STAT6046
Financial Mathematics

Course Description
Compound interest functions; valuation of annuities certain; loans repayable by instalments; comparison of value and yield of cash flow transactions; valuation of fixed interest securities, with and without tax on interest and capital gains; duration and volatility of securities; introduction to concept of immunisation and matching; consumer credit contracts; introduction to stochastic interest rate models.

<table>
<thead>
<tr>
<th>Semester and Year</th>
<th>Semester 1, 2016</th>
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<tbody>
<tr>
<td>Mode of Delivery</td>
<td>On campus</td>
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<tr>
<td>Prerequisites</td>
<td>Completion of STAT1008 Quantitative Research Methods OR STAT1003 Statistical Techniques</td>
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<tr>
<td>Course Convener</td>
<td>Dr Chong It Tan</td>
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<td>Office Location:</td>
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<tr>
<td>Consultation hours:</td>
<td>Friday 1-3pm or email for appointment</td>
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<tr>
<td>Bio and research interests</td>
<td>Chong It Tan joined RSFAS in 2015 after completed his PhD in the research areas of longevity risk management and bonus-malus system. He is a Fellow of the Society of Actuaries and a Chartered Enterprise Risk Analyst.</td>
</tr>
<tr>
<td>Tutor</td>
<td>Xun Chun Tee, Xiang Gao, Timina Liu</td>
</tr>
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<td>Student Administrators</td>
<td>Anna Pickering</td>
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COURSE OVERVIEW

Course Learning Outcomes
Upon successful completion of the requirements for this course, students should have the knowledge and skills to:

1. Define and describe the use of cash flow models, simple and compound rates of interest and discount as well as compare and distinguish between nominal and effective rates of interest and discount.
2. Describe various types of annuities and perpetuities and use them to solve financial transaction problems.
5. Analyse basic fixed interest financial transactions like Loan Valuation, Fixed Interest securities (eg. Bonds) and employ the skills developed in this course to evaluate such transactions. Incorporate the effects of taxation on such financial transactions.
7. Define interest rate risk in terms of duration and convexity of fixed interest products. Define immunisation and assess its use in mitigating interest rate risk.
8. Illustrate the basics of stochastic interest rate models and demonstrate its use to evaluate simple cash flow models.

Research-Led Teaching
Wherever possible the examples used in this course will reflect real world situations to emphasize the use of the techniques covered.

Technology, Software, Equipment
All course notes and materials will be provided via Wattle. You will need access to a computer to get the materials necessary for the course. There is a limited use of MS Excel in this course. Some in class work will be illustrated using MS Excel. Students will have an option to complete their assignment using MS Excel.

Co-teaching
This course will be taught alongside STAT2032. There will be some material in this course which may not be relevant to STAT2032 but applies only to STAT6046. This will be clearly identified during the lecture and/or tutorial. Students enrolled in STAT6046 will need to demonstrate a deeper understanding of the concepts and material. This will be done through different assessment tasks.

Student Feedback
All CBE courses are evaluated using Student Experience of Learning and Teaching (SELT) surveys, administered by Planning and Statistical Services at the ANU. These surveys are offered online, and students will be notified via email to their ANU address when surveys are available in each course. Feedback is used for course development so please take the time to respond thoughtfully. Course feedback is anonymous and provides the Colleges, University Education Committee and Academic Board with opportunities to recognise
excellent teaching and to improve courses across the university. For more information on student surveys at ANU and reports on feedback provided on ANU courses, visit http://unistats.anu.edu.au/surveys/selt/students/ and http://unistats.anu.edu.au/surveys/selt/results/learning/

