Government of **Western Australia**
School Curriculum and Standards Authority

MATERIALS DESIGN AND TECHNOLOGY

ATAR course

Year 11 syllabus

Acknowledgement of Country

Kaya. The School Curriculum and Standards Authority (the Authority) acknowledges that our offices are on Whadjuk Noongar boodjar and that we deliver our services on the country of many traditional custodians and language groups throughout Western Australia. The Authority acknowledges the traditional custodians throughout Western Australia and their continuing connection to land, waters and community. We offer our respect to Elders past and present.

Important information

This syllabus is effective from 1 January 2024.

Users of this syllabus are responsible for checking its currency.

Syllabuses are formally reviewed by the School Curriculum and Standards Authority (the Authority) on a cyclical basis, typically every five years.

Contents

Rationale

Materials are the basic ingredients of technology. Materials are used to make machines and these machines use materials to make products. Materials also supply the energy to enable technology to function. Throughout history, the evolution of technology has been largely determined by the availability of materials. These strong historical links between materials, design and technology remain significant in society today. As long as the desire to create new opportunities and to continue to improve our quality of life remains, the development of materials will continue.

Through developments in technology and science, a wider range of materials is now available. These new materials have further encouraged the development of technology and the design of new products.

The Materials Design and Technology ATAR course is a practical course. The course allows for the exploration and use of three materials learning contexts: metal, textiles and wood with the design and manufacture of products as the major focus. There is also the flexibility to incorporate additional materials from outside the three designated contexts. This can enhance and complement the knowledge and skills developed within the course as many modern-day products are manufactured using a range of different material types. Students may use a few or many materials in innovative designs and explore the interactions between materials, people and their environment. Students examine social and cultural values and the short-term and long-term impacts of the use and misuse of materials and associated technologies. Through this inquiry, experimentation and research, students develop their creativity and understanding of the society in which they live.

Working with materials, students develop a range of processing, manufacturing and organisational skills. When designing with materials, they develop cognitive skills such as critiquing, analysing, solving problems, generating innovative ideas and communicating what they do. This helps them become more technologically literate and, as consumers, enables them to make more informed decisions about the use and misuse of technology. It also prepares them to make predictions about likely changes to technology in the future.

This course connects to the world of work, further vocational education and training (VET) and university pathways. Students may achieve VET competencies as they complete their design projects, while at the same time, developing cognitive skills fundamental to designing in a practical context. This process enhances employability and may lead to further training and employment opportunities in areas that include textiles and clothing, manufacturing, design, built environment, science and engineering.

The Materials Design and Technology ATAR course aims to prepare all students for a future in a technological and material world by providing the foundation for lifelong learning about how products are designed and how materials are developed and used.

Course outcomes

The Materials Design and Technology ATAR course is designed to facilitate achievement of the following outcomes.

Outcome 1 – Technology process

Students apply a technology process to create or modify products, processes or systems in order to meet human needs and realise opportunities.

In achieving this outcome, students:

- investigate issues, values, needs and opportunities
- devise and generate ideas and prepare production proposals
- produce solutions and manage production processes
- evaluate intentions, plans and actions.

Outcome 2 – Understanding the use of materials

Students understand how the nature of materials influences design, development and use.

In achieving this outcome, students:

- understand the structure of materials
- understand the relationship between the structure and properties of materials
- understand how to select appropriate materials based on their structure and properties, and understand how these characteristics influence design, development and usage.

Outcome 3 – Using technology skills

Students create material products safely and efficiently to specified standards.

In achieving this outcome, students:

- plan and manage resources to create products within constraints
- select and apply appropriate techniques and procedures when creating and modifying technologies
- manipulate equipment and resources safely to meet defined standards.

Outcome 4 – Understanding materials, society and the environment

Students understand interrelationships between people, the environment and the use of materials.

In achieving this outcome, students:

- understand how values and beliefs influence materials selection, design and technology
- understand the impact and consequences on society and the environment when selecting and using materials, designs and technologies
- understand strategies for safe and sustainable practices when developing and using materials, designs and technologies.

Organisation

This course is organised into a Year 11 syllabus and a Year 12 syllabus. The cognitive complexity of the syllabus content increases from Year 11 to Year 12.

Structure of the syllabus

The Year 11 syllabus is divided into two units, each of one semester duration, which are typically delivered as a pair. The notional time for each unit is 55 class contact hours.

