### COURSE DETAILS

**Course Code:** F71AE  
**Full Course Title:** Survival Models  
**SCQF Level:** 11  
**SCAF Credits:** 15  
**Available as Elective:** No

### DELIVERY LEVEL

<table>
<thead>
<tr>
<th>Undergraduate:</th>
<th>Yes</th>
<th>Postgraduate Taught:</th>
<th>Yes</th>
<th>Postgraduate Research:</th>
<th>No</th>
</tr>
</thead>
</table>

**Additional Information:**

### COURSE AIMS

To understand the use of mathematical models of mortality, illness and other life history events in the study of processes of actuarial interest

To be able to estimate the parameters in these models, mainly by maximum likelihood

To apply methods of smoothing observed rates of mortality and to test the goodness-of-fit of the models.

### LEARNING OUTCOMES – SUBJECT MASTERY

After studying this course, students should be able to:

- Estimate a survival function using the Kaplan-Meier method
- Find the partial likelihood function in the Cox model
- Use the partial likelihood to estimate parameters (with standard errors) in the Cox model
- Write down an appropriate Markov multi-state model for a system with multiple transfers
- Obtain the Kolmogorov Forward Equations in a Markov multi-state model
- Derive the likelihood function in a Markov multi-state model
- Use the likelihood function to estimate parameters (with standard errors) in a Markov multi-state model
- Obtain the likelihood function in the 2-state model with states Alive and Dead under the binomial or Poisson models
- Use any of two assumptions (uniform distribution of death, constant force of mortality) to reduce the binomial likelihood to a function of a single parameter, and estimate the parameter
- Understand the need for graduation of observed rates of mortality and be familiar with the main methodologies in this area of survival modelling
- Apply a range of appropriate tests to check for adherence of a graduation to data
- Understand the effects of duplicate policies on estimates of mortality

Calculate exactly and from census data the central exposed to risk

### LEARNING OUTCOMES – PERSONAL ABILITIES
At the end of the course, students should be able to:

- Demonstrate the ability to learn independently
- Manage time, work to deadlines and prioritise workloads
- Present results in a way which demonstrates that they have understood the technical and broader issues of modelling mortality and morbidity data

Communicate findings effectively in the actuarial and financial services industry

SYLLABUS

- Conditional expectation.
- Estimating the lifetime distribution
- Markov models: theory
- Markov models: data and estimation
- Binomial and Poisson models of mortality
- Graduation and statistical tests
- Exposed to risk

COURSE RELATIONSHIPS

N/A

LOCATION AND ASSESSMENT METHODS

<table>
<thead>
<tr>
<th>Edi</th>
<th>SBC</th>
<th>Ork</th>
<th>Dub</th>
<th>Malay</th>
<th>IDL</th>
<th>COLL</th>
<th>ALP</th>
<th>OTH</th>
<th>Method</th>
<th>Weight</th>
<th>Exam Mins</th>
<th>Type</th>
<th>Diet</th>
<th>Synoptic Course</th>
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</thead>
<tbody>
<tr>
<td>Y</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>Examination</td>
<td>60</td>
<td>180</td>
<td>Assessment</td>
<td>Semester 2</td>
<td>F71SZ</td>
</tr>
</tbody>
</table>

Examination will be at least 60% and no more than 80%.

| Y   |     |     |     |       |     |      |     |     | Coursework| 40     | Assessment | Semester 2 |

Coursework will be at least 20% and no more than 40%.

| Y   |     |     |     |       |     |      |     |     | Examination| 100    | 120       | Reassessment| Semester 2 |

Re-assessment in the next academic year.