INDICATORS OF PROGRESSION FOR THE LEARNING OBJECTIVES FOR THE TECHNOLOGY SPECIALIST KNOWLEDGE AND SKILLS STRANDS

The *Indicators of Progression* (Indicators) provide support for teachers to interpret the Learning Objectives (LOs) for each specialist knowledge and skill technology component. They:

- provide an overview statement that explains the focus of the Learning Objectives and an overview statement about student progression from curriculum levels 6-8;
- restate the Learning Objectives for each level;
- provide guidance to teachers on what they could do to support student learning at curriculum levels 6-8;
- provide indicators of what students should know or be able to do at curriculum levels 6-8; and
- indicate the achievement standard(s) that align to the Learning Objective at curriculum levels 6-8.

The ***Teacher Guidance*** highlights the importance of the teacher's role in supporting student learning. It also acknowledges how the nature of teaching needs to change to ensure students are able to take more responsibility for their learning as they progress from curriculum levels 6-8 of the NZC. This has been emphasised by using the following terms to denote this shift in responsibilities from teacher to student.

- **Provide** is used when the teacher takes full responsibility for introducing and explicitly teaching new knowledge/skill or practices.
- **Guide** is used when the teacher assumes students will have some level of understanding/competency to draw from but continues to take the majority of the responsibility for developing these understandings further.
- **Support** is used when the balance shifts towards the student taking more responsibility for their learning, drawing from their past learning to consolidate and extend their understandings. In this case the teacher plays a more supportive role through questioning and challenging students to support them in their learning.

The ***Teacher Guidance*** also uses the term **ensure** to denote when the teacher plays a monitoring role to check that conditions critical for learning are present. For example, in 'planning for practice' and 'outcome development and evaluation' the teacher must ensure an appropriate brief is available to guide student work.

The ***Indicators*** describe specific understandings and capabilities that students should be able demonstrate consistently if they are to be considered to have met the related learning objective. The indicators for each level should be viewed 'collectively' as indicating the LO at that level.

NOTE: At this stage of developing indicators for the Learning Objectives the teacher guidance is based on the 'best' guidance we have available as to how to support learning at curriculum levels 6-7. It is envisaged that these will be refined later using **classroom informed evidence** *that demonstrates what students 'know' and 'can do' at curriculum levels 6-8.*

Contents

◀ BACK TO CONTENTS PAGE

DESIGN IN TECHNOLOGY: KNOWLEDGE OF DESIGN

Knowledge of design focuses on understanding the way informed, creative and critical development of new ideas is achieved and how these are realised into feasible outcomes.

Initially students learn basic concepts relating to 'What is design?' and how or why something may be described as a 'good' or 'bad' design. Students progress to advanced concepts relating to sustainable design and innovation as currently understood, and to complex concepts relating to future focused themes, principles of good design, and making judgements of a design's quality in the context of its use.

[Level 8 Learning Objectives, Teacher Guidance and Indicators of Progression wiil be published when Level 3 achievement standards are finalised for registration]

	LEVEL 6	LEVEL 7
LO	*Demonstrate understanding of basic concepts in design*	*Demonstrate understanding of advanced concepts in design*
TEACHER GUIDANCE	To support students to develop understandings about the basic concepts in design at level 6, teachers could: • Guide students to recognise that 'design' can be understood both as a verb and a noun. • Provide opportunity for students to explore/debate different definitions of 'design' in order to understand what design is. • Provide opportunity for students to explore how designing pulls together subjective and objective considerations to take human ideas into 'made' outcomes. Subjective considerations are those linked to aesthetics (where aesthetics is understood as it relates to all human senses/sensibilities). Objective considerations are those that can be established in a quantifiable sense. • Provide opportunity for students to explore differing opinions about the value of particular designs and how these arise due to differences in how subjective and objective considerations are prioritised. • Guide students to understand that designs can be evaluated as 'good' or 'bad' in terms of how they bring together form, function, cost and contextual understandings.	To support students to develop understandings about the advanced concepts in design at level 7, teachers could: • Provide opportunity for students to understand what 'designing for lifecycle' means and what additional considerations are required when designing for lifecycle (eg, those related to accessing materials/ongoing maintenance and disposal). • Provide opportunity for students to explore implications of additional considerations on how any design can be judged as 'good' or 'bad'. • Provide opportunity for students to debate the nature of innovative designing. • Guide students to determine the types of things that can inspire innovative ideas through analysing historical and contemporary innovations to identify inspirational drivers eg, previous designs (within a similar and dissimilar range of outcomes), art, nature, literature, attitudes, needs/desires/constraints/ opportunities. • Guide students to determine aspects that support innovative designing, eg, acceptance of risk taking, collaboration, freedom to explore diverse design ideas, appropriate resourcing, opportunity for free and frank debate, application of 'feasibility filters' – timing and 'depth'.
INDICATORS	Students can: • explain the elements that underpin design within a specified context. • explain considerations used to determine the quality of a design within a specified context. • discuss the quality of a design in relation to design elements and considerations of the specific context in which the design is situated.	Students can: • explain the relationship between lifecycle design, innovation and sustainability. • explain how lifecycle analysis is undertaken and how this determines the focus for design intervention. • discuss the competing priorities and compromises made as a result of lifecycle analysis when developing a sustainable technology.
AS	**AS91053 Generic Technology 1.10** *Demonstrate understanding of design elements* See: www.nzqa.govt.nz/ncea/assessment/search.do?query=Generic+Technology&view=achievements&level=01	**AS91363 Generic Technology 2.10** *Demonstrate understanding of sustainability in design*

◀ BACK TO CONTENTS PAGE

DESIGN IN TECHNOLOGY: HUMAN FACTORS IN DESIGN

Human factors in design refers to ergonomic and aesthetic factors that influence the design of products, systems and environments. These factors are supported by the use of anthropometric, psychological and sensory data gathering and analysis techniques. Understanding spatial relationships between people, objects and their environments is important when considering human factors in design.

Initially students learn about human factors that need to be considered when designing a product, system or environment. This should progress to students learning about the relationship between anthropometric data, user preference and ergonomic fit in a product, system or environment; as well as how customisation is undertaken to address personal preference and obtain ergonomic fit.

[Level 8 Learning Objectives, Teacher Guidance and Indicators of Progression wiil be published when Level 3 achievement standards are finalised for registration]

	LEVEL 6	LEVEL 7
LO	*Demonstrate understanding of basic concepts and techniques related to human factors in design*	*Demonstrate understanding of advanced concepts and techniques related to human factors in design*
TEACHER GUIDANCE	To support students to develop understandings about the basic concepts related to human factors in design, at level 6 teachers could: • Guide students to understand human factors that need to be considered when designing products, systems and environments. • Guide students to understand what the terms personal preference, style, and fashion refer to, how they differ from each other and can impact on the design of products, systems and environments. • Guide students to explore why ergonomics and aesthetics needed to be considered in the design of a range of products, systems and/or environments. • Provide opportunities for students to explore data gathering, including: anthropometrics, psychological and sensory data, and analysis techniques that were used inform the design of products, systems and environments. Discuss why they were used and their suitability.	To support students to develop understandings about advanced concepts related to human factors in design, at level 7 teachers could: • Provide opportunities for students to explore the role of statistics and probability in establishing guiding ratios and ergonomic aids. • Guide students to consider ethical and economic parameters as human factors. • Support students to explore how socio-cultural considerations impact on personal preference, style and fashion. • Support students to understand how customisation techniques are used to address user preferences. These include: using dressmakers mannequins, patterns, and ergonomes; using data from anthropometric, psychological and sensory data, focus groups and test subjects; using investigation and stimuli to establish personal preferences; and using functional modelling and prototypes. • Support students to understand the relationships between anthropometric data, user preference and ergonomic fit across a range of products, systems and environments. • Support students to identify the customisation undertaken to address personal preference and obtain ergonomic fit across a range of products, systems and environments.
INDICATORS	Students can: • describe the human factors that need to be considered when designing products, systems and environments. • explain how personal preference, group preferences, style and trends may impact on the design of products, systems and/or environments. • explain how data gathering and analysis techniques may be used in the design of products, systems and environments. • discuss why human factors identified for the design of a product, system and/or environment need to be considered. • discuss the suitability of data gathering and analysis techniques that may be used in the design of a product, system and/or environment.	Students can: • explain how statistics and probability are used to establish guiding ratios for anthropometric data and ergonomic aids. • explain how anthropometric data, user preference and ergonomic fit in a product, system or environment. • discuss the relationship between anthropometric data, user preference and ergonomic fit in a product, system or environment. • discuss customisation undertaken to address user preference and obtain ergonomic fit in a product, system or environment.
AS	**AS91054 Generic Technology 1.11** *Demonstrate understanding of basic human factors in design* See: www.nzqa.govt.nz/ncea/assessment/search.do?query=Generic+Technology&view=achievements&level=01	**AS91363 Generic Technology 2.11** *Demonstrate understanding of advanced concepts related to human factors in design*

◀ BACK TO CONTENTS PAGE

MANUFACTURING: KNOWLEDGE OF MANUFACTURING

Knowledge of manufacturing focuses on the underpinning concepts of manufacturing. This covers the systems and processes used in the production of goods.

Initially students learn about different manufacturing systems and various categories of manufacturing techniques. Students progress to complex understandings that also include broader concepts such as the use and availability of resources and political, social, economic and environmental factors.

[Level 8 Learning Objectives, Teacher Guidance and Indicators of Progression wiil be published when Level 3 achievement standards are finalised for registration]

	LEVEL 6	LEVEL 7
LO	*Demonstrate understanding of basic manufacturing concepts and techniques*	*Demonstrate understanding of advanced manufacturing concepts and techniques*
TEACHER GUIDANCE	To support students to develop understandings about basic manufacturing concepts and techniques at level 6, teachers could: • Provide a range of case studies to demonstrate different types of manufacturing systems. • Support students with their application of techniques used in manufacturing. • Support students to produce flow diagrams to communicate manufacturing processes. • Ensure students understand the need for differing manufacturing systems to meet specific requirements (eg, one off, batch and continuous production).	To support students to develop understandings about advanced manufacturing concepts and techniques at level 7, teachers could: • Support students with their understanding of how quality management techniques impact on manufacturing products. • Present advanced technologies to students such as CNC, PLC or SCADA systems. • Ensure students understand key drivers on manufacturing such as customer, social, environmental and safety imperatives.
INDICATORS	Students can: • explain how safety issues were addressed in a manufacturing process. • identify the impacts of new technologies and/or techniques on the suitability of different types of manufacturing systems and increased possibilities for quality control. • discuss how and why quality management techniques have been important in changing manufacturing practices.	Students can: • communicate manufacturing processes by using process flow and system diagrams. • explain why particular types of manufacturing systems are used in specified contexts. • discuss the application of a range of techniques to meet production requirements. • discuss how yield prediction and its determination, and quality control mechanisms, may be affected by social and environmental change.
AS	**AS91055 Generic Technology 1.12** *Demonstrate understanding of basic concepts used in manufacturing* See: www.nzqa.govt.nz/ncea/assessment/search.do?query=Generic+Technology&view=all&level=01	**AS91365 Generic Technology 2.12** *Demonstrate understanding of advanced concepts used in manufacturing*

◀ BACK TO CONTENTS PAGE

MANUFACTURING: IMPLEMENT A MULTI-UNIT MANUFACTURING PROCESS

Implement a multi-unit manufacturing process focuses on the application of underpinning concepts and techniques in the multi-unit manufacturing of goods.

Initially students will use a defined technological outcome suitable for manufacture that has established manufacturing specifications. They will determine and implement the manufacturing system by considering the type of outcome, the resources and the techniques to be used. Students progress towards the incorporation of quality management and quality control procedures in the development and implementation of a 'green' manufacturing process.

[Level 8 Learning Objectives, Teacher Guidance and Indicators of Progression wiil be published when Level 3 achievement standards are finalised for registration]

	LEVEL 6	LEVEL 7
LO	*Implement a multi-unit manufacturing process*	*Develop and implement an effective manufacturing process*
TEACHER GUIDANCE	To support students to implement a multi-unit manufacturing process at level 6, teachers could: • Provide opportunity for students to consider a range of manufacturing processes to explore relationships between the type of outcome and the resources and techniques selected. • Provide students with a defined technological outcome suitable for manufacture that has established manufacturing specifications. • Support students with their application of techniques used in their selected multi-unit manufacturing processes.	To support students to develop and implement an effective manufacturing process at level 7, teachers could: • Provide opportunity for students to analyse a range of technological outcome to determine suitability for manufacture and discuss design changes as required. • Support students in establishing specifications, including tolerances, required of the outcome that is to be manufactured. • Support students to select a manufacturing process and quality control procedures that enable units to meet the established specifications and tolerances. • Support students to organise and use resources and carry out techniques in keeping with relevant codes of practice.
INDICATORS	Students can: • Identify a manufacturing process suitable for multi-unit manufacture of the technological outcome. • implement the manufacturing process by using selected resources and carrying out techniques in keeping with accepted practices, including safety and legal requirements. • use feedback from quality control to review and modify the manufacturing process, leading to an improvement in the proportion of units meeting the specifications.	Students can: • analyse a range of technological outcomes to determine suitability for manufacture. • establish specifications, including tolerances, required of the outcome that is to be manufactured. • select a manufacturing process and quality control procedures that enable units to meet the established specifications and tolerances. • organise and use selected resources and carry out techniques independently and accurately in keeping with relevant codes of practice. • implement the manufacturing process using feedback from quality control to ensure the majority of the units meet the established specifications and tolerances.
AS	**AS91056 Generic Technology 1.13** *Implement a multi-unit manufacturing process* See: www.nzqa.govt.nz/ncea/assessment/search.do?query=Generic+Technology&view=all&level=01	**AS91366 Generic Technology 2.13** *Undertake development and implementation of an effective manufacturing process*

◀ BACK TO CONTENTS PAGE

DESIGN AND VISUAL COMMUNICATION: VISUAL COMMUNICATION

Visual communication refers to the effective communication and presentation of design ideas using modelling and graphic design techniques Initially students learn to communicate and present their design ideas and information by applying 2D and 3D drawing techniques such as sketching, rendering, digital, annotations, instrumental, templates, collage, overlays, Students progress to effectively and clearly applying complex and high quality visual techniques and knowledge that communicate a story to an audience - the intent of their design ideas.

