



MULTIMEDIA UNIVERSITY OF KENYA

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(MMU is ISO 9001:2008 certified)

DEPARTMENT OF CHEMISTRY

UNIT CODE: MAT 2211 UNIT NAME: Probability and Statistics

LECTURER NAME: Mwangi (Mr) CONTACTS: Mwangi.Daniel@mmu.ac.ke

Office: Department of Physical Sciences

Prerequisite: MAT 2111 Mathematics for Science

Purpose:

To enable the learner understand the concepts of probability and descriptive statistics, and to introduce them to various measures and tools used in summary and analysis of data.

Learning Outcomes:

At the end of the course, the student should be able to:

1. Present data in a more concrete manner in the form of tables, charts and graphs;
2. Summarize and analyze data using measures of central tendency, measures of dispersion, regression, skewness, and kurtosis;
3. Use linear regression for modeling a relationship between two variables.
4. Apply probability theory to solve physical problems.

Course Description:

Frequency distribution, mean, median, mode and other measures of central tendency, standard deviation and other measures of dispersion, moments, skewness and kurtosis, elementary probability theory and discontinuous probability distribution, binomial, Poisson and negative binomial distribution, continuous probability distributions, normal and exponential, characteristics of distributions, and regression analysis, basic concepts and applications of probability theory and statistics.

Teaching methodology: Lectures, tutorials; and group discussions

Instruction materials/equipment:

1. Liquid Crystal Displays
2. White boards/black boards
3. Flipcharts

Course Assessment:

Continuous Assessment	30%
End of Semester Examination	70%

Core Reading Materials:

Course Textbooks:

1. Dekking F.M. Kraaikamp C., Lopuhaa H.P. and Meester L.E. (2007). *A Modern Introduction to Probability and Statistics, Understanding Why and How*. London: Springer-Verlag. ISBN-13: 978-1852338961
2. Ross S.M. (2014). *Introduction to probability and statistics for engineers and scientists*, (5th Ed.). California: Academic Press. ISBN-13: 978-0123948113
3. Devore J.L. (2015). *Probability and Statistics for Engineering and the Sciences*, (9th Ed.). UK: Cengage Learning. ISBN-13: 978-1305251809

Course Journals:

1. *Journal of Mathematical Methods of Statistics*, Springer. ISSN: 1066-5307
2. *Journal of Nonparametric Statistics*, Taylor & Francis. ISSN: 1029-0311
3. *Journal of Theoretical Probability*, Springer. ISSN: 1572-9230

Reference Materials:

Reference Books:

1. Mendenhall W., Beaver R.J., and Beaver B.M. (2012). *Introduction to probability and statistics*, (14th Ed.). UK: Cengage Learning. ISBN-13: 978-1133103752
2. Ott L., and Longnecker M.T. (2015). *An introduction to statistical methods and data analysis*, (8th Ed.). Brooks/Cole. ISBN-13: 978-1305269484
3. Freund R.J., Mohr D., and Wilson W.J. (2010). *Statistical Methods*, (3rd Ed.). California: Academic Press. ISBN-13: 978-0123749703

Reference Journals

1. *Journal of Statistical Computation and Simulation*. Taylor & Francis. ISSN: 1563-5163
2. *Journal of Statistical Planning and Inference*. Elsevier. ISSN: 0378-3758

Content Summary

Lecture/ Week	Course content	Remarks
1	Review of MAT 2111 Mathematics for Science	
2	<ul style="list-style-type: none"> • Introduction to statistics <ul style="list-style-type: none"> ○ Definitions of some basic terms ○ Collection of data ○ Organization of data • Representation of data <ul style="list-style-type: none"> ○ Tables ○ Diagrams ○ Graphs. 	
3	<ul style="list-style-type: none"> • Descriptive measures • Measures of central location <ul style="list-style-type: none"> ○ Mean ○ Arithmetic mean, ○ Geometric mean; and ○ Harmonic mean ○ Mode and ○ median 	
4	<ul style="list-style-type: none"> • Descriptive measures • Measures of other locations <ul style="list-style-type: none"> ○ Quartiles ○ Deciles; and ○ Percentiles. • Measures of dispersion <ul style="list-style-type: none"> ○ Range ○ Inter and semi-interquartile range ○ Mean deviation ○ Variance and ○ Standard deviation. 	
5	<ul style="list-style-type: none"> • Measures of shape <ul style="list-style-type: none"> ○ Moments ○ Skewness and ○ Kurtosis • bivariate data <ul style="list-style-type: none"> ○ Correlation 	

	<ul style="list-style-type: none"> ○ covariance ○ rank correlation • Regression • Simple linear regression • CAT 1 	
6	<ul style="list-style-type: none"> • Before we start - Logistical Remarks • Why Probability (and Statistics)- An Introduction • Sample spaces and events <ul style="list-style-type: none"> ○ Counting techniques • The concept of Probability <ul style="list-style-type: none"> ○ Axioms of Probability ○ Algebraic rules for probabilities • Addition rules • Conditional Probability • Multiplication and total probability rules • Independence • Bayes' Theorem <ul style="list-style-type: none"> ○ Examples and Discussion ○ Simpson's Paradox • Introduction to Random Variables. 	
7	<p>Random variables:</p> <ul style="list-style-type: none"> • Definition of Random Variables <ul style="list-style-type: none"> ○ Continuous vs. Discrete • Discrete Random Variables • Continuous Random Variables • Probability Mass Function. • Probability Density Function • Cumulative Distribution Function • Mean and Variance <ul style="list-style-type: none"> ○ percentiles and mode ○ Functions of random variables • Independence of Random Variables; Mean and Variance of sums of independent random variables (without proof) 	
8	<ul style="list-style-type: none"> • Specific discrete distributions <ul style="list-style-type: none"> ○ Uniform ○ Bernoulli <ul style="list-style-type: none"> ▪ Bernoulli trials ○ Binomial <ul style="list-style-type: none"> ▪ Tables and Computational Tools for the evaluation of event probabilities. ○ Geometric <ul style="list-style-type: none"> ▪ Memoryless property. ○ Negative Binomial ○ Hypergeometric Distribution ○ The Poisson Distribution ○ The relation between Binomial and Poisson distributions. 	
9	<ul style="list-style-type: none"> • Specific Continuous Distributions 	

	<ul style="list-style-type: none"> ○ Uniform Distribution; ○ Exponential distribution; <ul style="list-style-type: none"> ▪ Motivation and some properties ▪ The standard normal distribution ▪ Basic Properties 	
10	<ul style="list-style-type: none"> • Specific Continuous Distributions: <ul style="list-style-type: none"> ○ Normal Distribution <ul style="list-style-type: none"> ▪ Motivation and some properties ▪ The standard normal distribution ▪ Basic Properties ▪ The standard normal distribution ▪ Basic Properties ▪ Standardizing a Normal random variable • Using probability tables and computational tools 	
11	<ul style="list-style-type: none"> • CAT 2 	
12 & 13	EXAM	