Unit 1

Students develop an understanding of the elements and fundamentals of design and consider human factors involved in the design, production and use of their projects. They develop creative thinking strategies and work on design projects within specified constraints. Students learn about the classification, structure and properties of a variety of materials, making appropriate materials selection for design needs.

Students learn about manufacturing and production skills and techniques. They develop the skills and techniques appropriate to the materials being used and gain practice in planning and managing processes through the production of design project. They learn about risk management and ongoing evaluation processes.

Unit 2

Students learn about the nature of designing for a client, target audience or market. Students apply an understanding of the elements and fundamentals of design and consider human factors involved in their design projects. Students learn about the nature, properties and environmental impacts and issues related to a variety of materials and production techniques. They develop creative thinking strategies, and work on design projects within specified constraints as well as consider the environmental impacts and issues related to the sustainability and recycling of materials.

Students extend their understanding of safe working practices and contemporary manufacturing techniques, and develop the knowledge, understanding and skills required to manage the processes of designing and manufacturing.

Each unit includes:

- a unit description – a short description of the focus of the unit
- defined contexts – three different contexts have been defined in this course:
  - Metal
  - Textiles
  - Wood.

The course units in each context have different codes.

Students can enrol in more than one context in this course but they can only sit one external examination for the course in Year 12.

- unit content – the content to be taught and learned
  - students study the unit common content and the content of their chosen defined context

Organisation of content

The course content is organised into common content and context specific content. Students must study all of the common content and at least one of the contexts.

The course content areas cover:

Materials

- Nature and properties of materials
- Materials in context

Design

- Design fundamentals and skills
  - investigate
  - devise
  - evaluate

Use of technology

- Skills and techniques
  - information and communication technology (ICT)
  - drawing
  - materials selection
- Safety
- Production management
  - product manufacture
  - ongoing evaluation.

Common Content

The Wood, Metal and Textiles learning contexts in the Materials Design and Technology ATAR course have common content in:

- Design fundamentals and skills
- Skills and techniques
  - ICT
  - drawing
- Safety
- Production management.

Students may use any material as a means through which they approach the course content, or teachers may choose to restrict the choice. Students will explore ways to use the nature and properties of the materials towards the completion of a product.

In design fundamentals and skills, students learn about the elements and principles of design, while developing a common understanding of the design process and variations that can apply to design tasks during the design cycle.

As student safety is a high priority in all activities, a common understanding of safe working practices, risk management and an awareness of occupational safety and health standards is achieved in each unit through coverage of common content under the safety heading.

In all three contexts, students design a product and plan to safely carry out the management of the making of the product. In Unit 1 and Unit 2, students are encouraged to integrate additional and complimentary material(s) from other contexts as a means through which they approach the course content, to develop a product. They explore ways to use the nature and properties of the material(s) towards the completion of a product.

Students are expected to plan and manage production processes and perform ongoing evaluation, recording any changes made to the production processes or the project design. For this reason, the skills required to follow a production plan, and the control of ongoing operations and processes to complete production, are common in all three contexts.

Materials

Nature and properties of materials

This aspect of the course focuses on the properties and characteristics of materials which influence the selection, processing and finishing choices that are made throughout the technology process. The effect and interrelationship of a material's structure, its properties and methods of processing and finishing are addressed in order to help students make appropriate decisions about materials selection and usage. Various types of materials and classification methods are covered. Materials include solid materials such as metals and alloys (ferrous and non-ferrous), textiles and fibres (natural and manufactured), timbers
(natural and manufactured) and other materials (polymers, plastics, composites and other non-contextual materials) and emerging materials.

The properties of materials underpin fundamental design decisions. The course examines materials within each context with reference to a range of physical properties, for example, thermal, electrical and magnetic properties; a range of chemical properties, for example, absorbency, solubility, oxidation, permeability, colourfastness, sun and chemical resistance; a range of mechanical properties, for example, durability, abrasion resistance, hardness, toughness, strength and dimensional stability, shrink resistance, resilience and elasticity; and some aesthetic properties, for example, lustre, colour, drape and texture. Properties of new and emerging, as well as traditional materials, are identified and tested for their suitability in product use and purpose. The course investigates material properties by accessing available materials data and specifications, and by undertaking the testing of materials.