[Level 8 Learning Objectives, Teacher Guidance and Indicators of Progression wiil be published when Level 3 achievement standards are finalised for registration]

	LEVEL 6	LEVEL 7
LO	*Demonstrate understanding of and skills in fundamental visual communication techniques*	*Demonstrate understanding of and skills in drawing techniques to communicate complex and detailed visual information*
TEACHER GUIDANCE	To support students to demonstrate understanding of, and skills in, fundamental visual communication techniques at level 6, teachers could: • Support students to develop competency in 2D and 3D drawing techniques (eg, oblique, isometric, and planometric, which includes freehand sketching and instrumental drawing). • Support students to develop competency in 2D sketching and instrumental drawing techniques (eg, multi-view orthographic drawings showing in-depth information such as hidden detail, surface development, and geometric construction). • Support students to develop competence in applying drawing techniques: quick rendering, crating, line hierarchy. • Support students to develop skills in rendering to communicate visual information of materials, how light falls on an object, how shadows are created. • Support students to develop competency in using drawing instruments (including computer programmes) to create instrumental 2D and 3D drawings incorporating conventions such as line weights, dimensioning, scale, reference lines, and geometric construction. • Guide students to understand how the use of media and drawing equipment are 'key' for presenting visual information. • Support students to develop an understanding about compositional principles of layout, visual impact and typography (as shown in different designers work) and how these can be applied to visually communicate designs.	To support students to demonstrate understanding of, and skills in, drawing techniques to communicate complex and detailed visual information at level 7, teachers could: • Support students to develop an appreciation of aesthetic and functional qualities in a design, and techniques for effectively visually communicating these qualities. • Support students to develop visual communication techniques such as sketching, rendering, modelling, and using digital media. • Support students to develop advanced 2D freehand and instrumental drawing techniques (eg, auxiliary views, sectional views, and assembly), to communicate design features. • Support students to understand how multiple drawings communicate details of shape and form. • Support students to develop advanced 3D freehand and instrumental drawing techniques (eg, one- and two-point perspective projection and isometric projection). • Support students to understand how media, drawing equipment and layout are 'key' for effectively presenting visual information. • Support students to develop skills in using modes and media to highlight design ideas. • Support students to develop skills associated with applying compositional principles such as proximity, alignment, hierarchy, positive and negative space when presenting design ideas.
INDICATORS	Students can: • create 2D and 3D freehand sketches that show in-depth design features in proportion relative to the context of the design brief to convey the intent of the design ideas. • produce accurate instrumental 2D drawings that show in-depth information about technical features of a design. • produce accurate paraline drawings that show in-depth information about design features. • skilfully apply rendering techniques to convincingly communicate shape and surface qualities, enhancing the realistic representation of design qualities to an audience. • use rendering techniques to communicate the form of design ideas. • skilfully plan, select and apply presentation skills that are of a high quality showing accurate layout skills, and visual impact to tell a story.	Students can: • communicate their design ideas using techniques that explore both identifiable aesthetic and functional details of a design; apply techniques such as sketching, modelling, rendering, collage, overlays and digital media. • produce a set of instrumental or computer related 2d working drawings showing technical details that indicate shape and form – these working drawings show the important design features of the item being communicated eg, parts and how they assemble, sizes or details of hidden parts (sections). • use appropriate engineering and architectural conventions correctly. • produce perspective instrumental projection drawings (parallel and/or angular) that communicate design features and the associated details. (such as spatial drawings: window framing, door handles, and engineering: webs, holes, fasteners. • apply instrumental projection conventions: picture plane, station point, eye level lines, ground level lines, vanishing points, height lines. • select a view point that enables the design features of an item to be shown. • select graphic modes and media, and apply compositional principles (eg, proximity, alignment, hierarchy, positive and negative space) that best present the design features of an item being communicated. • appropriately present visual information that includes consideration of the design context (eg, spatial design, product, landscape) and presentation context (eg, location, audience).
AS	**AS91063 Design and Visual Communication 1.30** *Produce freehand sketches to communicate own design ideas* **AS91064 Design and Visual Communication 1.31** *Produce instrumental, multi-view orthographic drawings that communicate technical features of design ideas* **AS91065 Design and Visual Communication 1.32** *Produce instrumental paraline drawings to communicate design ideas* **AS91066 Design and Visual Communication 1.33** *Use rendering techniques to communicate the form of design ideas* **AS91069 Design and Visual Communication 1.36** *Promote an organised body of work to an audience using visual communication techniques* See: www.nzqa.govt.nz/ncea/assessment/search.do?query=Design+and+Visual+Communication&view=all&level=01	**AS91337 Design and Visual Communication 2.30** *Use visual communication techniques to generate design ideas* **AS91338 Design and Visual Communication 2.31** *Produce working drawings to communicate technical details of a design* **AS91339 Design and Visual Communication 2.32** *Produce instrumental perspective projection drawings to communicate design ideas* **AS91343 Design and Visual Communication 2.36** *Use visual communication techniques to compose a presentation of a design*

◀ BACK TO CONTENTS PAGE

DESIGN AND VISUAL COMMUNICATION: GRAPHICS PRACTICE

Graphics practice refers to the creative application of drawing and design knowledge and techniques to develop conceptual outcomes that address a brief, or a technological outcome of a graphical nature. The brief used may be provided to the students or developed by the students as part of their practice. Quality outcomes resulting from graphics practice rely on the selection of appropriate and well-executed drawing techniques, and presentation methods that allow conceptual designs to be communicated effectively.

Initially students learn to apply drawing and design knowledge and techniques to visually communicate design ideas when developing conceptual outcomes to address a brief, through generating, testing, and evaluating design ideas. This should progress to students learning to undertaking critical analysis of a conceptual outcome against the brief to ensure justify its potential fitness for purpose.

[Level 8 Learning Objectives, Teacher Guidance and Indicators of Progression wiil be published when Level 3 achievement standards are finalised for registration]

	LEVEL 6	LEVEL 7
LO	*Demonstrate ability to explore and develop design ideas by applying visual communication and design techniques in response to a brief*	*Demonstrate ability to apply design knowledge and drawing techniques to develop, review and refine design ideas to address a brief, and compose a presentation of a design*
TEACHER GUIDANCE	To support students to to explore and develop design ideas by applying visual communication and design techniques in response to a brief, at level 6, teachers could: • Provide opportunity for students to develop design knowledge and a range of drawing techniques that can be used to address a brief. • Provide opportunity for students to explore, generate, and refine design ideas informed by principles of aesthetics and function. • Provide opportunity for students to develop design ideas to a conceptual design informed by research and testing. • Provide opportunity for students to incorporate design judgements when developing design ideas and undertaking ongoing evaluation during the development of a conceptual design. • Provide opportunity for students to present conceptual designs to an audience that visually communicate the details of design ideas in response to the design brief. • Provide opportunity for students to evaluate conceptual designs against the brief informed by audience feedback.	To support students to apply design knowledge and drawing techniques to develop, review and refine design ideas to address a brief, and compose a presentation of a design, at level 7, teachers could: • Provide opportunity for students to understand how design elements are characterised in different design movements and eras. • Provide opportunity for students to generate, develop and communicate design ideas informed by appropriate research and relevant testing and the identified design characteristics of a design movement or era. • Provide opportunity for students to use presentation techniques that draw on compositional principles (eg, proximity, alignment, hierarchy, use of positive and negative space), graphic modes (eg, digital, photography, animation, conventional sketching and drawing methods) and media (eg, pastels, collage, card and digital media, marker pens) to present design ideas and conceptual outcomes. • Provide opportunity for students to review and refine design ideas that incorporate specialist spatial design knowledge (eg, materials, processes; sustainability; environmental considerations such as climate, aspect, light) and graphic techniques (eg, architectural drawings, renderings, modelling) for inside and outside spaces in response to a brief. • Provide opportunity for students to review and refine design ideas that incorporate specialist product design knowledge (eg, materials, processes; sustainability; joining, fitting, fasteners, ergonomics, anthropometric data) and graphic techniques (eg, component drawings, sectioning, animation, renderings, modelling) in response to a brief. • Provide opportunity for students to incorporate design judgements in the development and ongoing evaluation of design ideas into a conceptual outcome. • Provide opportunity for students to explore a range of communication techniques to determine suitability for presenting design outcomes to different audiences. This should include opportunity to understand and use a variety of compositional principles, graphical modes, and media. • Guide students to effectively use visual communication techniques to present conceptual designs to an audience to detail design ideas in response to the design brief. • Guide students to evaluate conceptual designs against the brief informed by stakeholder and wider community feedback.
INDICATORS	Students can: • explore and refine design ideas by considering possible alternatives; • integrate principles of aesthetics and function, and design judgements, in a coherent and connected way to develop design ideas; • convincingly communicate design ideas visually in accordance with the context specified in the design brief.	Students can: • explore and refine design ideas that draw on spatial design knowledge. • explore and refine design ideas that draw on product design knowledge. • make design judgements on the positive and/or negative aspects of aesthetic and functional features of the design in response to the brief. • review and refine well-considered design ideas that incorporate specialist spatial design knowledge progressing towards an outcome. • review and refine well-considered design ideas that incorporate specialist product design knowledge progressing towards an outcome. • use presentation techniques, and the application of compositional principles, modes and media, to effectively present visual information.
AS	**AS91068 Design and Visual Communication 1.35** *Undertake development of design ideas through graphics practice* See: www.nzqa.govt.nz/ncea/assessment/search.do?query=Design+and+Visual+Communication&view=all&level=01	**AS91341 Design and Visual Communication 2.34** *Develop a spatial design through graphics practice* **AS91342 Design and Visual Communication 2.35** *Develop a product design through graphics practice* **AS91343 Design and Visual Communication 2.36** *Use visual communication techniques to compose a presentation of a design*

◀ BACK TO CONTENTS PAGE

DESIGN AND VISUAL COMMUNICATION: KNOWLEDGE OF DESIGN PRACTICE

Design practice focuses on developing conceptual designs in response to a brief. Knowledge of design practice includes understanding that designers identify the qualities and potential of design ideas in terms of the broad principles of design (aesthetics and function) and sustainability, and that they are influenced by societal, environmental, historical and technological factors.

Initially students learn about how design practice combines and prioritises different design elements and thought processes to initiate and develop ideas in a response to a brief, and how design and design thinking is a tool which is used to create new solutions to meet the needs of our society. Students progress to complex to learning about how design is a unique human activity of inquiry and action that fosters innovation and creativity by using design and design thinking as a tool to create new innovative solutions that meet the needs of our society and the global community, for the future.

[Level 8 Learning Objectives, Teacher Guidance and Indicators of Progression wiil be published when Level 3 achievement standards are finalised for registration]

	LEVEL 6	LEVEL 7
LO	*Demonstrate understanding of design principles and processes, and the work of influential designers*	*Demonstrate understanding of design movements or eras*
TEACHER GUIDANCE	To support students to develop understandings about design principles, approaches and the work of influential designers at level 6, teachers could: • Develop understandings of two principles of design (aesthetics and function) and of their derived elements; such as shape, form, rhythm, balance, proportion, colour, contrast, durability, stability, flexibility/rigidity. • Investigate key designers to develop an understanding of their design history and its continued impact. • Promote opportunities for students to investigate different designers design practice to initiate and develop their own ideas. • Promote students to ask questions of a given brief and explore the constraints in creative ways and to look for new directions.	To support students to develop understandings about design movements and eras at level 7, teachers could: • Seeing that the application (including their prioritisation) of design principles and elements is particularly susceptible to changes in fashion, taste, historical changes, technological advancements. • Understand that the development of designs does not occur in a vacuum that there are recognisable links and influences. • Visual motifs and concepts that emulate an era, style or historical. • Promote students to be design thinkers by putting people first and to imagine solutions that are inherently desirable and meet explicit needs.
INDICATORS	Students can: • select and research an influential designer. • identify and explain the aesthetic and functional characteristics of their chosen influential designer. • integrate aesthetic and functional characteristics of chosen influential designer when developing their own design ideas.	Students can: • investigate a design era or design movement and explain the aesthetic and functional characteristics of the design movement or era. • describe social factors such as cultural, historical, societal and technological, that influenced the design movement or era. • interpret and embed into their own designs characteristics identified in the chosen design era and movement. • show understanding that design does not develop in a vacuum, it is affected by the circumstances of the society in which it exists and serves (eg, Bauhaus responding to the need for industrial growth after the First World War),and that the social, economic and political environment has a significant impact on establishing and evolving a designs movement.
AS	**AS91067 Design and Visual Communication 1.34** *Use the work of an influential designer to inform design ideas* See: www.nzqa.govt.nz/ncea/assessment/search.do?query=Design+and+Visual+Communication&view=all&level=01	**AS91340 Design and Visual Communication 2.33** *Use the characteristics of a design movement or era to inform own design ideas*

◀ BACK TO CONTENTS PAGE

CONSTRUCTION AND MECHANICAL TECHNOLOGIES: CONSTRUCT A RESISTANT MATERIALS PRODUCT

Construct a resistant material's product requires students to implement procedures and tests to make specified products using resistant materials.

