F78SC Statistics for Science

COURSE DETAILS
Course Code: F78SC
Full Course Title: Statistics for Science
SCQF Level: 8
SCAF Credits: 15
Available as Elective: No

DELIVERY LEVEL
Undergraduate: Yes  Postgraduate Taught: No  Postgraduate Research: No

COURSE AIMS
• To develop an understanding of standard statistical techniques applied in the sciences including confidence intervals, hypothesis tests, and regression models
• To develop proficiency in applying these methods in the analysis of experimental data using the statistical software package Minitab.

LEARNING OUTCOMES – SUBJECT MASTERY
After studying this course, students should be able to:

• Understand the application of statistical testing and regression in a scientific context
• Use their statistical expertise to draw valid conclusions from experimental data

After studying this course, students should be able to:

• Apply statistical methods to investigate practical problems in a scientific context

LEARNING OUTCOMES – PERSONAL ABILITIES
After studying this course, students should be able to:

• Demonstrate facility with an appropriate statistical package
• Demonstrate an appreciation of the scientific problems to which statistical methods can be applied

After studying this course, students should be able to:
F78SC Statistics for Science

• Manage time in order to meet report deadlines and to discuss statistical problems confidently with peers and colleagues

After studying this course, students should be able to:

• Present results from a statistical analysis in a way that demonstrates that they have understood the technical and broader issues of statistical methodology as applied in practical situations

SYLLABUS

Data Summary: Plots, Histograms, Mean, Median, Standard Deviation, Quartiles

Probability: Rules of Probability, Conditional Probability, Bayes Theorem, Independence, Tree diagrams

Random variables and special distributions: Discrete and continuous random variables, expected value and variance, Binomial, Poisson, Geometric, Uniform, Exponential, and Normal random variables.

Sampling distributions and the Central Limit theorem with applications

Parameter estimation: Introduction to Method of Moments estimation, Maximum Likelihood estimation, and Method of Least Squares Estimation with examples

Confidence Intervals for: Population mean, population variance, population proportion, and two-sample confidence intervals for difference between population means and ratio of population variances.

Hypothesis Testing: Theory of classical fixed level hypothesis testing, P-values and their interpretation, standard hypothesis tests for mean, variance, population proportion, Poisson mean, difference between population means for independent populations and for paired data, relationship between testing and confidence intervals.

Regression: Simple linear regression, model fitting and checking, confidence intervals for parameter estimates, correlation, introduction to multiple regression

Chi-square tests: Goodness of Fit, Contingency tables.

COURSE RELATIONSHIPS

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LOCATION AND ASSESSMENT METHODS
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