor and team efficiencies and effectiveness

Graduates of the course will develop skills in:

- Autonomously gathering materials and organizing them into a coherent, comprehensive presentation
- Employing modern conventions for the presentation of scholarly work and scholarly referencing
- Creatively applying the theories learned over the course of the degree to develop critical and original solutions to their contemporary business problem
- Applying their in-depth, domain-specific knowledge and understanding to their contemporary business problem

Graduates of the course will be able to exercise the following judgment and critical ability skills:

- Assess, analyze, criticize and correct the various strategies for handling matters arising in the context of their contemporary business problem
- Compare and evaluate the different methodologies recommended in scholarly sources pertaining to their contemporary business problem
- Propose solutions to complex and changing problems pertaining their contemporary business problem

How will this course be taught?

The core pedagogical method used in this course will consist of synchronous meetings between an instructor (faculty member or a subject-expert instructor under the oversight of a

faculty member), and a group of students in a cohort (normally 4-6 students in a cohort). Student interaction plays a key role in the organization of each synchronous meeting.

The role of the instructor in a cohort's synchronous meetings is to ensure that students are achieving the learning objectives, and that the cohort is on course with their Digital Action Program roadmap. As the Capstone in Business Administration progresses, students are expected to increase their management over the synchronous meetings, including setting the meeting agenda for key discussion points of their progress. Students submit status reports before every synchronous meeting.

Preparing for each cohort synchronous meeting session requires about 25 hours of work, and cohort students must maintain regular communication with each other as they coordinate their project assignments, in accordance with the cohort charter.

How will this course be assessed?

For the Digital Action Program (DAP), 50% of the mark derives from each individual's cohort meeting submissions (individual status reports and related lesson submissions) and 50% from the cohort's final report, final presentation deck, final reflection, and peer evaluation on the team's performance.

The DAP follows Woolf's General Marking Criteria, Definition of Marks, and Classification as published in the Woolf Academic Handbook in the year of student enrolment.