Initially students learn to perform a sequence of techniques and tests to make resistant materials products that meet specifications. Students should progress to performing complex procedures, which incorporates interlocking parts to make a high quality resistant materials product that meets specifications.

[Level 8 Learning Objectives, Teacher Guidance and Indicators of Progression wiil be published when Level 3 achievement standards are finalised for registration]

	LEVEL 6	LEVEL 7
LO	*Implement basic procedures to make a resistant materials product*	*Implement advanced procedures to make a resistant materials product*
TEACHER GUIDANCE	To support students to implement basic procedures to make a resistant materials product, at level 6, teachers could: • Ensure students are aware of a wide range of basic measuring, cutting, shaping, joining and finishing techniques. • Ensure students are able to interpret job sequences from step-by-step instructions and understand the tests required to check progress when constructing products that will ultimately meet specifications. • Ensure students have an appropriate environment, tools and materials to enable students to work safely with resistant materials to make a product. • Provide opportunity for students to explore and discuss techniques and tests in terms of skilfulness and efficiency. • Provide opportunity to explore what techniques are most suitable for use with a variety of resistant materials. • Provide students with the opportunity to practice a range of basic techniques on different resistant materials and carry out appropriate checks to increase accuracy and finish. This may be through completing a range of individual products and/or joint class projects/activities.	To support students to implement advanced procedures to make a resistant materials product, at level 7, teachers could: • Ensure students are aware of a wide range of measuring, cutting, shaping, joining and finishing techniques. • Provide students with the opportunity to discuss what is meant by advanced procedures. That is procedures that require the student to make informed selection and scheduling of techniques and testing to make the product. • Support students to undertake evaluative tests to demonstrate the final product meets specifications. • Provide opportunity for students to explore and discuss advanced procedures in terms of skilfulness and efficiency. • Ensure students have an appropriate environment, tools and materials to enable students to work safely with resistant materials to make a product. • Provide opportunity to explore what techniques are most suitable for use with a variety of resistant materials. • Provide students with the opportunity to schedule and practice a range of techniques and tests to develop quality products. This may be through completing a range of individual products and/or joint class projects/activities.
INDICATORS	Students can: • undertake basic procedures to construct a product that meets specifications. • apply given techniques and tests in a way that complies with relevant health and safety regulations. • show independence and accuracy in the execution of basic techniques and tests. • perform basic techniques and tests in a manner that economises time, effort and materials.	Students can: • undertake advanced procedures to construct a product with special features that meets specifications. • select and apply scheduled techniques to comply with relevant health and safety regulations. • show independence and accuracy in executing the scheduled techniques and tests. • undertake techniques and tests in a manner that economises time, effort and materials.
AS	**AS91057 Construction and Mechanical Technologies 1.20** *Implement basic procedures using resistant materials to make a specified product* See: www.nzqa.govt.nz/ncea/assessment/search.do?query=Construction+and+Mechanical+Technologies&view=all&level=01	**AS91344 Construction and Mechanical Technologies 2.20** *Implement advanced procedures using resistant materials to make a specified product with special features*

◀ BACK TO CONTENTS PAGE

CONSTRUCTION AND MECHANICAL TECHNOLOGIES: CONSTRUCT A TEXTILES PRODUCT

Construct a textile material's product requires students to implement techniques and procedures and tests to make specified products using textile materials

Textile materials refer to a group of materials that are commonly grouped together because they show certain common characteristics. These materials include but are not limited to natural and synthetic fibres, yarns, knits and woven fabrics. Constructing using textile materials require particular techniques and procedures to be undertaken to enable materials to be skilfully and safely measured, cut, shaped, joined and finished to make quality products. Advanced and complex techniques are required to craft special features of a high standard in a product and rely on the consistent application to achieve a desired effect. Special features, structural, style and/or decorative, include such things as set in sleeve, fly front, tailored collars and cuffs, welt pocket, embroidering, shirring. Complex procedures include but are not limited to: joining materials with different properties, for example jacket shell and lining; changing the characteristics of the materials for example interfacing, interlining, boning, applied design; managing special fabrics, for example fine knits, sheers, satins; or designs cut on the bias.

Initially students learn to perform basic procedures by implementing a given sequence of techniques and tests to make a quality textile product that meets specifications. Students should progress to performing complex procedures that require them to select and perform at least two techniques involving different types of materials.

[Level 8 Learning Objectives, Teacher Guidance and Indicators of Progression will be published when Level 3 achievement standards are finalised for registration]

	LEVEL 6	LEVEL 7
LO	*Implement basic procedures to make a textiles product*	*Implement advanced procedures to make a textiles product*
TEACHER GUIDANCE	To support students to implement basic procedures to make a textiles product, at level 6, teachers could: • Ensure students are aware of a wide range of basic measuring, cutting, shaping, joining and finishing techniques. • Ensure students are able to interpret job sequences from step-by-step instructions and understand the tests required to check progress when constructing products that will ultimately meet specifications. • Ensure students have an appropriate environment, tools and materials to enable students to work safely with textile materials to make a product. • provide opportunity for students to explore and discuss techniques and tests in terms of skilfulness and efficiency. • Provide opportunity to explore what techniques are most suitable for use with a variety of textile materials. • Provide students with the opportunity to practice a range of basic techniques on different textile materials and carry out appropriate checks to increase accuracy and finish. This may be through completing a range of individual products and/or joint class projects.	To support students to implement advanced procedures to make a textiles product, at level 7, teachers could: • Ensure students are aware of a wide range of measuring, cutting, shaping, joining and finishing techniques. • Provide students with the opportunity to discuss what is meant by advanced procedures. That is procedures that require the student to make informed selection and scheduling of techniques and testing to make the product and undertaking evaluative tests to demonstrate the final product meets specifications. • Provide opportunity for students to explore and discuss advanced procedures in terms of skilfulness and efficiency. • Ensure students have an appropriate environment, tools and materials to enable students to work safely with textile materials to make a product. • Provide opportunity to explore what techniques are most suitable for use with a variety of textile materials. • Provide students with the opportunity to schedule and practice a range of techniques and tests to develop quality products. This may be through completing a range of individual products and/or joint class projects.
INDICATORS	Students can: • undertake basic procedures to construct a product that meets specifications. • apply given techniques and tests in a way that complies with relevant health and safety regulations. • show independence and accuracy in the execution of basic techniques and tests. • perform basic techniques and tests in a manner that economises time, effort and materials.	Students can: • undertake advanced procedures to construct a product with special features that meets specifications. • select and apply scheduled techniques to comply with relevant health and safety regulations. • show independence and accuracy in executing the scheduled techniques and tests. • undertake techniques and tests in a manner that economises time, effort and materials.
AS	**AS91058 Construction and Mechanical Technologies 1.21** *Implement basic procedures using textile material to make a specified product* See: www.nzqa.govt.nz/ncea/assessment/search.do?query=Construction+and+Mechanical+Technologies&view=all&level=01	**AS91345 Construction and Mechanical Technologies 2.21** *Implement advanced procedures using textile material to make a specified product with special features*

◀ BACK TO CONTENTS PAGE

CONSTRUCTION AND MECHANICAL TECHNOLOGIES: KNOWLEDGE OF RESISTANT MATERIALS CONSTRUCTION

Resistant Materials refer to a group of materials that are grouped together because they show certain common characteristics. These characteristics include: tensile strength, compressive resistance, hardness, malleability, ductility, elasticity, grain. Such materials are broadly categorised as wood, metal, ceramics, plastics, glass and their composites. Particular resistant materials exhibit characteristics to a greater or lesser extent. Resistant materials are often sub categorised. For example hardwood and softwood; thermosetting and thermoplastics, alloys and pure metals.

Resistant materials require particular basic techniques to be used to enable materials to be measured, cut, shaped, joined and finished when making products. Advanced and complex techniques are required to craft special features of a high standard in a product and rely on the consistent application of accepted conventions to achieve a desired effect. Special features can be structural and/or aesthetic and include such things as: inlays, special fit (eg, interference, push fit), matching turned components, internal screw cutting on a lathe, compound machining, glass fusing.

Knowledge within this component includes understanding how resistant materials are characterised, and understanding techniques used to work them. Understanding of techniques would include: how it is done in a safe and effective manner, the impact of the technique on materials involved, and when the technique would be suitable to use.

Initially students learn about resistant materials per se, the basic techniques commonly used to work them, and the relationship between these. Students progress to learning about advanced techniques and conventions required for highly crafted special features and the complex concepts and processes involved in resistant materials evaluation and development.

[Level 8 Learning Objectives, Teacher Guidance and Indicators of Progression wiil be published when Level 3 achievement standards are finalised for registration]

	LEVEL 6	LEVEL 7
LO	*Demonstrate understanding of basic techniques used to make resistant materials products*	*Demonstrate understanding of advanced techniques used to make resistant materials products*
TEACHER GUIDANCE	To support students to develop understandings about the basic techniques used to make resistant material products at level 6, teachers could: • Provide opportunity for students to categorise a range of materials and identify those that display characteristics associated with the broad categories: resistant materials and textiles. Including materials that exist at the boundaries of the category eg, Vinyl, leather. • Provide opportunity for students to explore a range of products made from resistant materials in order to discuss the materials used, their characteristics and the techniques that would be appropriate to work them safely. • Guide students to explore how and why resistant materials and techniques are combined differently for particular situations. • Provide students with the opportunity to understand how basic techniques are undertaken in safe and effective manner, and the impact of these techniques on different materials. Examples of basic techniques include: marking and layout; sawing, filing machining, folding, sanding, planning; gluing, welding, soldering, fastening, jointing; painting, staining, bluing, polishing, machine finishing.	To support students to develop understandings about the advanced techniques used to make products from resistant or any other material type at level 7, teachers could: • Provide opportunity for students to explore accepted conventions used when constructing products using resistant or any other material type, and discuss how these conventions guide construction in similar and diverse contexts. Examples of accepted conventions include: drape, flush, parallel, perpendicular, offset, symmetry, array, tolerance, ease, press fit, clearances, taper, level, plumb. • Guide students to explore similarities and differences between safe practice in classroom and in industrial environments.
INDICATORS	Students can: • explain how the characteristics of resistant materials influence the selection of safe techniques. • discuss why resistant materials require particular techniques for their safe handling and use. • discuss why techniques and resistant materials are combined in different ways across two or more situations.	Students can: • discuss how accepted conventions guide constructing in materials in similar contexts. • explain the differences between safe practice in classroom and industrial environments. • discuss how accepted conventions guide constructing with materials in diverse contexts.
AS	**AS91059 Construction and Mechanical Technologies 1.22** *Demonstrate understanding of basic concepts used to make products from resistant materials* See: www.nzqa.govt.nz/ncea/assessment/search.do?query=Construction+and+Mechanical+Technologies&view=all&level=01	**AS91347 Construction and Mechanical Technologies 2.22** *Demonstrate understanding of advanced concepts used to make products*

◀ BACK TO CONTENTS PAGE

CONSTRUCTION AND MECHANICAL TECHNOLOGIES: KNOWLEDGE OF TEXTILES CONSTRUCTION

Textile Materials refer to a group of materials that are grouped together because they show certain common characteristics. These materials include but are not limited to: natural and synthetic fibres, yarns, knits and woven fabrics.

Textile materials require particular basic techniques to be used to enable these materials to be measured, cut, shaped, joined and finished when making products. Advanced and complex techniques are required to craft special features of a high standard in a product and rely on the consistent application of accepted conventions to achieve a desired effect. Special features can be structural and/or aesthetic, and include: style features such as set in sleeves, fly front, tailored collars and cuffs, welt pockets; decorative features such as pin tucks, embroidery, shirring; and structural features such as 3D felting, combining different fibres in felting and different materials (eg, nuno felting).

Initially students learn about textile materials per se, the basic techniques commonly used to work them, and the relationship between these. Students progress to learning about advanced techniques required to craft special features and the complex concepts and processes involved in textile material evaluation and development.