Materials in context

Materials have social and environmental impacts when used in social, cultural and environmental contexts. Analysis of own and others' designs develops a sense of the interrelationships between materials, markets, society, communities and the environment. This involves investigating the impact that production, processing and use of various materials have on societies and the environment.

Materials are examined in relation to their personal, social and environmental sustainability. Opportunity, cost, waste management and recycling are considered essential in assessing the environmental impact of projects. Green design principles and the whole life cycle of products are explored. These principles result in less pollution and waste and more efficient use of energy and materials. The potential environmental impact of the product is assessed. This includes efficiently using materials during production, accounting for the disposal of the product after production and minimising nuisances such as noise, fumes, dust and accumulated waste materials.

Design

Design fundamentals and skills

A foundation of design knowledge is critical when developing projects. Concepts related to aesthetics, human factors and consumer markets are covered. Aesthetics include elements of line, shape, form, texture, colour and tone; and principles of unity, proportion, rhythm and balance. Applying human factors requires the understanding of ergonomics, anthropometrics and human-product interfaces. Consumer market knowledge includes demographics, consumer psychology, marketing and consumer trends. Some of these factors vary in different cultural contexts. Historical aspects of design, including significant designers, prominent periods of design and various design movements are investigated. Design styles and influences are considered when design concepts are being developed.

The process of designing consists of a number of skills. These include research and investigation, ongoing evaluation, generation of ideas, communicating design, modelling and testing ideas and developing skills of innovation and enterprise.

Inquiry into problems, the identification of opportunities and the analysis of solutions require a range of research and investigation techniques. Investigating markets, taking into account user needs and requirements and environmental and social issues, are aspects of enterprising approaches. Research into materials also contributes to design decisions. Intellectual property and patent regulations are relevant.

The course incorporates cognitive and creative skills that are used in generating ideas and developing solutions, such as rapid concept development, brainstorming, critical thinking and collaborative designing. It covers strategies for thinking innovatively and creatively, and problem solving. Experimentation is used as a way of developing and refining concepts.

Communication is an integral part of the thinking process as well as a means for sharing ideas with others. Information and communication technology is developed through the units, with an increasing level of computer technology being used to develop and communicate design ideas and solutions. The course covers graphical, oral, textual and mathematical communication skills. Skills in the graphic representation of design thinking using a range of manual and/or computer-generated techniques, are developed to specific standards. Effective communication and documentation of design intentions and development through to the final outcome is important. Skills associated with modelling and testing ideas include: computer modelling, physical scale modelling, prototyping, and component modelling. Tests may be devised using techniques such as market sampling, product analysis and market research.

Use of Technology

Skills and techniques

The course looks at technologies within a studio or workshop environment. This includes the reading and interpretation of plans, patterns, drawings and material specifications and the measurement and calculation of quantities. Different skills and techniques of ICT are developed at the different stages of study. Materials are used to realise designs. Skills and techniques are required for the manipulation of materials and project manufacture appropriate to their purpose. There is a relationship between the material and the processing techniques used. Techniques and skills include: forming, fabricating, cutting, joining, shaping, machine operations, constructing, embellishing, finishing and computer numerically-controlled processes (CNC). Skills and techniques are progressively extended through the different units.

Safety

Knowledge and information related to working safely is critical in any technology context. It is important to exercise a duty of care and operate in a safe and responsible manner, including the application of occupational safety and health legislation and codes of practice. There are safety issues related to the handling and manipulation of materials, for example, safety data information, materials handling and storage practice, and specific tool and machinery operation safety requirements. Risks have to be identified, assessed and managed.

Production management

Various skills are required to successfully manage the production process. Environmental factors, including management and reduction of waste and energy efficiencies must be considered. Project management of tasks and materials as well as task modification are employed throughout the production process. Therefore, management skills, principles of quality assurance, ongoing evaluation, and testing are all important factors in ensuring quality outcomes. Communication skills are also important. Working collaboratively with team members and producing various oral and written communications are all important aspects of the production process.

Representation of the general capabilities

The general capabilities encompass the knowledge, skills, behaviours and dispositions that will assist students to live and work successfully in the twenty-first century. Teachers may find opportunities to incorporate the capabilities into the teaching and learning program for the Materials Design and Technology ATAR course. The general capabilities are not assessed unless they are identified within the specified unit content

Literacy

Literacy is of fundamental importance in the study of the Materials Design and Technology ATAR course. Students will access design, materials and technological content through a variety of print, oral, visual, spatial and electronic forms, including data books, texts, computer software, images, and written technical materials. They learn to investigate, interpret, and apply design and technology principles from a variety of sources to design solutions for tasks. They analyse and evaluate information for reliability, relevance and accuracy. They learn to monitor their own language use for accuracy in the use of design principles and technological terms for clarity of ideas, processes and explanations of design activities and development and evaluation of functioning products.

