Module code	SM-4335			
Module Title	Advanced Probability			
Degree/Diploma	Bachelor of Science (Mathematics)			
Type of Module	Major Option			
Modular Credits	4	**Total student Workload**	10	hours/week
		Contact hours	4	hours/week
Prerequisite	SM-2205 Intermediate Statistics			
Anti-requisite	None			

Aims

The module is designed to introduce mathematics major students to advanced probabilistic concepts and techniques building on those learned in the Intermediate Statistics module SM-2205.

Learning Outcomes

On successful completion of this module, a student will be expected to be able to:

Lower order :	40%	- compute densities of functions of random variables; use the Jacobian matrix to compute joint densities of functions of many random variables
Middle order :	40%	- compute moment generating functions and characteristic functions and use them to find moments of random variables ; verify convergence or non-convergence of sequence of random variables in various modes
Higher order:	20%	- solve problems and prove assertions related to measures, measurable sets, measurable functions and Riemann and Lebesgue integrals; use Fatou's lemma, the monotone convergence theorem and the dominated convergence theorem to prove statements related to abstract integration - work independently

Module Contents

- Transformation of random variables. Characteristic functions.

- Sequence of random variables: convergence of random variables; various modes of convergence – almost sure convergence, convergence in probability, L^1, L^2 convergence and general L^p convergence; convergence in distribution; Borel-Cantelli lemma; the continuity theorem.

- Asymptotics of *i.i.d.* random variables: sequences of independent and identically distributed random variables; strong and weak laws of large numbers; the central limit theorem; the law of iterated logarithm.

- Measure and probability: fields and sigma fields; monotone class theorem; measure on a sigma field; Caratheodery extension theorem; Borel sets; Lebesgue measure and Lebesgue measurable sets; measurable functions; abstract measure spaces.

- Lebesgue integration: abstract integration and integration with respect to Lebesgue measure; the relation between Riemann integrability and Lebesgue integrability; Fatou's lemma, the monotone convergence theorem and the dominated convergence theorem.

Assessment	Formative assessment	Tutorial and feedback.

	Summative assessment	Examination: 60% Coursework: 40% - 2 class tests (40%)