



## UNIVERSITI TEKNOLOGI MARA

### BMS458: QUANTITATIVE METHODS FOR BIOLOGY

<b>Course Name (English)</b>	QUANTITATIVE METHODS FOR BIOLOGY <b>APPROVED</b>
<b>Course Code</b>	BMS458
<b>MQF Credit</b>	3
<b>Course Description</b>	This is an elementary course in biological data analysis. The course is design to equip students with the necessary analytical knowledge and tools in pursuance of their studies in biological sciences. The topics covered are basic probability theory; probability distributions – normal, binomial and Poisson; elementary sampling theory; estimation and hypothesis testing and the analysis of variance. The emphasis is on the laboratory sessions, where students will learn to formulate testable hypotheses, design a scientifically sound experiment, conduct the experiment and analyze the data using the methods taught in the lectures.
<b>Transferable Skills</b>	Computer skills - spreadsheet programming Data analysis skills - biostatistics Practical skills - sampling and measuring
<b>Teaching Methodologies</b>	Lectures, Practical Classes, Discussion
<b>CLO</b>	CLO1 Describe data variables and fundamental concepts of hypothesis testing in biological data analysis CLO2 Calculate statistics commonly used in biological data analysis CLO3 Apply appropriate statistical tests and tools on biological data CLO4 Perform analysis on biological data using spreadsheet functions and other software tools.
<b>Pre-Requisite Courses</b>	No course recommendations
<b>Topics</b>	
<b>1. 1.0 Introduction to the analysis of biological data</b> 1.1) Biological questions and hypothesis 1.2) Types of variables in biological data 1.3) Hypothesis testing concepts 1.4) Confounding variables	
<b>2. 2.0 Descriptive Statistics</b> 2.1) Measures of central tendency – mean, median, mode 2.2) Measures of variation – variance, standard deviation 2.3) Standard error of the mean	
<b>3. 3.0 Probability distributions</b> 3.1) Estimating probabilities 3.2) Permutations and Combinations 3.3) Discrete Probability distributions 3.4) . Binomial 3.5) . Poisson 3.6) Continuous Probability Distributions 3.7) . the Normal distribution 3.8) . tests for normality 3.9) . z scores 3.10) Confidence intervals	

<p><b>4. 4.0 Tests for nominal variables</b></p> <p>4.1) Exact binomial test  4.2) Chi-square test for goodness-of-fit  4.3) G-test for goodness-of-fit  4.4) Chi-square test of independence  4.5) G-test of independence</p>
<p><b>5. 5.0 Tests for measurement variables</b></p> <p>5.1) Students t-test  5.2) One-way Analysis of Variance  5.3) Two way Analysis of Variance  5.4) Analysis of variance with interactions</p>
<p><b>6. 6.0 Correlation and regression</b></p> <p>6.1) Correlation  6.2) Linear regression  6.3) Multiple regression</p>
<p><b>7. 7.0 Non-parametric tests</b></p> <p>7.1) Fisher exact test  7.2) Mann Whitney test  7.3) Wilcoxon signed-rank test  7.4) Kruskal-Wallis test  7.5) other nonparametric tests</p>
<p><b>8. 8.0 Sampling and Experimental design</b></p> <p>8.1) Sampling techniques  8.2) Randomization  8.3) Block designs</p>

Assessment Breakdown	%
Continuous Assessment	60.00%
Final Assessment	40.00%

Details of Continuous Assessment	Assessment Type	Assessment Description	% of Total Mark	CLO
	Assignment	Assignment on use of statistical tests	20%	CLO3
	Test	Test on concepts and basic applications	20%	CLO1
	Written Report	Reports on data analysis using spreadsheet	20%	CLO4

Reading List	Recommended Text
	<ul style="list-style-type: none"> <li>• J.H. McDonald 2015, <i>Handbook of Biological Statistics.</i>, 4th Ed., Sparky House Publishing Baltimore USA [ISBN: 22063985]</li> <li>• Allan Bluman 2017, <i>Elementary Statistics: A Step By Step Approach</i>, 10 Ed., McGraw-Hill Education [ISBN: 9781259755330]</li> <li>• Myra L. Samuels, Jeffrey A. Witmer, Andrew A. Schaffner 2016, <i>Statistics for the Life Sciences</i>, 5 Ed., Pearson College Division [ISBN: 9780321989581]</li> <li>• Graeme D. Ruxton, Nick Colegrave, <i>Experimental Design for the Life Sciences</i>, 4 Ed., Oxford University Press [ISBN: 9780198717355]</li> <li>• 2. S.S. Mangiafico 2015, <i>An R Companion for the handbook of Biological Statistics</i>, Rutgers Cooperative</li> <li>• William Navidi 2014, <i>Statistics for Engineers and Scientists</i>, 4 Ed., McGraw-Hill Education [ISBN: 9780073401331]</li> <li>• Robert E. McGrath 2015, <i>Creating and Verifying Data Sets with Excel</i>, SAGE Publications [ISBN: 9781483331454]</li> </ul>

<b>Article/Paper List</b>	This Course does not have any article/paper resources
<b>Other References</b>	This Course does not have any other resources