### COURSE SCHEDULE

<table>
<thead>
<tr>
<th>Week</th>
<th>Summary of Activities</th>
<th>Assessment</th>
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</thead>
<tbody>
<tr>
<td>0</td>
<td>Access to Wattle site for all enrolled students</td>
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<tr>
<td>1</td>
<td>Cash-flow models. Simple and compound interest. Accumulated and present values.</td>
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<tr>
<td>2</td>
<td>Nominal and effective rates of interest and discount. Force of interest.</td>
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<tr>
<td>3</td>
<td>Introduction to annuities and their valuation.</td>
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<tr>
<td>4</td>
<td>Perpetuities. Continuous, increasing, decreasing and indexed annuities.</td>
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<tr>
<td>5</td>
<td>Equations of value. Introduction to linear interpolation and annuity tables. Dealing with inflation.</td>
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<tr>
<td>6</td>
<td>Loan valuation and payments. Capital budgeting including NPV, IRR and DPP.</td>
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<tr>
<td>7</td>
<td>Measuring investment performance. TWRR and MWRR.</td>
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<tr>
<td>8</td>
<td>Valuation of fixed interest securities, with and without tax on interest and capital gains. Mid-semester Exam</td>
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<tr>
<td>10</td>
<td>Arbitrage and valuation of forward contracts. Yield curve and term structure of interest rates. Calculating forward and spot rates.</td>
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<tr>
<td>11</td>
<td>Interest rate risk: duration, effective duration and convexity. Conditions for and determination of immunisation.</td>
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<tr>
<td>12</td>
<td>Introduction to stochastic interest rate models. Assignment due 19 May 4pm</td>
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<tr>
<td>13</td>
<td>Revision</td>
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COURSE ASSESSMENT

Assessment Summary

<table>
<thead>
<tr>
<th>Item</th>
<th>Title</th>
<th>Value</th>
<th>Due Date</th>
<th>Linked Learning Outcomes</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Mid-semester Exam</td>
<td>20%</td>
<td>Week beginning 18 April</td>
<td>LO1 – LO4</td>
</tr>
<tr>
<td>2</td>
<td>Assignment</td>
<td>10%</td>
<td>19 May 4pm</td>
<td>LO5 – LO7</td>
</tr>
<tr>
<td>3</td>
<td>Final Exam</td>
<td>70%</td>
<td>Exam Period</td>
<td>All</td>
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Assessment Task 1: Mid-semester Exam (compulsory)
Details of task:
The mid-semester exam will be 1.5 hours long and will cover learning objectives LO1 — LO4. Specific details regarding examination conditions and the time and location for this examination will be provided on Wattle and in lectures once confirmed.

The mid-semester exam is non-redeemable and there will be no special examinations. For students who meet the necessary requirements for a special exam (eg. medical certificate), the 20% weighting will be moved to the final exam.

Assessment Task 2: Assignment (compulsory)
Details of task:
The assignment questions will be provided to all students at the relevant time on the course Wattle page. Students are expected to complete this assignment individually. Students will need to upload the soft copy submission via Wattle and are encouraged to use Excel to complete the assignment. The due date is 19 May 4:00pm.

Assessment Task 3: Final Exam (compulsory)
Details of task:
The final exam will be 3 hours long and will cover the entire syllabus. Specific details regarding examination conditions and the time and location for this examination will be provided on Wattle and in lectures once confirmed.

Assignment Submission
All students must submit an assignment of their own writing. The assignment is to be submitted online via Wattle with an attached assignment coversheet. Please keep a copy of the assignment for your record.

The ANU is using Turnitin to enhance student citation and referencing techniques, and to assess assignment submissions as a component of the University’s approach to managing Academic Integrity. For additional information regarding Turnitin please visit ANU Online.

Extension and Penalties
All assessment work must be submitted by due date and time. Anything that is submitted after the relevant date and time will receive a mark of 0%.

Returning Assignments
Feedback via Wattle.
Examinations
Both the mid-semester and final examinations are closed-book. A formula sheet will be provided. You are also allowed to bring in a non-programmable calculator and a dictionary (these must not contain any material added by the student, and will be subject to random checks during the course of the examination).

Scaling
Your final mark for the course will be based on the raw marks allocated for each assignment or examination. However, your final mark may not be the same number as produced by that formula, as marks may be scaled. Any scaling applied will preserve the rank order of raw marks (i.e. if your raw mark exceeds that of another student, then your scaled mark will exceed or equal the scaled mark of that student), and may be either up or down.