Numeracy

Numeracy is fundamental in calculating materials quantities and evaluating design and technology process costs. Students develop their understanding and skills of numeracy while undertaking tasks to produce, test and evaluate products. Common and context specific theory continues to be studied to forge greater understanding of the scientific, mathematical and technical concepts that explain how designed products function.

Information and communication technology (ICT) capability

Information and communication technology capability is important in all stages of the design process. Students use digital tools and strategies to locate, access, process and analyse information. They use ICT skills and understandings to investigate and devise design ideas. Students access information from websites and software programs to develop design solutions. Students use computer aided drawing software and computer control software to produce products.

Critical and creative thinking

Critical and creative thinking is integral to the design process. The design thinking methodologies are fundamental to the Materials Design and Technology ATAR course. Students develop understandings and skills in critical and creative thinking during periods of evaluation at numerous stages of the design process. They devise plausible solutions to problems, and then through interrogation, critically assess the performance of the most efficient solution. Students identify possible weaknesses in their design solutions, and analyse, evaluate and modify the developing solution to construct a functioning prototype.

Personal and social capability

Personal and social capability skills are developed and practiced in the Materials Design and Technology ATAR course by students enhancing their communication skills and participating in teamwork. Students have opportunities to work collaboratively during stages of investigation and production of products. Students develop increasing social awareness through the study of the impact of the use of materials, and manufacturing technology in society and on the environment.

Ethical understanding

Students have opportunities to explore and understand the diverse perspectives and circumstances that shape design processes and technology, the actions and possible motivations of people in the past compared with those of today. Students have opportunities both independently and collaboratively to explore the values, beliefs and principles that have influenced past designs and technological achievements, and the ethical decisions required by global design processes of today.

Intercultural understanding

Students have opportunities to explore the different beliefs and values of a range of cultural groups and develop an appreciation of cultural diversity. Students have opportunities to develop an understanding of different contemporary perspectives with regard to design inspiration, product styles, building materials, energy supply and use, and design and technological influences on different groups within society, and how they contribute to individual and group actions in the contemporary world.

Representation of the cross-curriculum priorities

The cross-curriculum priorities address the contemporary issues which students face in a globalised world. Teachers may find opportunities to incorporate the priorities into the teaching and learning program for the Materials Design and Technology ATAR course. The cross-curriculum priorities are not assessed unless they are identified within the specified unit content.

Aboriginal and Torres Strait Islander histories and cultures

Students may have opportunities to explore Aboriginal and Torres Strait Islander development and use of technology, and the interconnectedness between technologies and identity, People, Culture and Country/Place.

Asia and Australia's engagement with Asia

Students may have opportunities to explore traditional, contemporary and emerging technological achievements in the countries of the Asia region. Students explore Australia’s rich and ongoing engagement with the peoples and countries of Asia to create appropriate products and services to meet personal, community, national, regional and global needs. Students explore ways in which materials have been used over time and the methods used to manipulate those materials.

Sustainability

Students take action to create more sustainable patterns of living. Students can develop knowledge, understanding and skills necessary to design for effective sustainability.

Students focus on the knowledge, understanding and skills necessary to choose technologies and systems with regard to costs and benefits. They evaluate the extent to which the process and designed solutions embrace sustainability. Students reflect on past and current practices, and assess new and emerging technologies from a sustainability perspective.

Unit 1

Unit description

Students develop an understanding of the elements and fundamentals of design and consider human factors involved in their projects. They develop creative thinking strategies and work on design projects within specified constraints. Students learn about the classification, structure and properties of a variety of appropriate materials.

Students learn about manufacturing and production skills and techniques. They develop the skills and techniques appropriate to the materials being used and gain practice in planning and managing processes through the production of design project. They learn about risk management and ongoing evaluation processes.

Defined contexts

Three different contexts have been defined in this course:

- Metal
- Textiles
- Wood.

The course units in each context have different codes.

Students can enrol in more than one context in this course but they can only sit one external examination for the course in Year 12.