[Level 8 Learning Objectives, Teacher Guidance and Indicators of Progression wiil be published when Level 3 achievement standards are finalised for registration]

	LEVEL 6	LEVEL 7
LO	• Demonstrate understanding of basic techniques used to make textile materials products	• Demonstrate understanding of advanced techniques used to make textile materials products
TEACHER GUIDANCE	To support students to develop understandings about the basic techniques used to make resistant material products at level 6, teachers could: • Provide opportunity for students to categorise a range of materials and identify those that display characteristics associated with the broad categories: resistant materials and textiles. Including materials that exist at the boundaries of the category eg, Vinyl, leather. • Provide opportunity for students to explore a range of products made from textile materials in order to discuss the materials used, their characteristics (eg, Strength, thickness, stretch, drape) and the techniques that would be appropriate to work them safely. • Guide students to explore how and why textile materials and techniques are combined differently for particular situations. • Provide students with the opportunity to understand how basic techniques are undertaken in safe and effective manner, and the impact of these techniques on different materials. Examples of basic techniques include: measuring and marking out; sizing, shaping and forming; joining and assembling; finishing and detailing.	To support students to develop understandings about the advanced techniques used to make resistant material products at level 7, teachers could: • Provide opportunity for students to explore accepted conventions used when constructing products using textile materials, and discuss how these conventions guide constructing in materials in similar and diverse contexts. Examples of accepted conventions include: drape,parallel, perpendicular, offset, symmetry, array, tolerance, ease, clearances, taper, level. • Support students to understand special features and the skills associated with their construction. • Guide students to understand how and why techniques are brought together to achieve special features.
INDICATORS	Students can: • explain how the characteristics of textile materials influence the selection of safe techniques. • discuss why textile materials require particular techniques for their safe handling and use. • discuss why techniques and textile materials are combined in different ways across two or more situations.	Students can: • identify attributes of special features in textile products. • explain construction requirements of special features. • explain requirements to obtain a quality finish in special features. • discuss why techniques are selected to make special features and how they are influenced by the characteristics of the materials used.
AS	**AS91060 Construction and Mechanical Technologies 1.23** *Demonstrate understanding of basic concepts used to make products from textile materials* See: www.nzqa.govt.nz/ncea/assessment/search.o?query=Construction+and+Mechanical+Technologies&view=all&level=01	**AS91348 Construction and Mechanical Technologies 2.23** *Demonstrate understanding of advanced concepts used to make a product with textile materials*

◀ BACK TO CONTENTS PAGE

CONSTRUCTION AND MECHANICAL TECHNOLOGIES: KNOWLEDGE OF STRUCTURES

A structure refers to framework that is used to support a load(s). A framework is comprised of structural members that are assembled using pin or fixed joints. The integrity of a framework is reliant on the strength, weight, material and profile of its structural members; the combination and means of joining structural members; and the safety factors applied to the structure.

Knowledge within this component includes understanding of how pin jointed structural members transfer forces when a framework is subjected to gravitational loads; how safety factors are applied to ensure a frameworks integrity; and calculating using vector diagrams the magnitude, direction and type of force acting on pin jointed structural members in a framework.

Initially students learn what is meant by tension, compression, shear and torsion; how safety factors are applied in the design of frameworks; how structural members and pin joints transfer forces in a framework; and how the integrity of a framework is established. This should progress to students learning how to: use technical language, diagrams and symbols to explain structural members and materials used in structural systems such as buildings, bridges, cranes; explain the way structural members and materials enable a structural system achieve structural integrity through withstanding known loads; and evaluate the structural integrity of a structural system; and determine ways of increasing the structural integrity of a structural system.

[Level 8 Learning Objectives, Teacher Guidance and Indicators of Progression wiil be published when Level 3 achievement standards are finalised for registration]

	LEVEL 6	LEVEL 7
LO	*Demonstrate understandings of basic structures*	*Demonstrate understandings of advanced structures*
TEACHER GUIDANCE	To support students to understanding basic structures at level 6, teachers could: • Ensure students are aware that frameworks are designed to withstand loads of a greater capacity than they are placed under. • Provide opportunity for students to understand the causes and effects of internal forces within frameworks. That is, the relationship between tension, compression, bending, shear and torsion in structural framework members, and how material selection (i.e. composition, profile) is used to address this (eg, round pipe rather than solid round is used when members subjected to a compressive force). • Provide opportunity for students to understand how 'safety factor' is applied across different framework structure contexts (eg, bridges, cranes, trusses). • Provide opportunity for students to understand the structural members that form a framework (eg, Posts, beams, struts, ties) and how they are joined (eg, fixed, pin joint, moving) across different framework structure contexts. • Provide opportunity for students to understand how pin jointed structural members in a framework transfer forces due to gravity load to ensure the frameworks integrity is maintained.	To support students to understanding advanced structures at level 7, teachers could: • Provide opportunity for students to understand how, where and why pin and moving joints are used in frameworks across different framework structure contexts (eg, bridges, cranes, trusses). • Provide opportunity for students to explain, using vector diagrams, the magnitude, direction and type of force acting on pin jointed structural members when a framework is subjected to known gravitational loads. • Provide opportunity for students to explain how structural members combine to resist loads and transfer forces within a pin jointed framework to ensure the frameworks is maintained in equilibrium. • Provide opportunity for students to understand how 'safety factor' is applied across different framework structure contexts (eg, bridges, cranes, trusses) to ensure a frameworks integrity is maintained.
INDICATORS	Students can: • explain what is meant by tension, compression, shear and torsion. • explain the safety factors applied to a framework. • explain how structural members and pin joints transfer forces in a framework. • discuss how the integrity of a framework is established.	Students can: • describe where pin and moving joints are used on frameworks. • describe the effects of loads when fixed joints are used in frameworks. • describe the effects of load on pin jointed frameworks using vector diagrams. • explain the types of forces which can act on pin jointed structural members when a frameworks is placed under known gravitational loads. • explain how structural members combine to resist loads and transfer forces within a pin jointed framework. • explain structural member profiles and forms and why they are used in a framework. • explain how structural members combine to resist loads and transfer forces within pin jointed framework. • explain how safety factors are determined and discuss how they have been applied to ensure the integrity of a framework.
AS	**AS91061 Construction and Mechanical Technologies 1.24** *Demonstrate understanding of basic concepts related to structural frameworks* See: www.nzqa.govt.nz/ncea/assessment/search.do?query=Construction+and+Mechanical+Technologies&view=all&level=01	**AS91348 Construction and Mechanical Technologies 2.24** *Demonstrate understanding of advanced concepts related to structural frameworks*

◀ BACK TO CONTENTS PAGE

CONSTRUCTION AND MECHANICAL TECHNOLOGIES: KNOWLEDGE OF MACHINES

Machines consist of fixed and moving parts that modify mechanical energy and transmit it in a more useful form. A simple machine; such as a lever, a pulley, or an inclined plane; alters the magnitude or direction, or both, of an applied force. Complex machines have internal energy systems; such as electric motors, steam engines, turbines, combustion engines, solar energy systems, nuclear systems; that combine with levers, inclined planes and/or screws to enable the machine to perform their intended function/s.

Initially students learn about simple machines such as levers, inclined planes and screws and how when combined with mechanical components they are able to achieve a mechanical advantage and motion. This should progress to students learning how to explain the functionality of complex machines using technical language, diagrams and symbols; and being able to evaluate such machines in terms of their energy efficiency in order to suggest ways of improving this.

[Level 8 Learning Objectives, Teacher Guidance and Indicators of Progression wiil be published when Level 3 achievement standards are finalised for registration]

	LEVEL 6	LEVEL 7
LO	*Demonstrate understanding of basic concepts related to machines*	*Demonstrate understanding of advanced concepts related to machines*
TEACHER GUIDANCE	To support students to understanding basic concepts related to machines at level 6, teachers could: • Provide opportunity for students to explain the purpose of levers, inclined planes and screws. • Provide opportunity for students to explain the purpose of a range of mechanical components within a range of machines. • Guide students to explain the advantages and disadvantages of pneumatic and hydraulic systems. • Guide students to understand how a range of machines provide mechanical advantage and motion. • Guide students to discuss why particular levers, inclined planes and screws, and mechanical components were selected to ensure mechanical advantage and motion in across a range of machines.	To support students to understanding advanced concepts related to machines at level 7, teachers could: • Provide opportunity for students to explore efficiencies of machines (eg, block and tackle, chain block, pneumatic or hydraulic jack, and turntable) and explain their safe use. • These machines should include two or more mechanical components (eg, cams and followers; pivots and linkages; gears; belt or chains and sprockets; shafts and bearings) Guide students to explain how mechanical components combine to provide the desired mechanical advantage, and relative motion between input and output in a range of machines. • Guide students to discuss for a range of machines how mechanical advantage was obtained by combining mechanical components, the relative motion between input and output for the machines, and efficiency(s) obtained. Note: a machines efficiency is determined by the ratio of the energy delivered (or work done) by a machine to the energy needed (or work required) to operate it (i.e. output energy/input energy).
INDICATORS	Students can: • explain the purpose of levers, inclined planes and screws. • explain the purpose of a range of mechanical components. • explain the advantages and disadvantages of pneumatic and hydraulic systems. • explain how a machine provides the mechanical advantage and motion. • discuss why particular levers, inclined planes and screws, and mechanical components were selected to ensure the mechanical advantage and motion in machines.	Students can: • describe the efficiencies of machines in relation to their safe application. • explain how mechanical components combine to provide the desired mechanical advantage, and relative motion between input and output in a range of machines. • discuss why mechanical components were combined to provide the mechanical advantage, relative motion between input and output, and efficiency desired in a range of machines.
AS	*AS91062 Construction & Mechanical Technologies 1.25* *Demonstrate understanding of basic concepts related to machines* See: www.nzqa.govt.nz/ncea/assessment/search.do?query=Construction+and+Mechanical+Technologies&view=all&level=01	*AS91349 Construction & Mechanical Technologies 2.25* *Demonstrate understanding of advanced concepts related to machines*

◀ BACK TO CONTENTS PAGE

CONSTRUCTION AND MECHANICAL TECHNOLOGIES: PATTERN MAKING

Pattern making includes stills in pattern adaptation and pattern drafting. Pattern drafting requires a pattern block or working drawing to be established by using key measurements and using these to develop a pattern which interprets a garments or items design including its special features. Patterns are tested using toiles and mock-ups to ensure that pattern pieces correctly interpret a design and its special features.

Initially students learn how to select and adapt existing patterns to enable a garment to correctly fit for the body or an item to meet desired size and fit specifications. This should progress to students learning how to draft patterns and test these using toiles and mock-ups to ensure the final pattern correctly interprets a design and its special features. Students also learn how to develop a pattern guide sheet that incorporates appropriate language, symbols and/or diagrams to: communicate pattern layout, and the step by step instructions required to construct a garment or item.

[Level 8 Learning Objectives, Teacher Guidance and Indicators of Progression wiil be published when Level 3 achievement standards are finalised for registration]

	LEVEL 6	LEVEL 7
LO	*Make basic adaptations to a pattern to enable a design to fit a person or item*	*Make advanced adaptations to a pattern to change structural and/or style features of a design*
TEACHER GUIDANCE	To support students to make basic adaptations to a pattern to enable a design to fit a person or item at level 6, teachers could: • Provide opportunity for students to take key body or item measurements and select a suitable pattern size(s). • Guide students to interpret a selected patterns guide sheet to identify the correct pattern pieces for a selected design. • Guide students to show independence and accuracy when: • making basic adaptations to a pattern to accommodate the key measurements. • interpreting pattern symbols and using a patterns guide sheet to correctly place pattern pieces to suit material width and type. • developing a construction plan, using appropriate language, symbols and diagrams. • Provide opportunity for students to construct a toile or mock up using an adapted pattern and test to ensure that it interprets the design, providing the correct fit for the body or item in a manner that economises time, effort and materials.	To support students to make advanced adaptations to a pattern to change structural and/or style features of a design at level 7, teachers could: • Provide opportunity for students to undertake advanced adaptations to a pattern which has three or more pieces, by making changes to pieces to enable structural and/or style design features to be achieved. Such features requiring advanced pattern adaptation may include: manipulated darts, sleeves; added pleats, gores, yokes, button wraps, facings and collars; deep buttoning, waterproof openings, and changing the types of fastenings. • Guide students to correctly labell the adapted pattern with grainline, cutting information, pattern piece names, dots and notches. • Guide students to demonstrate independence and accuracy when constructing a toile/or mock-up; testing and refining the pattern where necessary, to ensure the final pattern correctly interprets the design and provides the correct fit for the body or item. • Guide students to undertake advance pattern adaptation in a manner that economises time, effort and materials.

INDICATORS	Students can:
	• take key body or item measurements to select pattern size(s).
	• interpret a selected patterns guide sheet to identify the correct pattern pieces for the selected design.
	• show independence and accuracy when:
	  • making basic adaptations to a pattern to accommodate the key measurements
	  • interpreting pattern symbols and using a patterns guide sheet to correctly place pattern pieces to suit material width and type
	  • developing a construction plan, using appropriate language, symbols and diagrams
	• construct a toile or mock up using the adapted pattern and test to ensure that it interprets the design, providing the correct fit for the body or item in a manner that economises time, effort and materials.
		Students can:
		• undertake advanced adaptations to a pattern that has three or more pieces, by making changes to pieces to enable structural and/or style design features to be achieved.
		• correctly labelling the adapted pattern with grainline, cutting information, pattern piece names, dots and notches.
		• demonstrate independence and accuracy when constructing a toile/or mock-up; testing and refining the pattern where necessary, to ensure the final pattern correctly interprets the design and provides the correct fit for the body or item.
		• undertake advance pattern adaptation in a manner that economises time, effort and materials.

AS	**AS91096 Construction & Mechanical Technologies 1.26** *Make basic adaptations to a pattern to enable a design to fit a person or item* See: www.nzqa.govt.nz/ncea/assessment/search.do?query=Construction+and+Mechanical+Technologies&view=all&level=01	**AS91350 Construction & Mechanical Technologies 2.26** *Make advanced adaptations to a pattern to change the structure and/or style feature of a design*

◀ BACK TO CONTENTS PAGE

DIGITAL TECHNOLOGIES: KNOWLEDGE OF DIGITAL INFORMATION MANAGEMENT

Knowledge of digital information management focuses on how information is managed at both an individual user level and with shared information within an organisation.

