Subject Description Form

Subject Code	AMA543
Subject Title	Loss Models
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	**Pre-requisite:** AMA528 Probability and Stochastic Models
Objectives	To enable students to have a thorough understanding of statistical loss distributions, their variations and their applications.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) Apply the concepts and terminology of loss models and risk analysis. (b) Calculate parametric and nonparametric estimators of a loss distribution. (c) Integrate the knowledge and techniques in statistical inference, probability models and risk theory to analyze complete and incomplete loss data. (d) Apply statistical tests to determine the suitability of a fitted model. (e) Make statistical inferences based on the knowledge and techniques in estimation, evaluation, and selection of loss models. (f) Apply parametric and semi-parametric models and inference procedures to analyze loss data. (g) Apply the acquired knowledge and techniques to manage risks in insurance and financial industries. (h) Learn claim amount distributions, stop-loss reinsurance, analysis of reinsurance using ruin theory.
Subject Synopsis/ Indicative Syllabus	Complete and incomplete statistical data: complete, censored, truncated, grouped and shifted data; estimation adjustments based on the presentation of the sample data. Parametric estimation of a failure time or loss distribution: method of moments, percentile matching, maximum likelihood, and Bayesian estimation. Nonparametric estimation of a failure time or loss distribution: the empirical distribution, the Kaplan-Meier estimator and the Nelson-Aalen estimator. Properties of estimators: efficiency, bias, consistency, and mean squared error. Variance and confidence intervals of estimators: method for empirical distributions, information matrix and the delta method. Statistical tests to determine the suitability of a fitted model: Pearson's chi-square statistic, likelihood ratio test, Kolmogorov-Smirnov statistic, Bayesian Schwarz Criterion. Models with covariates: Cox proportional hazard models, parametric and semi-parametric models, generalized linear models; likelihood and partial likelihood methods. Models for individual claim random variables, frequency and severity

<table>
<tr><td></td><td>distributions, distribution of aggregate claims, discrete and continuous time models, adjustment coefficient, ruin theory, maximal aggregate loss.
Claim amount distributions, stop-loss reinsurance, analysis of reinsurance using ruin theory. Risk analysis and insurance applications.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>The subject will be delivered mainly through lectures and tutorials. The teaching and learning approach is mainly problem-solving oriented. The approach aims at the development of statistical techniques and how the techniques can be applied to solving problems. Students are encouraged to adopt a deep study approach by employing high level cognitive strategies, such as critical and evaluative thinking, relating, integrating and applying theories to practice.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="8">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td><td>g</td><td>h</td></tr>
<tr><td>1. Assignments</td><td>10%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>2. Tests</td><td>30%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td></tr>
<tr><td>3. Examination</td><td>60%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="8"></td></tr>
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Continuous Assessment comprises of assignments and tests. A written examination is held at the end of the semester.</td></tr>
<tr><td>Student Study Effort Required</td><td>
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<tr><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lecture</td><td>26 Hrs.</td></tr>
<tr><td>▪ Tutorial</td><td>13 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Assignment/Mini-project</td><td>38 Hrs.</td></tr>
<tr><td>▪ Self-study</td><td>60 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>137 Hrs.</td></tr>
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</td></tr>
<tr><td>Reading List and References</td><td>
<table>
<tr><td>Klugman, S.A., Panjer, H.H., and Willmot, G.E.</td><td>Loss Models: From Data to Decision, 4th Edition</td><td>Wiley, 2012</td></tr>
<tr><td>Smith, P.J.</td><td>Analysis of Failure and Survival Data</td><td>Chapman & Hall, 2002</td></tr>
<tr><td>Buhlmann, H.</td><td>Mathematical Methods in Risk Theory</td><td>Springer-Verlag 2005</td></tr>
<tr><td>Kaas, R.,</td><td>Modern Actuarial Risk Theory: Using R</td><td>Springer, 2008</td></tr>
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	Goovaerts, M., Dhaene, J., and Denuit, M.