Students study the unit common content and the content of their chosen defined context.

Unit content

This unit includes the knowledge, understandings and skills described below.

Common content

Design

Design fundamentals and skills

- investigate
  - designs in practice
  - needs, values and beliefs of the designer/developer
  - sources of design inspiration
  - performance criteria for products
  - application of design fundamentals and factors affecting design
    - aesthetics
    - environmental impact and considerations

  - function
  - safety
  - cost
  - ergonomics
  - anthropometric data

- devise
  - using communication and documentation techniques
    - sketching and drawing
    - rendering
    - annotating
    - sampling
    - modelling
  - applying the elements and principles of design where applicable in context
    - line
    - shape
    - form
    - texture
    - colour
    - tone
    - repetition
    - gradation
    - rhythm
    - radiation
    - harmony
    - contrast
    - dominance
    - proportion
    - balance
    - unity
  - using rapid concept development techniques to generate design ideas and concepts
  - final design concept, using design brief and performance criteria
  - review and justification of best idea using design brief and performance criteria
  - design solution
    - developing best concept using annotated hand or computer-generated graphics – front, back views and detailed sketches as necessary
    - 2D illustrations – working/technical drawings
    - 3D illustration – presentation drawings
    - inspiration/concept/storyboard
  - production plans
    - materials list
    - costing for all materials components
    - stages of production
- evaluate
  - final product against design brief, initial design and performance criteria related to needs, values and beliefs of the end user

Use of technology

Skills and techniques

- demonstrate ICT, portfolio development and communication skills
    - photography – final product and features of the final product
    - documenting presentations and evaluations
- develop context appropriate drawing and relevant technical information to produce the final product to demonstrate:
    - sketching rapid concept developments
    - 3D presentation drawings
    - rendering techniques
    - 2D working drawings or using templates
    - inspiration/concept or storyboard development and presentation
    - design and making specification sheets
- use workroom/studio terminology appropriate to context
- select appropriate materials and calculate the quantities of materials required to complete the project
- with supervision operate machinery and tools appropriate to context

Safety

- use correctly personal protective equipment (PPE) where applicable
- demonstrate occupational safety and health (OSH) practices appropriate to tasks being undertaken in workshops
- apply risk management strategies in the workshop/studio
- assess the condition of tools and machinery

Production management

- manage a production plan
    - using tools, equipment and machinery to complete production
        - follow instructions from plans
        - maintain safety requirements
    - record changes to materials lists or costing
- use ongoing evaluation techniques: ongoing progress/decision changes made to the project

Metal context content

Materials

Nature and properties of materials

- investigate metals
  - ferrous
    - explain functional differences between low, medium, high carbon steels, cast iron, cast steel
    - describe the processes of producing different types of carbon steels: iron and steel production, carbon percentage in different steels
- metal morphology and structure
  - mild steel
    - physical characteristics
    - microscopic appearance
- metal alloy types and classifications
  - ferrous – steel, cast iron
  - non-ferrous – aluminium alloys, copper alloys, nickel alloys
- identify the different common cross sections and sizes of metals from the following list:
  - wire
  - rod
  - flat
  - square
  - hexagonal
  - octagonal bar
  - sheet
  - plate
  - round tube
  - square tube
  - rectangular hollow section
  - angle
- aesthetic properties
  - lustre
  - colour
  - texture
- physical properties
  - ductility
  - malleability
  - hardness
  - tensile strength
  - density
  - conductivity
  - melting point
- explain the relationship between structure, properties and end uses of metals

Materials in context

- investigate and classify the uses of the major metal types for:
  - furniture products
  - building and construction materials
  - consumer products
- investigate the processes and the environmental impact of metals production
  - raw material extraction and processing
  - manufacturing, packaging and distribution
  - end-of-life of a product – recycling and safe disposal

Use of technology

Skills and techniques

- select and apply appropriate and accurate marking out tools and techniques for measuring and marking out in sheet metal, bar and tube projects, which may include the use of:
  - rule
  - square
  - scriber
  - centre punch
  - combination squares
  - inside/outside callipers
  - vernier callipers with and without dial indicators
- select and safely apply technical skills using a range of tools and machinery, that could include:
  - hand tools for shaping
  - files and filing
  - hacksaws and blades
  - metal lathe
  - vice and clamps
  - hand tools for cutting
  - electric hand drill
  - drill press/pedestal drill
- apply methods of drilling different metals, including:
  - preparations for drilling
  - drill speeds
  - lubricants for different metals
- identify and name parts of HSS twist drills
- select and apply appropriate methods of fixing metals together through permanent and non-permanent joining, that could include:
  - welding
  - types of nuts and bolts
  - riveting
  - screws