Initially students learn about basic concepts of information management in relation to producing digital information outcomes. This includes understanding the key features of operating systems and common application software, file management procedures, and ethical issues related to the management of information. Students progress to learning about complex concepts of information systems within organisations. This includes explaining the interaction between the main components of an information system used in an organisation, discussing the nature and value of information to an organisation, discussing the characteristics of good information, and end-user considerations, and discussing the implications of security management for information systems.

[Level 8 Learning Objectives, Teacher Guidance and Indicators of Progression will be published when Level 3 achievement standards are finalised for registration]

	LEVEL 6	LEVEL 7
LO	*Demonstrate understanding of basic digital information management tools and systems*	*Demonstrate understanding of advanced digital information management tools and systems*
TEACHER GUIDANCE	To support students to develop understandings about basic digital information management tools and systems at level 6, teachers could: • Provide students with opportunities to explain how application software and operating system software interact to manage information. • Provide students with a way of selecting and justifying the selection of application software to perform a task to manage information. • Provide students with opportunities to explain the purpose and conventions of file management procedures and the use of storage devices. • Provide students with opportunities to compare and contrast the use of different file types for different purposes. • Provide students with opportunities to describe ethical issues related to management of information. • Guide students on how to prepare reports including ways to structure a report and literacy strategies to support report writing in a way that will allow students to identify, describe, explain, justify, and compare and contrast. • Provide opportunities for students to practice report writing.	To support students to develop understandings about advanced digital information management tools and systems at level 7, teachers could: • Guide students on how to research the information management issues related to shared information within an organisation. • Provide students with opportunities to explain file management considerations related to shared information and the related procedures and conventions for privacy and permission. • Provide students with opportunities to discuss ethical and legal issues related to shared information within an organisation. • Provide students with opportunities to evaluate backup procedures and conventions for information systems within an organisation. • Provide students with opportunities to evaluate the effectiveness of information systems for managing shared information within an organisation. • Ensure students understand the requirement at this level to look at information management issues related to shared information and information systems within an organisation. • Ensure students have access to a suitable organisation to use for the case study. • Support students to prepare reports including ways to structure a report and literacy strategies to support report writing in a way that will allow students to describe, explain, discuss, and evaluate. • Ensure students have opportunities to practice report writing.
INDICATORS	Students can: • identify and describe key features of operating systems and common application software as they relate to the management of information. • identify and describe file management procedures, and explain the purpose and conventions of file management procedures and use of storage devices. • describe ethical issues related to management of information (eg, copyright, privacy, file security, appropriateness of the material in its context). • explain the purpose of operating systems and the purposes of common application software to manage information and how application software and operating system software interact to manage information. • justify the selection of application software to perform a task to manage information. • compare and contrast the use of different file types for different purposes (eg, pdf versus doc, jpeg versus bmp).	Students can: • explain the file management considerations related to shared information. • explain the role of an information system for managing shared information within an organisation, and discuss the advantages and disadvantages of an information system for managing shared information within an organisation. • identify the input, storage, retrieval and manipulation of data within an information system. • discuss ethical and legal issues related to shared information within an organisation and the implications for procedures and conventions for privacy and permission. • explain the implications of back up procedures and conventions for information systems within an organisation, and evaluate the backup procedures and conventions for information systems used within an organisation. • evaluate procedures and conventions for privacy and permissions used within an organisation. • evaluate the effectiveness of an information system for managing shared information within an organisation.
AS	**AS91070 Digital Technologies 1.40** *Demonstrate understanding of basic concepts of information management* *See: www.nzqa.govt.nz/ncea/assessment/search.do?query=Digital+Technologies&view=all&level=01*	**AS91367 Digital Technologies 2.40** *Demonstrate understanding of advanced concepts relating to managing shared information within information systems*

◀ BACK TO CONTENTS PAGE

DIGITAL TECHNOLOGIES: CREATE A DIGITAL INFORMATION OUTCOME

Apply digital information management tools to create a digital information outcome requires students to create a digital information outcome that involves manipulating and combining data from more than one application. The specifications for the digital information outcome, software and techniques to be used need to be determined prior to the outcome being made.

When creating digital information outcomes students will use appropriate techniques and data integrity and testing procedures. Students will apply appropriate file management procedures, design elements, and formatting techniques. Students will consider their legal, ethical, and moral responsibilities when developing digital information outcomes.

Initially students learn to perform a set of basic procedures, as instructed, to produce a digital information outcome that involves manipulating and combining data from at least two applications out of word processing, spreadsheets, database, and presentation software. Students should progress to using complex procedures to design and produce a database application with dynamically linked data.

[Level 8 Learning Objectives, Teacher Guidance and Indicators of Progression will be published when Level 3 achievement standards are finalised for registration]

	LEVEL 6	LEVEL 7
LO	*Implement basic procedures to create a digital information outcome*	*Implement advanced procedures to create a digital information outcome with dynamically linked data*
TEACHER GUIDANCE	To support students to implement basic procedures to produce a digital information outcome, at level 6, teachers could: • Provide an opportunity for students to learn and practice a range of basic procedures in at least two software application types from word processing, spreadsheets, database, and presentation. • Provide a brief for a specified digital information outcome, or guide students to develop their own brief. • Ensure students are aware of the requirement at this level to produce an outcome that results from manipulating and combining data from at least two of the software application types listed above. • Support students to apply appropriate file management procedures when developing digital information outcomes. • Support students to apply design elements and formatting techniques as they develop digital information outcomes. • Support students to apply data integrity and testing procedures as they develop digital information outcomes. • Support students to understand their legal, ethical, and moral responsibilities when developing digital information outcomes.	To support students to implement advanced procedures to produce a digital information outcome, at level 7, teachers could: • Provide an opportunity for students to learn and practice a range of advanced procedures in a database and at least one other software application. • Provide a brief for a specified digital information outcome, or guide students to develop their own brief. • Ensure students are aware of the requirement at this level to produce an outcome that integrates data from a database and at least one other application using dynamic linking. • Ensure students apply design elements and formatting techniques accurately and independently as they develop digital information outcomes. • Ensure students apply data integrity and testing procedures as they develop digital information outcomes. • Ensure students understand their legal, ethical, and moral responsibilities when developing digital information outcomes in terms of the social implications of the outcome within an organisation and the wider community.
INDICATORS	Students can: • select appropriate software and apply basic techniques to produce a specified digital information outcome that meets specifications and involves manipulating and combining data from at least two software applications out of word processing, spreadsheets, database, and presentation. • apply appropriate file management procedures. • apply appropriate design elements and/or formatting techniques. • show accuracy in the application of techniques and testing procedures. • show independence with regard to decision making in the application of techniques, and testing procedures. • undertake techniques and testing procedures in a manner that economises the use of resources in the outcome's production and its use. • follow legal, ethical and moral responsibilities as appropriate to the outcome.	Students can: • apply advanced techniques to produce a specified digital information outcome that meets specifications and integrates data from a database and one other application using dynamic linking. • apply appropriate design elements and/or formatting techniques. • show accuracy in the application of techniques, design elements, and testing procedures. • show independence with regard to decision making in the application of techniques, design elements, and testing procedures. • undertake techniques and testing procedures in a manner that economises the use of resources in the outcome's production and its use. • follow legal, ethical and moral responsibilities as appropriate to the outcome by considering the social implications of the outcome within an organisation and the wider community.
AS	**AS91071 Digital Technologies 1.41** *Implement basic procedures to produce a specified digital information outcome* *See: www.nzqa.govt.nz/ncea/assessment/search.do?query=Digital+Technologies&view=all&level=01*	**As91368 Digital Technologies 2.41** *Implement advanced procedures to produce a specified digital information outcome with dynamically linked data*

◀ BACK TO CONTENTS PAGE

DIGITAL TECHNOLOGIES: KNOWLEDGE OF DIGITAL MEDIA

Knowledge of digital media focuses on understanding of concepts of digital media that need to be considered when developing digital media outcomes. Initially students learn about basic concepts of digital media. These basic concepts include such things as the media types, software resources, and techniques used to create digital media outcomes. They also include such things as influence of design elements, communication purpose, and ethics are considered when developing digital media outcomes. Students progress to learning about complex concepts of digital media such as those tools and techniques used to present content across multiple outcomes, application of digital media standards and conventions, asset management, file management, naming conventions, and legal, ethical, and moral considerations in relation to the requirements of digital media outcome within the wider community.

[Level 8 Learning Objectives, Teacher Guidance and Indicators of Progression wiil be published when Level 3 achievement standards are finalised for registration]

	LEVEL 6	LEVEL 7
LO	*Demonstrate understanding of basic concepts in digital media*	*Demonstrate understanding of advanced concepts in digital media*
TEACHER GUIDANCE	To support students to develop understandings about basic concepts in digital media at level 6, teachers could: • Provide students with the opportunity to explore a range of digital media outcomes. • Ensure the digital media outcomes students investigate demonstrate an integration of media types and are of sufficient rigour for this level (see indicators below). • Provide opportunity for students to explain how basic tools and techniques have been used to create digital media outcomes. • Guide students to consider why ethical considerations are important when developing digital media outcomes. • Guide students on how to prepare reports including ways to structure a report. • Support students to develop literacy strategies that assist them to write reports in a way that will allow them to identify, describe, explain, and discuss.	To support students to develop understandings about the advanced concepts in digital media at level 7, teachers could: • Provide students with the opportunity to explore a range of digital media outcomes. • Ensure the digital media outcomes students investigate demonstrate an integration of media types and are of sufficient rigour for this level (see indicators below). • Provide opportunity for students to explain how advanced tools and techniques have been used to create digital media outcomes. • Provide opportunity for students to discuss the implications of adhering to digital media standards and conventions whilst developing digital media outcomes. • Provide opportunity for students to discuss the importance of asset management and file management whilst developing digital media outcomes. • Guide students to consider the legal, ethical, and moral responsibilities to the wider community when developing digital media outcomes. • Guide students to understand the importance of appropriate data integrity and testing procedures whilst developing digital media outcomes. • Support students to develop literacy strategies that assist them to write reports in a way that will allow them to identify, describe, explain, and discuss.
INDICATORS	Students can: • identify the digital media types in a digital media outcome. • describe the software resources used to create a digital media outcome. • describe basic techniques used to create a digital media outcome. • describe design elements in a digital media outcome. • describe the communication purpose of a digital media outcome, and discuss why distinguishing characteristics of a digital media outcome support its communication purpose. • explain how software resources and techniques used affected the technical quality of a digital media outcome. • explain why ethical considerations were important in the creation of a digital media outcome. • discuss why software resources and techniques were used to create a digital media outcome and how they affected its technical quality.	Students can: • discuss why advanced tools and techniques have been used to create, edit and integrate digital media outcomes and how their use have enhanced the outcome. • explain the digital media standards and conventions used to produce digital media outcomes, and discuss the positive and negative implications of adhering to these standards and conventions when developing digital media outcomes. • explain how asset management and file management are applied in the development of digital media outcomes, and discuss the importance of effective and appropriate asset management and file management in the development of digital media outcomes. • explain legal, ethical and moral considerations in relation to the requirements of digital media outcomes in the wider community. • explain the data integrity and testing procedures used to ensure a digital media outcome meets the specifications, and how they were applied. • discuss the importance of appropriate data integrity and testing procedures in the development of digital media outcomes. • evaluate how the application of advanced tools, techniques, standards and conventions affect the quality of digital media outcomes. • discuss the relationship between standards and conventions, and legal, ethical and moral considerations in relation to the requirements of digital media outcomes.
AS	**AS91072 Digital Technologies 1.42** *Demonstrate understanding of basic concepts of digital media* *See: www.nzqa.govt.nz/ncea/assessment/search.do?query=Digital+Technologies&view=all&level=01*	**AS91369 Digital Technologies 2.42** *Demonstrate understanding of advanced concepts of digital media*

◀ BACK TO CONTENTS PAGE

DIGITAL TECHNOLOGIES: CREATE A DIGITAL MEDIA OUTCOME

Create a digital media outcome requires students to construct a digital media outcome that integrates media types and incorporates original content. The specifications for the digital media outcome, software and techniques to be used need to be determined prior to the outcome being made.

Initially students learn to perform a set of techniques, as instructed, to produce a digital media outcome. Students should progress to integrating digital media types using complex tools and techniques (eg, *Web design*: HTML/CSS, scripting dynamic data handling, interaction between user and content, multiple device outputs; Desktop publishing: interactivity, form elements, chapters and sections: *Motion graphics*: Complex transitions, multiple tracks, post processing; *Audio*: multiple tracks, manipulating multiple tracks, overlays, equalising; *Image manipulation:* colour histograms and adjustments, non destructive editing, pen tools and paths, filter effects, graphic optimisations, colour management and printing, automation/scripts) when constructing original digital media outcomes such as an *animation or multi-page website* that integrates student created graphics, video and/or audio; an edited, student-produced *movie* integrating student created soundtrack, graphics and/or animation; a *multi-page desktop published document* integrating student created graphics and/or still images.

