2151AES
Mathematics and the Assessment of Risk

Semester 2 - 2007

Academic Organisation: Griffith School of Environment
Faculty: Science, Environment, Engineering and Technology
Credit point value: 10
Student Contribution Band: Band 2
Course level: Undergraduate
Campus/Location/Learning Mode: Nathan / On Campus / In Person
Convenor/s: Dr Gurudeo Tularam (Nathan)
Enrolment Restrictions: Nil
This document was last updated: 27 June 2007

BRIEF COURSE DESCRIPTION

COURSE OFFERED LAST TIME IN 2008

This course will introduce mathematical aspects of risk concepts, assessments and knowledge of financial instruments available. Practical operations and the use of financial instruments will also be introduced. However, relevant mathematics calculations which enable better use and understanding of derivatives and financial instruments will be taught throughout the course. Finally the course will aim to cover the important aspect of financial risk management using the financial instruments.

Incompatible: EM12042 Mathematics and the Assessment of Risk
COURSE AIMS

Mathematics of risk assessment is a course designed for all students who are interested in studying risk and risk management in a quantitative manner although qualitative analysis is also considered. While useful for environmental scientists, this course is particularly designed for those studying accounting, finance and economics. This is because in modern times financial analysts and business professionals are daily dealing with public investments and thus require a good understanding of the quantitative aspects of risk and risk management to avoid large losses. The mathematics of risk assessment course focuses on the mathematical models and risk related to single investment and investment portfolios. Hedging is a means of overcoming risk and this course examines mathematics related hedging of funds as well. Any risk course must include the study of probability and some general distributions and these are also studied. This course revises simple probability, binomial, poisson, and normal distributions as they are applied to measures of risk. The mathematical aspects of hedging using forwards, futures and options are studied in some detail. The focus will be on related quantitative and graphical aspects as well as developing formulae for valuing and pricing of options. For example, the Black-Scholes model will be studied in detail. The mathematical aspects of swaps, forward rate agreements and detailed study of the binomial tree modelling will be studied. The course assessment will involve assignment and/or project work followed by a final exam in exam week. The material presented in lectures will be supported by problem solving based tutorials in which students solve real life type problems by firstly using their prior knowledge to understand the important processes involved and then translate the procedures and processes into mathematics so that quantitative risk analyses may be undertaken.

LEARNING OUTCOMES

After completing the course the student should be able to undertake an initial risk analysis of many real life situations related to the financial sector. Given the student will first be versed in more general strategies of risk analysis and management he or she will be able to lead or at the least be an active agent in the analysis and/or management of more general risks and hazards be they environmental or other types. The students who have satisfactorily completed this course will be able to think logically and develop well thought out plans for hedging risks when dealing with futures, forwards, options related to the financial markets. The students will be able to understand and apply various types of distributions such as binomial, poisson and normal to risk problems related to risk. They will be able to apply the general distributions to analyse given case studies such as how companies decide to set insurance premiums. The students will demonstrate a sound knowledge of the share market, and show mathematical applications related to futures, forwards, and options in the financial marketplace. The students will be able to present graphical explanations of how hedging occurs with forwards, futures, swaps and options. They will also demonstrate satisfactory understanding of correlations as well as how to calculate correlations when dealing with portfolio analysis. They will be able to calculate a correlation matrix given a set of financial data to study portfolio variances involving different combinations of investment types. The students will demonstrate a mathematical understanding of covariance and correlations of various products and be able to investigate mathematically how each influence the total variance of a given group of investments. The analysis of portfolio investment will mainly deal with a two investment case but the students will be able to use their mathematical knowledge to infer more general formulas. The students will be able to analyse hedging of risks using negatively correlated products in the market place and more generally demonstrate higher order thinking and creative behaviour when dealing with any type of investment or portfolio analysis by considering the many risks involved. In a more general way, the students will study particular disasters in the market place to examine why and how financial companies fail. Also affective/emotional aspects of such disasters related will be discussed, that is, how the share holders and connected individuals deal with disasters within the business environment.
CONTENT, ORGANISATION AND TEACHING STRATEGIES