- demonstrate methods of heat treatments, that could include:
  - annealing
  - normalising
  - hardening
  - tempering
- name and operate a powered cutting machine or mechanical cutting device
- identify and report worn or damaged files and hacksaw blades
- name and operate machines for folding and shaping metals
- apply correct methods of gas and electric metal welding, including:
  - metal preparation
  - set up
  - welding operations
  - testing
- apply appropriate finishing techniques using brush or cloth and/or spray gun followed by correct clean up procedure

Textiles context content

Materials

Nature and properties of materials

- identify fibre types and classification
  - natural fibres
    - cellulosic – cotton, linen
    - protein – wool, silk
  - manufactured fibres
    - regenerated – rayon, acetate
    - synthetic – polyester, nylon
- investigate fibres
  - natural fibres – cotton, wool, silk
    - classification and origin
    - microscopic structure
    - properties
    - fabrics and fabric blends
    - care
- fibre morphology and structure
  - physical characteristics
  - microscopic appearance
- fabric structures
  - woven – warp, weft, selvedge
  - knitted – course, wale

- non-woven – felt, web

- fabric types and classifications
  - woven – plain, satin, twill, jacquard, pile
  - knit – warp, weft
  - non-woven – felt, interfacings
- aesthetic properties
  - lustre
  - drape
  - handle
- physical properties
  - durability
  - strength
  - abrasion resistance
  - resilience
  - elasticity
  - dimensional stability
  - shrink resistance
- chemical properties
  - absorbency
  - thermal properties
  - flammability
  - sun resistance
  - colourfastness
  - effect of chemicals
- explain the relationship between structure, properties and end uses of textiles

Materials in context

- investigate specific textiles and their uses
  - apparel
  - furnishings
  - costumes
  - textile arts
  - non-apparel items
- identify at least two factors contributing to textile value in society
  - vintage
  - culture
  - value adding to other industries
  - economic value
  - social significance
- investigate environmental impact of the textile industry
  - growing, extraction and processing
  - manufacturing, packaging and distribution
  - end-of-life of a product – recycling and safe disposal

Use of technology

Skills and techniques

- use ICT skills related to design development and presentation
- demonstrate drawing skills
  - sketching – rapid concept development
  - 3D presentation drawings – using templates
  - 2D working drawings – using templates
  - inspiration/concept and storyboard
- apply pattern skills
  - use a commercial pattern
  - take basic body measurements
  - design and wearing ease
  - select pattern using body measurements
  - pattern parts
  - pattern layout
  - cutting out
  - transfer pattern markings
  - pattern adaptations as required
- demonstrate how to correctly operate and adjust:
  - a sewing machine
  - an overlocker
- demonstrate machine skills
  - threading
  - straight stitch
  - zig zag
  - changing machine feet
  - changing machine needle
  - use overlocker for neatening
- select and apply appropriate construction and pressing techniques
  - joining
  - shaping
  - closures
  - finishing
- select and apply fabric decoration, embellishment and manipulation techniques as required

Wood context content

Materials

Nature and properties of materials

- identify wood types and classification
  - natural wood
    - hardwood – jarrah, Australian oak
    - soft wood – radiata pine, Douglas fir
  - man-made board
    - plywood – interior, exterior, marine
    - medium density fibreboards – plain, veneered
    - particle board
- explain the structure of a tree and describe the function of:
  - bark
  - cambium layer
  - bast (phloem)
  - pith
  - sapwood (xylem)
  - medullary rays
  - heartwood
  - growth rings – early wood, latewood
- identify natural defects in timber
  - knots
  - gum veins
  - shakes
  - grain defects
- explain the difference between rough sawn and DAR timbers
- identify and name common timber sizes, lengths, widths and thicknesses
- physical properties
  - durability
  - strength
  - abrasion resistance
  - resilience
  - flexibility
  - dimensional stability
  - shrink resistance
- classify adhesives for timber
  - PVA
  - epoxy
  - cyanoacrylate
  - latex-based/rubber-based