[Level 8 Learning Objectives, Teacher Guidance and Indicators of Progression wiil be published when Level 3 achievement standards are finalised for registration]

	LEVEL 6	LEVEL 7
LO	*Implement basic procedures to create a digital media outcome*	*Implement advanced procedures to create a digital media outcome*
TEACHER GUIDANCE	To support students to implement basic procedures to create a digital media outcome, at level 6, teachers could: • Provide opportunity for students to explore and develop technical expertise with digital media tools. • Provide opportunity for students to apply an understanding of digital media to design and create a number of different digital media outcomes using a variety of digital media technologies. • Provide opportunity for students to develop an understanding about the legal, ethical and moral responsibilities as appropriate to a digital media outcome. • Provide opportunity for students to develop an understanding about, and apply data integrity and testing procedures that ensure a digital media outcome meets brief specifications. • Provide opportunity for students to interpret the needs of a situation to publish a successful and appropriate digital media outcome.	To support students to implement advanced procedures to create a digital media outcome, at level 7, teachers could: • Provide opportunity for students to apply advanced tools and techniques to enhance the presentation of digital media content. • Guide students to select digital media software applications and specific features when creating, editing and integrating digital media. • Provide opportunity for students to identify and apply file management techniques to successfully publish digital media content. • Provide opportunity for students to input, manipulate and test digital media data, and ensure its compliance with current web standards or other digital media compliance requirements. • Provide opportunity for students to apply processes for media input, editing, testing, and publishing techniques that ensure data integrity; and consider legal, ethical and moral responsibilities that ensure a digital media outcome addresses a brief's specifications. • Provide opportunity for students to create virtual, incomplete or new realised digital media outcomes in a manner that economises the use of resources in production and ensure a digital media outcomes usability, eg, timely fashion, optimisation of tool selection and use.
INDICATORS	Students can: • use appropriate features of digital media software to edit and integrate digital media types to create a digital media outcome. • apply formatting techniques, design elements, and data integrity and testing procedures, to ensure the outcome meets the specifications. • follow legal, ethical, and moral responsibilities as appropriate to the outcome. • show accuracy and independence in the application of techniques and testing procedures. • undertake techniques and testing procedures in a manner that economises the use of resources in a digital media outcome's production and use.	Students can: • select software based on the features of the program(s) that enable media types to be created, edited and integrated. • use advanced tools and techniques to edit and integrate digital media types to create a digital media outcome. • apply advanced formatting techniques, design elements, and data integrity and testing procedures, to ensure a digital media outcome meets the specifications. • follow legal, ethical, and moral responsibilities as appropriate to a digital media outcome. • show accuracy and independence in the application of advanced tools, techniques and testing procedures. • apply tools and techniques and testing procedures in a manner that economises the use of resources in a digital media outcome's production and usability.
AS	**AS91073 Digital Technologies 1.43** *Implement basic procedures to produce a specified digital media outcome* *See: www.nzqa.govt.nz/ncea/assessment/search.do?query=Digital+Technologies&view=all&level=01*	**AS91370 Digital Technologies 2.43** *Implement advanced procedures to produce a specified digital media outcome*

◀ BACK TO CONTENTS PAGE

DIGITAL TECHNOLOGIES: KNOWLEDGE OF COMPUTER SCIENCE AND SOFTWARE ENGINEERING

Computer science and software engineering refers to a group of concepts associated with the discipline of computer science and how they are applied in user interfaces.

Initially students learn about basic concepts of algorithms, programming language and user interface. Students progress to learning about tractability, data representations, coding, usability heuristics, formal specification of the syntax of programming languages, and software development methods.

[Level 8 Learning Objectives, Teacher Guidance and Indicators of Progression wiil be published when Level 3 achievement standards are finalised for registration]

	LEVEL 6	LEVEL 7
LO	*Demonstrate understanding of basic concepts in computer science and software engineering*	*Demonstrate understanding of advanced concepts in computer science and software engineering*
TEACHER GUIDANCE	To support students to develop understandings about the basic concepts in computer science and software engineering at level 6, teachers could: • Ensure students understand the concept of an algorithm vs. a program, and that there are different costs for different algorithms for the same task. This could be illustrated with searching (linear and binary) and/or sorting. • Provide students with an opportunity to understand the programming language concepts of: high level languages, machine languages, interpretation and compilation; and the idea that programming languages are precise. • Guide students to informally critique user interfaces based on personal experience rather than using heuristics eg, identify a frustrating user interface and explain why it was difficult to use.	To support students to develop understandings about the advanced concepts in computer science and software engineering at level 7, teachers could: • Ensure students understand the concepts of complexity and tractability– the idea that some problems are inherently difficult to solve on a computer. • Provide students with an opportunity to understand how various kinds of data can be represented using bits. • Provide students with an opportunity to understand how coding for compression, error control or encryption enable technologies eg, mp3 players, reliable storage and communication, e-commerce. • Guide students to evaluate a Human-Computer interface in terms of simple usability heuristics, eg, Nielsen's usability heuristics would be a suitable framework to use.
INDICATORS	Students can: • explain how algorithms are distinct from related concepts such as programs and informal instructions. • compare and contrast the concepts of algorithms, programs, and informal instructions. • determine and compare the costs of two different iterative algorithms for the same problem of size n. • compare and contrast high level and low level (or machine) languages, and explaining different ways in which programs in a high level programming language are translated into a machine language. • discuss how different factors of a user interface contribute to its usability by comparing and contrasting related interfaces.	Students can: • compare and contrast different ways in which different types of data can be represented using bits and discuss the implications. • discuss how a widely used technology is enabled by one or more of compression coding, error control coding, and encryption enable. • suggest improvements to a given human-computer interface based on an evaluation in terms of simple usability heuristics.
AS	**AS91074 Digital Technologies 1.44** *Demonstrate understanding of basic concepts from computer science* *See: www.nzqa.govt.nz/ncea/assessment/search.do?query=Digital+Technologies&view=all&level=01*	**AS91371 Digital Technologies 2.44** *Demonstrate understanding of advanced concepts from computer science*

◀ BACK TO CONTENTS PAGE

DIGITAL TECHNOLOGIES: DESIGN A SOFTWARE PROGRAM STRUCTURE

Design a software program focuses on designing the structure of a software programs.

Initially students learn to specify variables and their data types, construct flexible and robust plans, and determine structures that combine well-chosen actions, conditions and control structures that provide well-structured logical solution to tasks. They establish sets of test cases with expected, boundary and invalid input for testing programs. Students progress to designing the structure of a complex software program where the plan has a modular structure, an indexed data structure, input and output, and procedural structures that combine sequential, conditional, and iterative structures. By level 8 students should be using an Integrated Development Environment (IDE) to develop code following a disciplined development process with cycles of incremental development and testing.

[Level 8 Learning Objectives, Teacher Guidance and Indicators of Progression wiil be published when Level 3 achievement standards are finalised for registration]

	LEVEL 6	LEVEL 7
LO	*Demonstrate ability to design the structure of a basic software program*	*Demonstrate ability to design the structure of an advanced software program*
TEACHER GUIDANCE	To support students to develop an ability to design the structure of a basic software program at level 6, teachers could: • Guide students on how to specify variables and their data types. • Guide students to independently construct flexible and robust plans. • Guide students on how to specify procedural structures that combine well-chosen actions, conditions and control structures, that constitute well-structured logical solution to tasks. • Guide students specify comprehensive sets of test cases with expected, boundary and invalid input for testing programs.	To support students to develop an ability to design the structure of an advanced software program at level 7, teachers could: • Guide students on how to specify well-chosen scopes for variables, their scopes and data types. • Guide students on how to specify indexed data structures. • Guide students on how to specify modular structures for programs with well-chosen parameters, including details of procedural structures of modules, that constitute well-structured logical decomposition of tasks. • Guide students on how to specify a comprehensive set of expected, boundary and exceptional input cases for testing programs. • Guide students on how to specify variables, constants, and derived values effectively so as to maximise the flexibility and robustness of independently constructed plans
INDICATORS	Students can: • specify variables and their data types. • independently construct a flexible and robust plan. • specify a procedural structure that combines well-chosen actions, conditions and control structures that constitutes a well-structured logical solution to the task. • specify a comprehensive set of test cases with expected, boundary and invalid input for testing the program.	Students can: • specify well-chosen scopes for variables, their scopes and data types. • specify an indexed data structure. • specify a modular structure for the program with well-chosen parameters, including details of the procedural structures of the modules, that constitute a well-structured logical decomposition of the task. • specify a comprehensive set of expected, boundary and exceptional input cases for testing the program. • specify variables, constants, and derived values effectively so as to maximise the flexibility and robustness of an independently constructed plan.
AS	**AS91075 Digital Technologies 1.45** *Construct a plan for a basic computer program for a specified task* *See: www.nzqa.govt.nz/ncea/assessment/search.do?query=Digital+Technologies&view=all&level=01*	**AS91372 Digital Technologies 2.45** *Construct a plan for an advanced computer program for a specified task*

◀ BACK TO CONTENTS PAGE

DIGITAL TECHNOLOGIES: CONSTRUCT A SOFTWARE PROGRAM

Construct a software program focuses on constructing a computer program for a specified task including testing and debugging the program to ensure the program works correctly.

Initially students learn to construct basic computer programs in any programming language (drag-and-drop language, specialised programming language, or a general purpose programming language) that include:

- variables, assignment, predefined actions, expressions, and sequence, selection, and iteration control structures; and
- obtains and uses input from a user, sensors, or other external source.

Students progress to constructing complex computer programs using a text based programming language.

[Level 8 Learning Objectives, Teacher Guidance and Indicators of Progression wiil be published when Level 3 achievement standards are finalised for registration]

	LEVEL 6	LEVEL 7
LO	*Demonstrate ability to construct a basic software program*	*Demonstrate ability to construct an advanced software program*
TEACHER GUIDANCE	To support students to develop an ability to construct a basic software program at level 6, teachers could: • Guide students to independently implement a plan for a basic program in a suitable programming language (drag-and-drop language, specialised programming language, or a general purpose programming language) that uses a procedural structure with well-chosen actions, conditions and control structures that ensures the program is flexible and robust. • Guide students on how to set out program code concisely, and document programs with variable names and succinct comments that accurately explain and justify code function and behaviours. • Guide students on how to comprehensively test and debug programs in an organised time effective way to ensure that they work on expected, boundary and invalid inputs.	To support students to develop an ability to construct an advanced software program at level 7, teachers could: • Guide students on how to independently implement a plan to construct advanced programs, in suitable programming language, where the modules (including their procedural structures) constitute a well-structured logical decomposition of the tasks. • Guide students on how to use variables, constants, and derived values effectively to increase the flexibility and robustness of programs. • Guide students on how to set out program code clearly and document programs with variables and module names, and include comments that explain and justify code functions and behaviours. • Guide students on how to comprehensively test and debug programs in organised and time effective ways to ensure that programs are correct on expected, boundary's and invalid inputs.
INDICATORS	Students can: • write a program with sequence, selection, and iteration control structures. • write a program with multiple data types, iteration control structures nested inside other iteration control structures, and structures in which complex logical conditions are expressed economically. • comprehensively test and debug the program in an organised and time effective way to ensure the program is correct on all inputs (including expected, exceptional, out-of-range, boundary, and invalid inputs).	Students can: • independently implement a plan for an advanced program in a suitable programming language (preferably a text-based programming language). • construct an advanced program where the modules (including their procedural structures) constitute a well-structured logical decomposition of the task. • use variables, constants, and derived values effectively so as to increase the flexibility and robustness of the program. • set out the program code clearly and concisely and document the program with comments that explain and justify decisions. • comprehensively test and debug the program in an organised and time effective way to ensure the program is correct on expected, boundary and invalid inputs.
AS	**AS91076 Digital Technologies 1.46** *Construct a basic computer program for a specified task* *See: www.nzqa.govt.nz/ncea/assessment/search.do?query=Digital+Technologies&view=all&level=01*	**AS91373 Digital Technologies 2.46** *Construct an advanced computer program for a specified task*

◀ BACK TO CONTENTS PAGE

DIGITAL TECHNOLOGIES: KNOWLEDGE OF DIGITAL INFRASTRUCTURE

Knowledge of digital infrastructure focuses on the concepts of digital infrastructure within personal computers, local area networks (LANs) and Wide Area Networks (WANs).

Initially students learn about the common components of basic digital infrastructures consisting of personal computer hardware, associated peripherals and system software. Students learn about the purpose of the components, typical connections and data flow between components, characteristics of components that limit their inter-operability, and procedures and protocols for installing or replacing a component or a program. Student's progress to learn about complex concepts of digital infrastructure associated with LANs and WANs.

