

## DESIGN RESEARCH EXPERIMENTS

UNIT CODE: UNIT CODE: MATH/OS/AS/CR/05/6/A

### Unit description

This unit specifies the competencies required to design experiments. It involves recognise and develop statement of the problem, Determine the treatments and outcome variables, Design research experiments, Conduct the experiment, analyse experimental data, write report, draw conclusions and make recommendation sand making recommendations.

### ELEMENTS AND PERFORMANCE CRITERIA

<b>ELEMENT</b> These describe the key outcomes which make up workplace function.	<b>PERFORMANCE CRITERIA</b> These are assessable statements which specify the required level of performance for each of the elements. <i><b>Bold and italicized terms are elaborated in the Range</b></i>
1. Recognise and develop statement of the problem	1.1 The problem statement is developed as per the workplace procedures. 1.2 Research objectives are stated as per the problem statement. 1.3 The null and alternative hypothesis are stated as per the research objectives.
2. Determine the treatments and outcome variables	2.1 The <i>levels of treatment(s)</i> are determined based on research objectives. 2.2 The outcome variables are determined as per the research objectives.
3. Design research experiments	3.1 The research site is identified as based on problem statement. 3.2 The study population is defined based on problem statement. 3.3 The data collection tools are identified based on the data to be collected. 3.4 Randomization criteria is determined as per the levels of treatment. 3.5 A control experiment is set as per the problem statement

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	3.6 The manual data spreadsheet is prepared as per the treatments.
4. Conduct the experiment	4.1 The site is prepared based on the levels of treatments 4.2 The plots are prepared based on the population or site 4.3 Treatment are applied to the plots based on randomisation 4.4 The outcome variable is measured based on the treatments 4.5 The data is recorded as per the measurements.
5. Analyse experimental data	5.1 The various assumptions of Analysis of variance (ANOVA) are checked and explained as per the methodology. 5.2 The ANOVA is performed as per the procedures 5.3 The ANOVA output is explained as per the results and the information required. 5.4 Sources of variation are explained as per the results obtained
6. Write report, draw conclusions and make recommendations	2.3 Conclusions are drawn and recorded as per the results and the problem statement. 2.4 Recommendations are made as per the results and conclusions made. 2.5 Recommendations are implemented as per the workplace procedures. 2.6 The analysis results are written and the report prepared as per the workplace procedures. 2.7 Need for and an appropriate approach to, further research is identified and recommended as per the research findings.

## RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	Range
<ul style="list-style-type: none"><li>levels may include but is not limited to:</li></ul>	<ul style="list-style-type: none"><li>The settings or possible values of a factor in an experimental design e.g.<ul style="list-style-type: none"><li>5g, 10g or 20g of fertilizer A</li><li>10ml, 15ml or 20ml of syrup B</li></ul></li></ul>
<ul style="list-style-type: none"><li>treatments may include but is not limited to:</li></ul>	<ul style="list-style-type: none"><li>amount or type fertilizer</li><li>type and dosage of drug</li><li>Levels of temperature etc.</li><li>Education level</li><li>Teaching method etc.</li></ul>

## REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit of competency.

### Required Skills

The individual needs to demonstrate the following skills:

- Creative thinking
- Use of computer and software to design random experiments
- Analytical skills
- Communication skills
- Numeracy skills
- Presentation techniques
- Reporting methods

### Required Knowledge

The individual needs to demonstrate knowledge of:

- Assumptions in using ANOVA
- Randomisation
- Completely randomised block design
- Experiments with random factors
- Using ANOVA in CRBD
- Pooling variance (within and between samples)

## EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical Aspects of Competency	<p>Assessment requires evidence that the candidate:</p> <p>1.1 Demonstrated knowledge of designing a research experiment</p> <p>1.2 Demonstrated knowledge designing an experiment with replications, blocking, randomisation etc.</p> <p>1.3 Demonstrated knowledge designing a manual spreadsheet and capturing experimental data.</p> <p>1.4 Demonstrated knowledge analysing experimental data using ANOVA</p> <p>1.5 Demonstrated knowledge of interpreting ANOVA results and writing a report</p>
2. Resource Implications	<p>The following resources should be provided:</p> <p>2.1 Computer</p> <p>2.2 Internet</p> <p>2.3 Statistical software</p> <p>2.4 Stationery</p> <p>2.5 Measuring tools</p> <p>2.6 Treatments</p>
3. Methods of Assessment	<p>3.1 Competency may be assessed through:</p> <p>3.2 Portfolio Assessment</p> <p>3.3 Interview</p> <p>3.4 Case Study/Situation</p> <p>3.5 Oral questioning</p> <p>3.6 Written Tests</p>
4. Context of Assessment	<p>Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken</p>

	in a closely simulated workplace environment or During Industrial Attachment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

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