In each lecture the students will be provided with a general overview of each section of work to be covered during the coming weeks. The lectures will be the focus of the learning as it will be present material to be discussed and understood during the tutorials. The students will be given problem worksheets during tutorials and they will be asked to work through in groups to identify the fundamental aspects of the mathematics of risk and risk management in the solving of the problems. The tutorials will be student centred and problem solving based. The lectures will also be problem based presentations. The material will be presented in way that it is student centred as interjections will be allowed as student pose questions and seek answers for clarification of the notes etc. This will make the lectures less threatening and more interesting as student take more share and responsibility of their learning. Also, during tutorials students will be given solutions to certain problems posed in the problem sheets and they will be required to do solve with others either during the tutorial session or as homework. It is sometimes possible to bring in a guest lecturer to demonstrate the real life share broking thus providing more real insight into the problems of hedging and risk taking. All relevant notes, readings, and other material including the lecture notes will be available on line the learning@GU website in the resources section. The students will be also encouraged to visit the lecturer during consultation times to gain access to any material related to the course. Importantly, during student group problem solving various dynamics will allow students to experience social and group interactions will allow students to learn to cope with others and their own difficulties. Also, students will learn to deal with conflicts and experience alternative views. The total learning process in this course will allow the students to acquire the necessary tools to manage the solving of real life problems. The tutor will guide, stimulate and manage the student learning during tutorials in a way that allows the focus to be mainly on the mathematical analyses of risk and risk management.

Contact Summary

It is expected that students to attend all lectures and tutorials as lectures and tutorials will be based on a problem solving format that will mean a number of examples and problems will be solved in both sessions. Important information regarding exams and types of questions that may appear in the exams and assignments may be discussed during lectures and tutorials.

CONTENT SUMMARY

<table>
<thead>
<tr>
<th>Topic</th>
<th>Lecture Content</th>
<th>Tutorial/Laboratory Content</th>
<th>Readings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Introduction to the Mathematics of Risk and Risk Management: Definitions, Environmental and Financial Risk: General Risk and Risk Management Strategies</td>
<td>Define risk, and risk management, and differentiate between various type of risk</td>
<td>Set readings given by Lecturer</td>
</tr>
<tr>
<td>2.</td>
<td>Revision of Algebra and Fractions. Study of Derivatives - Mathematics of Forwards and Futures</td>
<td>Definitions and mathematical calculations</td>
<td>Lecturer assigned reading material</td>
</tr>
<tr>
<td>3.</td>
<td>Mathematics of Forwards-derivation of Forwards and Futures-graphical</td>
<td>Examples and problems of algebraic manipulations</td>
<td>Lecturer Notes</td>
</tr>
<tr>
<td>4.</td>
<td>Definition and the Mathematics of Options. Revision of functional derivatives</td>
<td>Discussion on nature of options, introduction to calculus concepts-derivative</td>
<td>Lecturer Notes</td>
</tr>
<tr>
<td>Topic</td>
<td>Lecture Content</td>
<td>Tutorial/Laboratory Content</td>
<td>Readings</td>
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<tr>
<td>5.</td>
<td>Graphical study of Options and various types as well as the related mathematical formulae including the study of the Black-Scholes Formula</td>
<td>Problems on options</td>
<td>Lecturer assigned readings</td>
</tr>
<tr>
<td>6.</td>
<td>Managing Risks: Hedging involving Futures, Forwards and Option</td>
<td>General examples and problems on the three derivatives</td>
<td>Lecturer Notes</td>
</tr>
<tr>
<td>7.</td>
<td>Modelling utility functions, Square Root, Log functions, and mathematical calculations related to Utility modelling</td>
<td>Problems on functions</td>
<td>Lecturer Notes</td>
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<tr>
<td>8.</td>
<td>Revision of Probability and statistical Distributions- Expectations, correlations. Study of Binomial Tree modelling</td>
<td>Problems on probability, expectation, correlations</td>
<td>Lecturer Notes</td>
</tr>
<tr>
<td>9.</td>
<td>Portfolio Analysis – a detailed study of two case scenarios-develop more general equations - the study of Correlations, Covariances. Value at Risk-Linear and Quadratic Modelling. Value at Risk-volatilities and correlations</td>
<td>Algebraic manipulation and development of a Two case scenario-generalization to n case. Introduction examples on Linear and Quadratic modelling</td>
<td>Lecturer Notes</td>
</tr>
<tr>
<td>10.</td>
<td>Study of more Probability distributions, Poisson etc</td>
<td>Examples on probability distributions</td>
<td>Lecturer Notes</td>
</tr>
<tr>
<td>11.</td>
<td>Simulation as a tool for decision making</td>
<td>Example simulations and problems</td>
<td>Lecturer Notes</td>
</tr>
<tr>
<td>12.</td>
<td>Multivariate statistical techniques as required in Risk Analysis</td>
<td>Multivariate problem solving</td>
<td>Lecturer Notes</td>
</tr>
<tr>
<td>13.</td>
<td>General-Study real disasters – case studies</td>
<td>Discussion on Past Disasters</td>
<td>Readings will be given</td>
</tr>
</tbody>
</table>