[Level 8 Learning Objectives, Teacher Guidance and Indicators of Progression will be published when Level 3 achievement standards are finalised for registration]

	LEVEL 6	LEVEL 7
LO	*Demonstrate understanding of digital infrastructure components*	*Demonstrate understanding of LAN infrastructure systems*
TEACHER GUIDANCE	To support students to develop understandings about of digital infrastructure components at level 6, teachers could: • Provide students with the opportunity to explore digital infrastructure in order to identify personal computer hardware, associated peripherals and system software. • Provide the opportunity for students to explore the purpose of components and their characteristics. • Assist in the refinement of reflective and inquiry questions related to the understanding of procedures and protocols associated with basic infrastructure. • Guide students on how to prepare reports including ways to structure a report and literacy strategies to support report writing in a way that will allow students to describe, explain, and discuss. • Provide opportunities for students to practice report writing.	To support students to develop understandings about LAN infrastructure systems at level 7, teachers could: • Provide students with the opportunity to explore local area networks (LAN s) consisting of a number of networked devices which includes at least three PCs connected with an unmanaged switch, simple server elements and a single connection to the internet. • Provide the opportunity for students to explore the characteristics and purposes of LANs, and discuss their components, network layers, bandwidth, data transmission modes, IP addressing, DHCP (Dynamic Host Configuration Protocol), NAT (Network Address Translation) and ICMP (Internet Control Message Protocol). • Assist in the refinement of reflective and inquiry questions related to the understanding of procedures and protocols associated with the development and maintenance of LANs. • Support students to prepare reports including ways to structure a report and literacy strategies to support report writing in a way that will allow students to describe, explain, and discuss. • Ensure students have opportunities to practice report writing.
INDICATORS	Students can: • describe and identify the purpose of the components of basic digital infrastructures. • describe the typical connections and data flow between components of a basic digital infrastructure. • describe the key characteristics of components of a basic digital infrastructure that limit their inter-operability. • describe a procedure or protocol for installing or replacing a physical component or a program. • explain how the purpose of components determines the connections between components and the typical flow of data along them. • explain how the key characteristics of components limit their inter-operability. • explain the importance of procedures and protocols when installing or replacing a component or a program. • discuss the characteristics and limitations of the connections that carry data between components. • discuss the key characteristics used to specify each kind of component in terms of inter-operability, tradeoffs, efficiencies, cost, and context of use.	Students can: • describe networking concepts such as the characteristics and purposes of a local area network (LAN), standard networking models, bandwidth, data transmission modes, IP addressing, DHCP, NAT, and ICMP. • explain why the components have been used in a LAN to achieve the desired characteristics. • explain how the connection technologies allow the components to function in a LAN. • describe the access control method used in the Ethernet architecture. • compare and contrast the characteristics and the purposes of peer-to-peer LANs and client/server LANs. • explain the layers in the TCP/IP networking model and the role of this model in a LAN architecture. • explain IP (Internet Protocol) addressing with reference to static addresses and dynamically obtained addresses. • discuss the advantages and disadvantages of the common cable, fibre and wireless technologies for connecting the components of a LAN. • discuss IP addressing schema including the consequences for static addresses and dynamically obtained addresses. • discuss how the access control method used in the Ethernet architecture manages Ethernet traffic on a LAN.
AS	**AS910780 Digital Technologies 1.50** *Demonstrate understanding of the common components of basic digital infrastructures* *See: www.nzqa.govt.nz/ncea/assessment/search.do?query=Digital+Technologies&view=all&level=01*	**AS91377 Digital Technologies 2.50** *Demonstrate understanding of local area network technologies*

◀ BACK TO CONTENTS PAGE

DIGITAL TECHNOLOGIES: DESIGN A DIGITAL INFRASTRUCTURE SYSTEM

Design a digital infrastructure system refers to the assembly and management of a specified system.

Designing a digital infrastructure system requires particular techniques to be used to select, assemble, configure and install components for a specified purpose. Components are hardware and software.

When designing an infrastructure system students will employ standard procedures for installing and configuring hardware and peripherals (eg, systematic use of procedures specified in manufacturer OEM manuals, antistatic procedures, electrical safety procedures, and relevant OSH regulations) and standard procedures for installing and configuring software (eg, standard best practice and procedures specified in manuals, installation guides, installation programs, and system documentation including Help facilities).

Initially students learn to assemble and service a personal computer system. Students progress to assembling, configuring and managing local and wide area networks.

[Level 8 Learning Objectives, Teacher Guidance and Indicators of Progression wiil be published when Level 3 achievement standards are finalised for registration]

	LEVEL 6	LEVEL 7
LO	*Select components for a single computer system for a specified purpose*	*Select components and parameters for a local area network for a specified purpose*
TEACHER GUIDANCE	To support students to develop skills in constructing a single computer system at level 6, teachers could: • Ensure students can identify components of a single computer system. • Provide an opportunity for students to select components [eg, memory capacity, graphics cards, peripherals] that have sufficient capacity to meet the needs of specified software. • Guide students to identify and resolve installation and configuration faults related to hardware and software.	To support students to develop skills in constructing and managing a local area network (LAN) at level 7, teachers could: • Ensure students can identify components of a LAN. • Ensure students understand and follow administrative procedures to manage a LAN. • Provide students with an opportunity to undertake testing procedures through the use of: hardware identification tools, system software identification tools and stand alone programs. • Provide an opportunity for students to select network components [eg, LAN speed, routers/switches] that have sufficient capacity for a specified purpose [eg, file sharing, file storage, shared services]. • Guide students to identify and resolve installation and configuration faults related to hardware, network architecture and software.
INDICATORS	Students can: • show accuracy and independence in following standard procedures for installing and configuring hardware, software and peripherals of a personal computer system. • show accuracy and independence in diagnosing and troubleshooting to identify and resolve given installation and configuration faults in a system. • diagnose and troubleshooting to identify and resolve given installation and configuration faults in a system, in a manner that is economical in time, effort and resources.	Students can: • follow standard administrative procedures to manage a LAN, showing organisation, confidence, accuracy and independence. • diagnose and troubleshooting a LAN to identify and resolve given installation and configuration faults in a manner that is economical in time, effort and resources showing organisation, confidence, accuracy and independence.
AS	**AS91073 Digital Technologies 1.51** *Implement basic procedures servicing a personal computer system* *See: www.nzqa.govt.nz/ncea/assessment/search.do?query=Digital+Technologies&view=all&level=01*	**As91370 Digital Technologies 2.51** *Implement procedures for administering a local area network*

◀ BACK TO CONTENTS PAGE

DIGITAL TECHNOLOGIES: KNOWLEDGE OF ELECTRONIC ENVIRONMENTS

Knowledge of electronic environments focuses on the concepts and operational function of components that underpin the understanding of how electronic environments (functional combinations of hardware and embedded software in the real world, ie, circuits, prototypes or products) are developed, assembled and tested.

Initially students learn about basic components and the concepts that describe the behaviour of a circuit. Students progress from this to more advanced understanding of circuit and embedded programming concepts and learn about an increasing range of components and their operation function in real circuits. At the highest level, students will be able to discuss complex electronic environments in terms of their subsystems and programming structures and apply some basic mathematical calculations within this discussion.

[Level 8 Learning Objectives, Teacher Guidance and Indicators of Progression wiil be published when Level 3 achievement standards are finalised for registration]

	LEVEL 6	LEVEL 7
LO	*Demonstrate understanding of basic concepts and components in electronic environments*	*Demonstrate understanding of advanced concepts and components in electronic environments*
TEACHER GUIDANCE	To support students to develop understandings about basic concepts and components in electronic environments at level 6, teachers could: • Provide opportunity for students to learn about basic concepts through practical settings eg test conductors, insulators and semiconductorsusing a multimeter (ohms) or a light bulb and battery or learn why a circuit must be complete by identifying hidden breaks in a circuit using a multimeter. • Guide students to identify basic components and their symbols by creating games eg, 'lotto' cards or 'snakes and ladders'. • Support students to experiment with basic components in simple circuits to consolidate their understanding. • Guide students to classify a provided selection of components in a tray as sensors, actuators or processors and to identify their operational function in situ. • Provide opportunity for discussion about the components properties in terms of energy transfer, eg, an LDR converting light to electrical energy. • Support students to use symbols to create schematics for simple circuits. • Provide a range of practical experiences eg exploring the properties of series and parallel connections using light bulbs or LEDs in a circuit; using a multimeter in a simple LED-resistor circuit to introduce the concept of voltage as an energy level, and the concepts of current and resistance. • Provide opportunity for students to program a simple microcontroller (eg, PICAXE 08M) to perform basic functions such as blinking an LED. Students will be provided with the basic program structures for this. • Guide students to examine simple two -loop circuits, including those with a microcontrollerto identify and explain voltage divider and transistor switch subsystems in these.	To support students to develop understandings about advanced concepts and components in electronic environments at level 7, teachers could: • Provide opportunity for students to learn about advanced concepts, including power and heat dissipation, analogue and digital signals, time constant, amplification, logical AND/OR and truth tables, bistable, monostable and astable, parallel and series, how a single component type may have varied roles through hands-on practical work and research etc. • Provide opportunities for students to discuss and investigate practically, software programme development using advanced concepts, such as variables, binary notation (bits, bytes and words), logical structuring of software programmes (eg, flowcharting) and the use of subroutines and variables. • Provide opportunity for students to experiment with an extended range of components in circuits eg, diode (pn and zener), capacitor (various types), npn transistor, and an extended range of common sensors and actuators eg, Hall sensor, servo etc. • Guide students to explore the properties of integrated devices eg,555, gates, H-bridge, voltage regulators. • Guide students to research information (books,online etc) about the properties and operation of components and guide them to in selecting relevant material from these sources. • Support students to perform advanced calculations, including power rating, parallel and series, time constant, based on parameters important in the behaviour of real circuits. • Provide opportunity for students to explore an extended set of subsystems, including filters, timers, amplifier stages etc. and enable students to recognise these in advanced circuit schematics.
INDICATORS	Students can: • analyse basic concepts of electronics to explain the behaviour of electronic systems. • discuss the operational function of electronic components in a practical context.	Students can: • use advanced concepts of electronics to discuss the implications of multiple variables on the performance of electronic environments. • discuss the advantages and disadvantages of different electronic components to achieve desired advanced operational functions.
AS	**AS91077 Digital Technologies 1.47** *Demonstrate understanding of basic concepts used in the design and construction of electronic environments* *See: www.nzqa.govt.nz/ncea/assessment/search.do?query=Digital+Technologies&view=all&level=01*	**AS91374 Digital Technologies 2.47** *Demonstrate understanding of advanced concepts used in the construction of electronic environments*

◀ BACK TO CONTENTS PAGE

DIGITAL TECHNOLOGIES: DEVELOP AN ELECTRONIC ENVIRONMENT

Development of electronic environments focuses on the analysis of how electronic environments (functional combinations of hardware and embedded software in the real world i.e. circuits, prototypes or products) work in terms of their components, subsystems and software and how these components may be selected, subsystems put together and the hardware and software tested and debugged so that the electronic environment is functional with respect to agreed specifications. The model produced through these skills is a necessary precursor to developing a functional electronic and embedded system.

Initially students learn basic functional modelling, circuit analysis, subsystem assembly and adjustment, testing and debugging skills. Students progress from this to more advanced skills to deal with more advanced and eventually complex environments. This progression will involve the introduction of more complex calculation and competency in the use and interpretation of data from devices such as multimeters (extended function), oscilloscopes and other test instruments. At the highest level, students will be able to analyse and develop complex electronic environments in terms of their subsystems and programming structures and employ mathematical calculations as part of this process.

[Level 8 Learning Objectives, Teacher Guidance and Indicators of Progression wiil be published when Level 3 achievement standards are finalised for registration]

	LEVEL 6	LEVEL 7
LO	*Demonstrate ability to develop a basic electronic environment*	*Demonstrate ability to develop an advanced electronic environment*
TEACHER GUIDANCE	To support students to demonstrate ability to develop a basic electronic environment at level 6, teachers could: • Provide, or develop in negotiation with the student, specifications for an electronic environment that will require applying some basic interfacing procedures. • Provide experiences that involve functional modelling eg, breadboard simple circuits, use Crocodile Clips, kitsets (eg, Electroflash Kit), or emulators (eg, PICAXE Programme Editor functionality). • Support students to analyse basic circuits (including those with a microcontroller) in terms of their subsystems (eg, voltage divider and transistor switch). • Guide student to use functional modelling to perform measurements in, and to test, debug and make adjustments to voltage divider and transistor switch subsystems. • Guide student to use functional modelling to develop software for an embedded system, given provided programme structures. • Guide student to use functional modelling to test, debug and make adjustments to embedded software. • Guide student to use functional modelling to interface subsystems to each other and to the embedded software in a microcontroller. • Provide and explain a datasheet for a common component eg, a resistor or LED. • Provide opportunity for students to practice simple calculations based on selecting components for real circuits eg, the value of a resistor to match an LDR. • Guide students to test and debug an integrated electronic environment to ensure functionality.	To support students to demonstrate ability to develop an advanced electronic environment at level 7, teachers could: • Provide, or develop in negotiation with the student, specifications for an electronic environment that will require applying some advanced interfacing procedures. • Support students to analyse advanced circuits (those involving gates, 555s, filters, timers, amplifier stages etc in terms of their subsystems. • Provide functional modelling tools to enable students to perform measurements in, and to test, debug and make adjustments to advanced circuit subsystems. • Guide student to use functional modelling to develop clearly annotated software (including variables, subroutines and an extended range of commands) for an advanced embedded system. • Provide functional modelling tools to enable students to test, debug and make adjustments to advanced embedded software. • Guide student to use functional modelling to interface subsystems to each other and to the embedded software in a microcontroller. • Provide opportunity for students to practice interpreting datasheets and undertaking calculations based on real circuits, including voltage, current and power eg, selecting components for a motor driver subsystem based on average and maximum power requirements. • Support students to test and debug an integrated electronic environment to ensure functionality.
INDICATORS	Students can: • use datasheets or calculations to assist in choosing appropriate component types and values for the sensor and actuator subsystems. • write well-structured, clearly annotated, readily understandable interface software given simple programme structures. • Interface subsystems to each other and to the embedded software in a microcontroller. • test and debug a functional model of the interface.	Students can: • use provided functional sensor subsystems to interact with the environment. • use provided functional actuator subsystems to interact with the environment. • modify sensor subsystems to substantially improve the quality of the data delivered by the interface. • modify actuator subsystems to substantially improve the way they work. • write well-structured, clearly annotated, readily understandable software that interfaces effectively with the data provided by the sensors and with the actuators it controls. • Interface subsystems to each other and to the embedded software in a microcontroller. • test and debugging a functional model of the interface to achieve and demonstrate substantially improved operation.
AS	**AS91078 Digital Technologies 1.48** *Implement basic interfacing procedures in a specified electronic environment* *See: www.nzqa.govt.nz/ncea/assessment/search.do?query=Digital+Technologies&view=all&level=01*	**AS91375 Digital Technologies 2.48** *Implement advanced interfacing procedures in a specified electronic environment*

◀ BACK TO CONTENTS PAGE

DIGITAL TECHNOLOGIES: ASSEMBLE AND TEST ELECTRONIC AND EMBEDDED SYSTEMS

The assembly and testing of electronic and embedded system is focused on developing the skills needed to integrate technologies (hardware, software, mechanical) to produce a working prototype. These skills follow directly from those acquired during the development of an electronic environment as a functional model. It is also about the application of testing, debugging and modification skills to ensure the prototype is operational, fit for purpose and meets specifications.

