

Unit 103: Scientific Basis of Physical Sciences: Mathematics, Statistics and Informatics

Level:	4
Unit type:	Optional (Equipment Management and Clinical Engineering)
Credit value:	10
Guided learning hours:	80

Unit summary

In this unit, you will gain the understanding of mathematics, statistics and informatics needed to work within physical sciences. You will be expected to apply and contextualise your knowledge and skills by performing routine technical skills and developing and building your professional practice in accordance with Good Scientific Practice.

Unit assessment requirements

There are no specific assessment requirements for this unit. Please refer to the assessment strategy in *Annexe B*.

Additional information

AC1.1 must include an explanation of each of the three topics (mathematics, statistics and informatics):

- data sharing and the role of the patient in informed consent
- legal and ethical issues associated with:
 - information security and governance
 - safeguarding personal data
 - confidentiality
 - privacy.

AC1.4 includes:

- networking of medical devices
- effective system management
- patient safety and confidentiality
- patient consent for use of data.

AC2.1 to 2.2 – learners should be able to select the most appropriate technique to analyse data and information and use spreadsheets, databases and presentation software. The range of mathematical and statistical techniques used in physical sciences that should be covered include:

- numerical representation and scientific calculator use: standard form, negative numbers, percentages, accuracy and precision, conversion of units of measure
- algebra: review of basic concepts
- graphs: linear and non-linear graphs in the x-y plane, plotting a graph of the function, solving equations using graphs, solving simultaneous equations graphically
- logarithmic expressions: indices, laws of indices, laws of logs, combinations of logs, natural logs and base 10 logs, solving equations with logarithms, properties and graph of \ln and \log function
- angles and trigonometry: degrees, radians, trigonometry ratios (sine, cosine, tangent), solving trigonometric equations, maxima and minima, graphs and waves generated by trigonometry
- exponential functions: exponential expressions, exponential function and its graph, solving equations involving exponential terms using a graphical method
- determinants, matrices and vectors
- differentiation: gradient function, rules for differentiation, higher derivatives, maximums, minimums, points of inflection, differentiation of sums, differentiation of differences
- advanced differentiation: products, quotients, exponential functions, logarithmic functions, function of a function
- indefinite integration: indefinite integration, some rules for indefinite integration, constant of integration
- definite integration: areas under curves, areas bounded by lines and curves, finding areas where some or all lie below the x-axis
- types of data: discrete and continuous data
- summarising data graphically: dot plot, stem and leaf, box and whisker, grouped frequency distribution, histogram, cumulative frequency distribution, cumulative frequency polygon, bar chart, one and two
- summarising data numerically: mean, median, mode, samples, when to use various averages, standard deviation, error, interquartile range, box and whisker plots, variance, range, measures of skewness
- normal distribution: mean, standard deviation, areas under the curve, standard normal transformation, solution of problems
- simple probability
- samples and population distributions: reasons for sampling sample size, random sampling, biased sampling, quota sampling, systematic sampling and

stratified sampling, relationship to normal distribution, primary and secondary data

- basic set theory for database application of one-to-one and one-to-many

application:

- the basic principles of databases
- the basic principles of spreadsheets
- creating a database
- interrogating a database and producing reports
- evaluating and amending a database
- interpreting data using spreadsheet software
- present data using spreadsheet software
- using data securely, respecting confidentiality and maintaining consent in the use of data
- identifying potential errors in data analysis and how these can be minimised
- identifying potential errors in data interpretation and how these can be minimised.

AC2.3 includes applying the knowledge and skills gained in 2.1 and 2.2:

- the principles of data presentation, effective choice and use of data presentation methods
- selection and use of presentation software
- creation of a short presentation applying appropriate techniques
- effective use of visual aids
- delivering the presentation
- obtaining feedback from peers
- critical reflection.

Learning outcomes and assessment criteria

To pass this unit, learners need to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria outline the requirements that the learner is expected to meet **in own area of work and in accordance with Standard Operating Procedures (SOPs)** to achieve the learning outcomes and the unit.

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Understand the application of mathematics, statistics and informatics in physical science	1.1	Explain how mathematics, statistics and informatics are applied in own area of practice within physical sciences			
		1.2	Evaluate processes to maintain data security and confidentiality in own area of work			
		1.3	Analyse the reporting process for breaches in data security and confidentiality			
		1.4	Discuss the essential issues associated with computing technologies and their management in physical sciences			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
2	Be able to manipulate, analyse and present technical and clinical information	2.1	Analyse technical and clinical data within a work-based context			
		2.2	Present technical and clinical information appropriately, using spreadsheets, databases and presentation software			
		2.3	Solve problems by applying appropriate mathematical and statistical techniques			
		2.4	Use data securely, respecting confidentiality and maintaining consent in the use of data			
		2.5	Present data appropriately and communicate effectively			

Learner name: _____

Date: _____

Learner signature: _____

Date: _____

Assessor signature: _____

Date: _____

Internal verifier signature: _____

Date: _____

(if sampled)