**ASSESSMENT**

<table>
<thead>
<tr>
<th>Item</th>
<th>Assessment Task</th>
<th>Length</th>
<th>Weighting</th>
<th>Total Marks</th>
<th>Relevant Learning Outcomes</th>
<th>Due Day and Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Assignment 1</td>
<td>3 weeks</td>
<td>20%</td>
<td>20</td>
<td>1-9</td>
<td>Week 5, Friday 5pm</td>
</tr>
<tr>
<td>2.</td>
<td>Assignment 2</td>
<td>3 weeks</td>
<td>20%</td>
<td>20</td>
<td>10-13</td>
<td>Week 10, Friday 5pm</td>
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## Assessment Details

Relevant assessment information will be posted on Learning@Griffith at the start of the course.

However, students will need to submit all assessment items in order to be eligible to achieve a satisfactory result and thus pass the course.

## Return of Assessment Items

All assessment items are to be handed in to the University Assignment collection centre by the due date and time. Marks may be deducted daily if assignments are handed in late. Please see the 2151AES Learning@GU website for further details.

## Notification of Availability of Feedback on Assessment

Assignment and exams will be marked and feedback provided within 1-2 weeks after the due date.

## GRADUATE SKILLS

<table>
<thead>
<tr>
<th>Graduate Skills</th>
<th>Taught</th>
<th>Practised</th>
<th>Assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective communication (written)</td>
<td>☒</td>
<td>☐</td>
<td>☒</td>
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<tr>
<td>Effective communication (oral)</td>
<td>☒</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>Effective communication (interpersonal)</td>
<td>☒</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>Information literacy</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>Problem solving</td>
<td>☒</td>
<td>☒</td>
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<tr>
<td>Critical evaluation</td>
<td>☒</td>
<td>☐</td>
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<tr>
<td>Work autonomously</td>
<td>☒</td>
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<tr>
<td>Work in teams</td>
<td>☒</td>
<td>☒</td>
<td>☐</td>
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<tr>
<td>Creativity and innovation</td>
<td>☒</td>
<td>☒</td>
<td>☐</td>
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<tr>
<td>Ethical behaviour in social / professional / work environments</td>
<td>☒</td>
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<tr>
<td>Responsible, effective citizenship</td>
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## TEACHING TEAM

### Course Convenor

<table>
<thead>
<tr>
<th>Convenor Details</th>
<th>Nathan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campus Convenor</td>
<td>Dr Anand Tularam</td>
</tr>
<tr>
<td>Email</td>
<td><a href="mailto:a.tularam@griffith.edu.au">a.tularam@griffith.edu.au</a></td>
</tr>
</tbody>
</table>
Office Location | N55 Room 2.37
---|---
Phone | 3375 3522
Fax | 3375 7459
Consultation times | Wednesday 9 -11am

Additional teaching team members

COURSE COMMUNICATIONS

Student needing to contact convenors should email first or visit him or her during the consultation times. Students must read their university mails for vital information is sent using this university data system. The course notes, tutorial and other lecture information is all provided in the learning@GU site in the resources section so please use the site to download relevant material. Weekly information for example, students are to predo the tutorial questions so they can discuss the topics during the tutorial sessions will be placed on the announcement board at learning@GU site or sent by mail so please visit the site and read university emails daily and be sure to clear it regularly.