READING LISTS
There are no prescribed textbooks for this course. All course materials will be provided via the course Wattle page.

Supplementary Reading:

- Course Material for CT1: Financial Mathematics, ACTED Australia
TUTORIAL AND/OR SEMINAR REGISTRATION

Students will be expected to attend a one hour tutorial per week from the second week of semester. The tutorials in this unit serve two functions. Firstly, they provide students with the opportunity to seek assistance concerning lecture material. Secondly, practice problems will be assigned each week and the solutions will be discussed in the tutorials. Generally the questions will relate to the lecture material of the previous week. Students are expected to have attempted the questions prior to the tutorial. Solutions to the tutorial questions will also be placed on the course website.

Enrolment in tutorials will be completed online using the CBE Electronic Teaching Assistant (ETA). To enrol, follow these instructions:

1. Go to http://eta.fec.anu.edu.au
2. You will see the Student Login page. To log into the system, enter your University ID (your student number) and password (your ISIS password) in the appropriate fields and hit the Login button.
3. Read any news items or announcements.
4. Select "Sign Up!" from the left-hand navigation bar.
5. Select your courses from the list. To select multiple courses, hold down the control key. On PCs, this is the Ctrl key; on Macs, it is the ⌘ key. Hold this key down while selecting courses with the mouse. Once courses are selected, hit the SUBMIT button.
6. A confirmation of class enrolments will be displayed. In addition, an email confirmation of class enrolments will be sent to your student account.
7. For security purposes, please ensure that you click the LOGOUT link on the confirmation page, or close the browser window when you have finished your selections.
8. If you experience any difficulties, please contact the School Office (see page 1 for contact details).

COMMUNICATION

Email
If necessary, the lecturers and tutors for this course will contact students on their official ANU student email address. Information about your enrolment and fees from the Registrar and Student Services' office will also be sent to this email address.

Announcements
Students are expected to check the Wattle site for announcements about this course, e.g. changes to timetables or notifications of cancellations. Notifications of emergency cancellations of lectures or tutorials will be posted on the door of the relevant room.

Course URLs
All course materials will be available on Wattle, the University's online learning environment. Log on to Wattle using your student number and your ISIS password.
POLICIES

The University offers a number of support services for students. Information on these is available online from http://students.anu.edu.au/studentlife/

ANU has educational policies, procedures and guidelines, which are designed to ensure that staff and students are aware of the University’s academic standards, and implement them. You can find the University’s education policies and an explanatory glossary at: http://policies.anu.edu.au/

Students are expected to have read the Student Academic Integrity Policy before the commencement of their course.

Other key policies include:

- Student Assessment (Coursework)
- Student Surveys and Evaluations

ACTUARIAL PROFESSION INFORMATION

Exemption from Actuarial Professional examination

The Australian National University is accredited by the Actuaries Institute to provide students with exemptions from the Part I professional examinations of the Institute. Exemptions are recommended subject to obtaining sufficiently high grades in designated courses. This course closely follows the syllabus of Subject CT1 of the IAAust.

To qualify for an exemption from the IAAust professional examination CT1, students are required to receive a mark of 60% or greater in this course. The standard required by the Institute of Actuaries of Australia for an exemption will be upheld and thus no quota applies to the percentage of students receiving each grade in this course.

University subscription to the Institute of Actuaries

The Institute of Actuaries of Australia (IAAust) allows students to become IAAust University Subscribers free of charge. Full time undergraduates studying at an Institute accredited university who are members of a university student actuarial society are eligible.

To sign up, go to: http://www.actuaries.asn.au/becoming-an-actuary/becoming-a-university-subscriber

The University Subscriber offer is not a membership of the IAAust but a subscription to receive information on career opportunities, invitations to selected IAAust events and online publications. You might also consider joining the IAAust – there are advantages in doing so while a full-time student.

For membership information, go to http://www.actuaries.asn.au/becoming-an-actuary/becoming-a-member/becoming-a-student-member