

## DESIGNING RESEARCH EXPERIMENTS

**UNIT CODE:** MATH/CU/AS/CR/05/6/A

### Relationship to Occupational Standards

This unit addresses the unit of competency: Design research experiments

**Duration of Unit:** 200 hours

### 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.

### Summary of Learning Outcomes

1. Recognise and develop statement of the problem
2. Determine the treatments and outcome variables
3. Design research experiments
4. Conduct the experiment
5. Analyse experimental data
6. Write report, draw conclusions and make recommendations

### Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Recognise and develop statement of the problem	<ul style="list-style-type: none"><li>• Problem identification</li><li>• Application of Experimental designs<ul style="list-style-type: none"><li>• Improve process yields</li><li>• Improving product yields</li><li>• Reduction of manufacturing costs</li></ul></li><li>• Introduction &amp; definition of terms<ul style="list-style-type: none"><li>• Experimentation</li><li>• Objective</li><li>• Hypothesis</li></ul></li><li>• Research Problem</li></ul>	<ul style="list-style-type: none"><li>• Written test</li><li>• Observation</li><li>• Third party report</li><li>• Oral questioning</li><li>• Interviews</li></ul>

Learning Outcome	Content	Suggested Assessment Methods
	<ul style="list-style-type: none"> <li>• Formulation of hypothesis</li> </ul>	
2. Determine the <i>treatments</i> and outcome variables	<ul style="list-style-type: none"> <li>• Choice of variable</li> <li>• Independent variables <ul style="list-style-type: none"> <li>• Factors</li> <li>• Levels</li> <li>• Ranges</li> </ul> </li> <li>• Response variables</li> </ul>	<ul style="list-style-type: none"> <li>• Written test</li> <li>• Observation</li> <li>• Third party report</li> <li>• Oral questioning</li> <li>• Interviews</li> </ul>
3. Design research experiments	<ul style="list-style-type: none"> <li>• History of statistical designs</li> <li>• Principles of experimental design <ul style="list-style-type: none"> <li>• Randomization</li> <li>• Replication</li> <li>• Blocking</li> </ul> </li> <li>• Designing clinical trials</li> <li>• Experimental designs <ul style="list-style-type: none"> <li>• Simple Comparative designs</li> <li>• Small samples, <math>n &lt; 30</math> (t-test)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Written test</li> <li>• Observation</li> <li>• Third party report</li> <li>• Oral questioning</li> <li>• Interviews</li> </ul>
4. Conduct the experiment	<ul style="list-style-type: none"> <li>• Strategy of Experimentation <ul style="list-style-type: none"> <li>• Best guess approach</li> <li>• One factor at a time approach without replication</li> <li>• One factor at a time approach with replication</li> <li>• Factorial approach</li> </ul> </li> <li>• Data observation &amp; recording <ul style="list-style-type: none"> <li>• Data capture</li> <li>• Data storage</li> </ul> </li> <li>• Upload /Archiving</li> </ul>	<ul style="list-style-type: none"> <li>• Written test</li> <li>• Observation</li> <li>• Third party report</li> <li>• Oral questioning</li> <li>• Interviews</li> </ul>

Learning Outcome	Content	Suggested Assessment Methods
5. Analyse and interpret experimental data	<ul style="list-style-type: none"> <li>• Choice of statistical technique               <ul style="list-style-type: none"> <li>• Reasons</li> <li>• Assumptions of technique</li> </ul> </li> <li>• Statistical data Analysis               <ul style="list-style-type: none"> <li>• T-test Analysis</li> <li>• ANOVA</li> </ul> </li> <li>• ANOVA as a special case of regression</li> <li>• Interpretation</li> </ul>	<ul style="list-style-type: none"> <li>• Written test</li> <li>• Observation</li> <li>• Third party report</li> <li>• Oral questioning</li> <li>• Interviews</li> </ul>
6. Write report, draw conclusions and make recommendations	<ul style="list-style-type: none"> <li>• Report format of               <ul style="list-style-type: none"> <li>• T-test Analysis</li> <li>• Analysis of Variance (ANOVA)</li> </ul> </li> <li>• Conclusion &amp; Recommendations</li> </ul>	<ul style="list-style-type: none"> <li>• Written test</li> <li>• Observation</li> <li>• Third party report</li> <li>• Oral questioning</li> <li>• Interviews</li> </ul>

### Suggested Methods of Instructions

- Projects
- Demonstration by trainer
- Practice by the trainee
- Discussions
- Direct instruction

### Recommended Resources

1. Statistical software
2. Computer
3. Stationary
4. Workstation
5. Data sets