All students will need to read their university emails and the Learning@GU site to keep in constant communication with the lecturer. Day to day student requirement is emailed to you on the university email address. Remember it is vitally important that you check the Learning@GU resources site and university email daily.

TEXTS AND SUPPORTING MATERIALS

Recommended Readings

SECTION B – ADDITIONAL COURSE INFORMATION

If no additional course information is to be included in this Section, a statement such as “Students should refer to the Learning@Griffith website for further information about this course” should be included.

Faculties/Schools/Convenors may wish to include information in Course Outlines which falls outside the specified subsection headings in Section A. Schools may wish to include additional University policy information in this section, or provide their own information, which accords with, but provides more detail than University policy.

Below are a number of potential subsection headings (sample University level content may be available for some of these):

- Assignment Extensions and Penalties
- Assignment Submissions and Returns
- Copyright
- Course Evaluation
- Employment Screening
- Examinations
- Grade Descriptions
- Study Program
Student Charter

Risk assessment/health and safety information

The following types of information may previously have been included in the Course Outline but should now be provided via Learning@Griffith and are not considered appropriate for inclusion in the Course Outline:

- Referencing guidelines
- Further reading/additional references
- Forms associated with course administration (attendance forms, assignment cover sheets, etc.)
- Equipment guidelines
SECTION C – KEY UNIVERSITY INFORMATION

ACADEMIC MISCONDUCT

Students must conduct their studies at the University honestly, ethically and in accordance with accepted standards of academic conduct. Any form of academic conduct that is contrary to these standards is academic misconduct, for which the University may penalise a student. Specifically it is academic misconduct for a student to:

- present copied, falsified or improperly obtained data as if it were the result of laboratory work, field trips or other investigatory work;
- include in the student's individual work material that is the result of significant assistance from another person if that assistance was unacceptable according to the instructions or guidelines for that work;
- assist another student in the presentation of that student's individual work in a way that is unacceptable according to the instructions or guidelines for that work;
- cheat; (Cheating is dishonest conduct in assessment);
- plagiarise (Plagiarism is knowingly presenting the work or property of another person as if it were one's own.)

Visit the University's Policy on Academic Misconduct for further details.

PLAGIARISM DETECTION SOFTWARE

In semester 2, 2007 the University is piloting the use of plagiarism detection software. Students should be aware that your Course Convenor may use this software to check submitted assignments. If this course is included in the pilot your Course Convenor will provide more detailed information about how the detection software will be used.

KEY STUDENT-RELATED POLICIES

All University policy documents are accessible to students via the University’s Policy Library website at: www.griffith.edu.au/policylibrary. Links to key policy documents are included below for easy reference:

- Student Charter
- Student Administration Policy
- Assessment Policy
- Academic Calendar
- Health and Safety Policy
- Academic Standing, Progression and Exclusion Policy
- Policy on Student Grievances and Appeals
- Examinations Timetabling Policy and Procedures
- Guideline on Student E-Mail

UNIVERSITY SUPPORT RESOURCES

The University provides many facilities and support services to assist students in their studies. Links to information about University support resources available to students are included below for easy reference:

- Learning Centres - the University provides access to common use computing facilities for educational purposes. For details visit www.griffith.edu.au/cuse
- Learning@Griffith - there is a dedicated website for this course via the Learning@Griffith student portal.
- Student Services facilitate student access to and success at their academic studies. Student Services includes: Careers and Employment Service; Chaplaincy; Counselling Service; Health Service; Student Equity Services (incorporating the Disabilities Service); and the Welfare Office.
- Learning Services within the Division of Information Services provides learning support in three skill areas: computing skills; library skills; and academic skills. The study skills resources on the website include self-help tasks focusing on critical thinking, exam skills, note taking, preparing presentations, referencing, writing, proof reading, and time management.