Initially students learn basic assembly and testing skills and about working safely in the classroom and/or workshop environment. Students progress from here to levels that require more advanced and complex skills. This progression may require developing competency in calculating values and in the use and interpretation of data from devices such as multimeters (extended functions), oscilloscopes and other test instruments. At the highest level, students will be able to use complex techniques to construct and debug electronic and embedded systems to meet design specifications.

[Level 8 Learning Objectives, Teacher Guidance and Indicators of Progression will be published when Level 3 achievement standards are finalised for registration]

	LEVEL 6	LEVEL 7
LO	*Demonstrate basic assembly and testing techniques used in electronic and embedded systems*	*Demonstrate advanced assembly and testing techniques used in electronic and embedded systems*
TEACHER GUIDANCE	To support students to demonstrate basic assembly and testing techniques used in electronic and embedded systems at level 6, teachers could: • Provide, or develop in negotiation with the student, specifications for an electronic environment that will require basic techniques. • Provide opportunity for students to select components that match a given schematic. • Provide instruction for students in the design and production of a simple PCB (printed circuit board) using 'pen and etch' technique. • Provide opportunity for students to develop correct soldering techniques. • Ensure students apply acceptable standards of cleanliness in their work area and care for their equipment. • Provide opportunity to discuss necessary safety procedures for soldering, drilling and PCB production. • Provide opportunity for students to develop skills in drilling, populating and soldering up of a circuit on a PCB. • Provide opportunity for students to work with other circuit platforms, such as copper tape and veroboard. • Provide opportunity for students to develop the art of visual critical inspection of their handiwork, including all hardware (circuits and mechanicals) as well as software programs. • Ensure students test each soldered joint for continuity with a multimeter, as each joint is completed. • Guide students to use a multimeter to test components (eg, resistor values) and locate basic faults in a real circuit, such as a bad joint, by measuring voltage levels at different points. • Provide opportunity for students to develop, test and download programs into embedded software, given supplied programme structures as a starting point. • Provide opportunity for students to inspect and debug software programs. • Guide students to employ basic techniques to evaluate, test and debug the assembled electronic and embedded system so that the overall system is functional. • Provide students with opportunity to work and cooperate in groups. • Ensure students understand how an outcome is evaluated against specifications in a brief.	To support students to demonstrate advanced assembly and testing techniques used in electronic and embedded systems at level 7, teachers could: • Provide, or develop in negotiation with the student, specifications for an electronic environment that will require advanced techniques. The environment will include more than one subsystems and include at least one multi-pin device. • Provide opportunity for students to select an extended range of components to match a schematic. • Provide instruction for students in the design and production of a PCB using advanced techniques, such as CAD and iron-on or routing. • Provide opportunity for students to develop advanced soldering techniques (eg, temperature controlled, desoldering etc.) so that students can achieve consistently reliable results. • Provide opportunity for students to use advanced multimeter functions to test an extended range of components (eg, capacitor values) to locate faulty components and other problems in a circuit, visual inspection, using an extended range of techniques in a logical manner (eg, voltage levels and current at the system and progressive subsystem levels). • Provide opportunity for students to perform systematic and logical testing, evaluation of data and debugging in the electronic environment. • Provide instruction in and examples for students that show how calculation and measurement can assist in the testing and debugging of the hardware and software in the system. • Provide instruction in and examples of advanced techniques for the development, testing and debugging of clearly annotated embedded software that uses features such as variables and subroutines. • Guide students to employ advanced techniques to evaluate, test and debug the assembled electronic and embedded system so that the overall system is functional.
INDICATORS	Students can: • construct and test reliable functional systems with well-soldered joints; optimised track and component layout and secure, reliable, well-organised connections to any components that are mounted off the board. • write and debug embedded software so that the program is logical, efficient and clearly annotated.	Students can: • develop and produce a printed circuit board (PCB) using PCB CAD software. • construct and test reliable functional circuits on PCB, with substantially improved track layout and soldering. • write and debug well-structured, clearly annotated, and readily understandable embedded software which uses extended features and specialised commands.
AS	**AS91079 Digital Technologies 1.49** *Implement basic techniques in constructing a specified electronic and embedded system* *See: www.nzqa.govt.nz/ncea/assessment/search.do?query=Digital+Technologies&view=all&level=01*	**AS91376 Digital Technologies 2.49** *Implement advanced techniques in constructing a specified electronic and embedded system*

◀ BACK TO CONTENTS PAGE

PROCESSING TECHNOLOGIES: IMPLEMENT A PROCESS

Implement a process focuses on undertaking appropriate procedures to process a specified product. Products may include but are not limited to: fermented or non-fermented foods and beverages; biologically active products; household chemicals; toiletries; cosmetics; paper; resin or fibreglass products.

Initially students learn to follow appropriate processing operations and undertake testing to make a product that meets specifications. Students progress to complex processing operations that require analysis, modification, testing and calculation of relevant factors.

[Level 8 Learning Objectives, Teacher Guidance and Indicators of Progression wiil be published when Level 3 achievement standards are finalised for registration]

	LEVEL 6	LEVEL 7
LO	*Implement basic procedures to make a processed product*	*Implement advanced procedures to make a processed product*
TEACHER GUIDANCE	To support students to implement basic procedures to make a processed product at level 6, teachers could: • Provide opportunity for students to undertake basic processing operations. • Develop step by step guides to inform student practice. • Enable students to undertake basic testing such as pH, temperature, size to determine appropriateness of a product. • Ensure students apply relevant health and safety practices.	To support students to implement advanced procedures to make a processed product at level 7, teachers could: • Support students with their undertaking of advanced processing operations. • Guide students with advanced testing techniques such as: viscosity; moisture content; and degree of fermentation. • Ensure students comply with health and safety documentation such as HACCP and HSNO (see AS/NZ3343.3:200s)
INDICATORS	Students can: • Implement basic processing operations. • Conduct basic tests to determine if a product has met required specifications. • Follow relevant health and safety practices.	Students can: • Work independently in the execution of advanced procedures. • Undertake advanced testing techniques to determine if a product meets established specifications. • Comply with relevant health and safety documentation.
AS	**AS91082 Processing Technologies 1.60** *Implement basic procedures to process a specified product* See: www.nzqa.govt.nz/ncea/assessment/search.do?query=Processing+Technologies&view=all&level=01	**AS91351 Processing Technologies 2.60** *Implement advanced procedures to process a specified product*

◀ BACK TO CONTENTS PAGE

PROCESSING TECHNOLOGIES: KNOWLEDGE OF PROCESSING

Knowledge of processing focuses on the underpinning concepts associated with processing.

Initially students learn about the operations and practices inherent to processing. Students progress to complex understandings that enable them to explain, evaluate and justify a broad range of operations and practices related to processing.

[Level 8 Learning Objectives, Teacher Guidance and Indicators of Progression wiil be published when Level 3 achievement standards are finalised for registration]

	LEVEL 6	LEVEL 7
LO	*Demonstrate understanding of basic techniques involved in processing materials*	*Demonstrate understanding of advanced techniques involved in processing materials*
TEACHER GUIDANCE	To support students to develop understandings about basic techniques involved in processing materials at level 6, teachers could: • Provide a range of case studies to demonstrate different processing systems and sequences. • Support students with their understanding of techniques and skills in a processing operation. • Demonstrate safe practices in processing. • Model a range of processing operations such as: measuring; safe disposal of biologically active material; culturing by plating; and controlling of enzymes.	To support students to develop understandings about advanced techniques involved in processing materials at level 7, teachers could: • Support students with their understanding of how advanced techniques are implemented in processing materials. • Present a range of advanced processing operations such as: cell counting; emulsifying; and centrifuging. • Ensure students understand the difference between health and safety in the classroom and industry.
INDICATORS	Students can: • Explain the relationship between processing operations, tests, and expected outcomes. • Discuss processing operations and tests and their suitability for different materials and/or purposes. • Communicate the need for safe processing practices.	Students can: • Identify advanced techniques used in processing materials. • Describe how processing operations and tests can be combined in a processing sequence. • Explain why specific tests are used in processing operations.
AS	**AS91083 Processing Technologies 1.61** *Demonstrate understanding of basic concepts used in processing* See: www.nzqa.govt.nz/ncea/assessment/search.do?query=Processing+Technologies&view=all&level=01	**AS91352 Processing Technologies 2.61** *Demonstrate understanding of advanced concepts used in processing*

◀ BACK TO CONTENTS PAGE

PROCESSING TECHNOLOGIES: KNOWLEDGE OF PRODUCT PRESERVATION, PACKAGING AND STORAGE

Product preservation, packaging and storage focuses on the ways in which products can be treated during and after their development in order to maintain their integrity over time by inhibiting internal degradation and/or protecting them from external damage. Initially students learn basic concepts relating to why certain types of products require the use of preservation techniques, and which techniques are suitable for use in domestic settings where the product planned to be used in the near future and storage will be within known environmental conditions. They also will learn how packaging and storage procedures work together to further protect products in local environments. Students progress to learning more advanced concepts relating to ensuring products maintain integrity over an extended time and the variable environmental conditions of a national market, and the increasingly sophisticated techniques used in industrial settings, and then to understanding the technical and sociocultural implications and complexities involved in the preservation, packaging and storage of products suitable for international distribution.

[Level 8 Learning Objectives, Teacher Guidance and Indicators of Progression wiil be published when Level 3 achievement standards are finalised for registration]

	LEVEL 6	LEVEL 7
LO	*Demonstrate understanding of basic concepts and techniques used in the preservation, packaging and storage of products*	*Demonstrate understanding of advanced concepts and techniques used in the preservation, packaging and storage of products*
TEACHER GUIDANCE	To support students to develop understandings about basic concepts and techniques used in the preservation, packaging and storage of products, at level 6, teachers could: • Provide opportunity for students to explore why we need to preserve certain products to maintain their integrity over time. • Provide opportunity for students to explore different forms of packaging and storage instructions and relate this to the specific nature of the product and the techniques used in its preservation. • Ensure students are aware of the requirements for labelling of preserved products to ensure end-users can make informed choices. • Ensure students are familiar with a wide range of basic preservation techniques (eg, freezing, heating, air drying, chemical additives – use of vinegar/sugar), and packaging (eg, bottling, vacuum packing, solid wall containers, padded protective wrapping, labelling for identification) and storage procedures (eg, freezer, refrigerator, cool/dark cupboard) commonly used in domestic situations. • Guide students to understand how the techniques and procedures used in preserving/packaging and storage of a range of products allows them to maintain their integrity over time and in a known environment (eg, in the home, at school). • Provide students with multiple opportunities to select and test different basic techniques and procedures to enhance product integrity. This would include understanding the properties and implications of the materials used in the product and what is required of the product in terms of withstanding changes over short periods of time and in known environments.	To support students to develop understandings about advanced concepts and techniques used in the preservation, packaging and storage of products, at level 7, teachers could: • Provide opportunity for students to explore a range of different types of products to understand the changes needed in the preservation/packaging/storage decision-making to ensure products are able to withstand changing environments over extended times (eg, preservation during transportation, storage in warehouses, packaging for safe handling etc). • Guide students to develop understanding of how preserving/packaging and storage work together to ensure products maintain integrity over extended times and variable physical environments. • Provide students opportunity to explore and debate the implications of, and for, the distribution of products to national markets on the preservation, packaging and storage of products. • Provide opportunities for students to become familiar with a wide range of advanced preservation techniques (eg, spray drying of liquids, ultra violet reaction inhibition, liquid immersion freezing and chilling, chemical additives), and packaging (eg, canning, retortable pouches, gas flush packages, permeable packaging films, sealing mechanisms, portion control, labelling for point of difference – eco, heart ticks etc) and storage procedures (eg, controlled atmosphere) commonly used in industrial situations. • Provide students with opportunities to explore advanced techniques being used currently in a range of industries. This would include understanding the properties and implications of the materials used in the product and what is required of the product in terms of ensuring particular shelf-life and withstanding variable environmental conditions.
INDICATORS	Students can: • explain the links between types of decay and preservation techniques. • explain why a particular preservation and packaging technique was chosen for a specific product to be stored in a local environment • discuss how to control the storage environment to limit decay of different types of products during storage. • discuss why legal labelling is required in a local environment. • compare and contrast preservation and packaging techniques for a product to be stored in a local environment.	Students can: • explain the links between combinations of decay mechanisms in preservation and packaging techniques. • compare and contrast preservation and packaging techniques for a product in a national environment. • discuss why labelling is legally required and how labelling for marketing is used in a national environment.
AS	**AS91084 Processing Technologies 1.62** *Demonstrate understanding of basic concepts used in preservation and packaging techniques for product storage* See: www.nzqa.govt.nz/ncea/assessment/search.do?query=Processing+Technologies&view=all&level=01	**AS91353 Processing Technologies 2.62** *Demonstrate understanding of advanced concepts used in preservation and packaging techniques for product storage*