UNIVERSITY COLLEGE of the FRASER VALLEY

COURSE IMPLEMENTATION DATE: January 2005
COURSE REVISED IMPLEMENTATION DATE:
COURSE TO BE REVIEWED: May 2009
(Four years after implementation date) (MONTH YEAR)

OFFICIAL COURSE OUTLINE INFORMATION

Students are advised to keep course outlines in personal files for future use.
Shaded headings are subject to change at the discretion of the department and the material will vary - see course syllabus available from instructor

FACULTY/DEPARTMENT: **Science, Health & Human Services / Mathematics & Statistics**

MATH 370		**3**
COURSE NAME/NUMBER	FORMER COURSE NUMBER	UCFV CREDITS

Probability and Stochastic Processes
COURSE DESCRIPTIVE TITLE

CALENDAR DESCRIPTION:

This course covers the theory of probability and stochastic processes for science and mathematics students who have experience with second-year calculus and elementary probability and statistics. Topics include probability space, conditional probability and independence, continuous and discrete random variables, jointly distributed random variables, expectation, conditional expectation and properties, limit theorems, Markov chains and Poisson processes, lifetime distributions, Cox's proportional hazard model, Kaplan-Meier estimate of the survival function, and simulation.

PREREQUISITES: **MATH 211, MATH 270**
COREQUISITES:

SYNONYMOUS COURSE(S)
(a) Replaces: _____ *(Course #)*
(b) Cannot take: _____ *(Course #)* for further credit.

SERVICE COURSE TO: _____ *(Department/Program)* _____ *(Department/Program)*

TOTAL HOURS PER TERM: **60**
STRUCTURE OF HOURS:

Lectures:	**60**	Hrs
Seminar:		Hrs
Laboratory:		Hrs
Field Experience:		Hrs
Student Directed Learning:		Hrs
Other (Specify):		Hrs

TRAINING DAY-BASED INSTRUCTION
LENGTH OF COURSE:
HOURS PER DAY:

MAXIMUM ENROLLMENT: **36**
EXPECTED FREQUENCY OF COURSE OFFERINGS: **Once a year**

WILL TRANSFER CREDIT BE REQUESTED? (lower-level courses only)	☐ Yes	☐ No
WILL TRANSFER CREDIT BE REQUESTED? (upper-level requested by department)	☒ Yes	☐ No
TRANSFER CREDIT EXISTS IN BCCAT TRANSFER GUIDE:	☐ Yes	☒ No

AUTHORIZATION SIGNATURES:

Course Designer(s): Ali Reza Fotouhi
Chairperson: Gillian Mimmack *(Curriculum Committee)*
Department Head: Gillian Mimmack
Dean: Jacalyn Snodgrass
PAC Approval in Principle Date:
PAC Final Approval Date: December 10, 2004

LEARNING OBJECTIVES / GOALS / OUTCOMES / LEARNING OUTCOMES:

Successful students will be able to:
1. construct a probability model and investigate the properties of probability considering probability as a set function.
2. construct conditional probability models, investigate the independence of events, and use Bayes' formula.
3. formulate problems related to probability in real life using random variables and distributions of random variables.
4. investigate relationships between random variables that explain processes in applications.
5. calculate joint and conditional distributions, distributions of functions of random variables, and distributions of order statistics.
6. compute expectation, covariance, variance, correlation, conditional expectations and use properties of these quantities.
7. find moment generating functions and joint moment generating functions and use their properties.
8. apply the law of large numbers and some important inequalities such as Chebyshev's inequality.
9. use Markov chains and Poisson processes to solve simple problems.
10. model lifetimes using lifetime distributions, use hazard and survival functions in simple problems.
11. apply Weibull and Cox's proportional hazard models in lifetime analysis.
12. simulate data from continuous and discrete distributions.

METHODS:

Classroom lectures. Evaluation includes assignments, tests and a three-hour comprehensive examination.

PRIOR LEARNING ASSESSMENT RECOGNITION (PLAR):

Credit can be awarded for this course through PLAR (Please check:) ☒ Yes ☐ No

METHODS OF OBTAINING PLAR:

Course challenge. Please check online at http://www.ucfv.ca/math/challenge.htm for the departmental challenge policy.

TEXTBOOKS, REFERENCES, MATERIALS:

[Textbook selection varies by instructor. An example of texts for this course might be:]

The text is chosen by a departmental curriculum committee. Recommended texts are:

Sheldon Ross. A First Course in Probability. 6th edition.
Sheldon Ross. Introduction to Probability Models.
Saeed Ghahramani. Fundamentals of Probability with Stochastis Process, third edition.

SUPPLIES / MATERIALS:

STUDENT EVALUATION:

[An example of student evaluation for this course might be:]

The weighting of the components may vary amongst instructors and years. There have to be at least two tests. The final examination has to be comprehensive and worth 40 to 50%. Students must obtain at least 40% on the final exam to pass the course.

A typical breakdown is as follows:

Assignments	20%
Term Tests	35%
Final Exam	45%

COURSE CONTENT:

[Course content varies by instructor. An example of course content might be:]

Probability: axioms of probability, probability space, probability as a continuous set function, conditional probabilities, Bayes' formula, independent events.

Continuous and Discrete Random Variables: random variables, discrete random variables, important discrete random variables (uniform, Bernoulli, binomial, Poisson, geometric, negative binomial, hypergeometric), continuous random variables, important continuous random variables (uniform, exponential, gamma, chi square, normal, Cauchy, beta).

Jointly Distributed Random Variables: joint distribution functions, independent random variables, sums of independent random variables, conditional distributions for discrete and continuous random variables, probability distributions of functions of random variables, order statistics, t and F distributions, bivariate normal distributions.

Expectation and Properties: definition of expectation, covariance, variance, correlation, expectations and variances of important

random variables, conditional expectations and properties thereof, moment generating functions and properties thereof, joint moment generating functions and properties thereof.

Limit Theorems: Chebyshev's inequality, weak law of large numbers, central limit theorem, strong law of large numbers.

Markov Chains and Poisson Processes: Markov chains, Poisson processes, surprise, uncertainty, entropy.

Lifetime Distributions: lifetime distributions (exponential, Weibull, lognormal, gamma, logistic, log-logistic, extreme-value), hazard functions, survival functions, Kaplan-Meier estimate of the survival function, Cox's proportional hazard model.

Simulation: general techniques for simulating continuous random variables, special techniques for some continuous distributions (normal, gamma, chi square, beta, exponential), simulating discrete random variables.