Materials in context

- investigate and classify the uses of the major timber types for:
  - furniture products
  - building and construction materials
  - consumer products
- investigate the processes and the environmental impact of producing timber:
  - growth/harvesting
  - milling/conversion
  - seasoning
  - methods of seasoning timber (air, kiln, combined, microwave)
  - dressing
  - distribution
  - end-of-life of a product – recycling and safe disposal

Use of technology

Skills and techniques

- use ICT skills related to design development and presentation
- demonstrate drawing skills
  - drawing, reading and interpreting plans/ patterns/templates
  - isometric and pictorial hand sketches for project development
  - dimensioned orthogonal drawing in 3rd angle for working drawing
- select and safely apply technical skills using a range of tools and machinery that could include:
  - bandsaw
  - drill press
  - various grinders or carving tools
  - sanding machines
  - portable or fixed routers
  - radial arm saw or drop saw or compound mitre saw
  - biscuit joiner
  - domino joiner
  - table saw
  - mortise machine
  - wood lathe
- demonstrate how to correctly use and adjust two of the following power tools
  - biscuit joiner
  - domino joiner
  - trimmer router
  - portable sander: orbital and belt sander

- use hand tools and/or machinery to fabricate at least two of the following joints
  - widening joint
  - finger joint
  - cross-halving joint
  - dovetail joint
  - housing joint
  - mortise and tenon
  - bridle joint
  - biscuit joint
- select and use the correct type and grade of abrasive paper
- correctly prepare a surface for finishing
- apply appropriate finishing techniques using brush or cloth and/or spray gun

Unit 2

Unit description

Students learn about the nature of designing for a client, target audience or market. Students learn about the nature, properties and environmental impacts and issues related to a variety of materials, and production techniques. Students apply an understanding of the elements and fundamentals of design and consider human factors involved in their design projects. They develop creative thinking strategies, and work on design projects within specified constraints as well as consider the environmental impacts and issues related to the sustainability and recycling of materials.

Students extend their understanding of safe working practices and contemporary manufacturing techniques, and develop the knowledge, understanding and skills required to manage the processes of designing and manufacturing.

Defined contexts

Three different contexts have been defined in this course:

- Metal
- Textiles
- Wood

The course units in each context have different codes.

Students can enrol in more than one context in this course but they can only sit one external examination for the course in Year 12.

Students study the unit common content and the content of their chosen defined context.

Unit content

This unit builds on the content covered in Unit 1.

This unit includes the knowledge, understandings and skills described below.

Common content

Design

Design fundamentals and skills

- investigate
  - design for others
  - needs, values and beliefs of the designer/developer
  - needs, values and beliefs of the client/target audience/market
  - performance criteria related to needs, values and beliefs of the end user
  - historical, social and cultural sources of design inspiration

  - specific design characteristics/features of
    - products
    - designers
    - industries
  - application of design fundamentals and factors affecting design
    - aesthetics
    - function
    - safety
    - cost
    - environmental impact and considerations
    - ergonomics
    - anthropometric data
- devise
  - using communication and documentation techniques
    - sketching and drawing
    - rendering
    - annotating
    - sampling
    - modelling
  - applying of elements and principles of design where applicable in context
  - using rapid concept development techniques, images and annotation
  - design development
    - review and justification of best ideas using design brief and performance criteria
    - best ideas developed using annotated hand or computer-generated graphics – front, back views and detailed sketches as necessary
    - 2D illustrations – working/technical drawings
    - 3D illustration – presentation drawings)
    - inspiration/concept/storyboard development and presentation
  - production plan
    - materials list
    - estimated and actual costing for all materials and components
    - production plan, including deadlines
- evaluate
  - design and production processes
  - product against design brief, initial design and performance criteria related to needs, values and beliefs of the end user

Use of technology

Skills and techniques

- demonstrate ICT, portfolio development and communication skills
    - client and market research techniques
    - client presentation techniques
    - photography – final product and features of the final product
    - documenting presentations and evaluations
- develop context appropriate drawings and relevant technical information to produce the final product
    - sketching rapid concept developments
    - 3D presentation drawings
    - multi-colour rendering techniques
    - 2D working drawings or using templates
    - inspiration/concept or storyboard development and presentation
    - design and making specification sheets
- use workroom/studio terminology appropriate to context
- select appropriate materials and calculate the correct amount required to order and purchase materials to complete the project
- operate machinery and tools appropriate to context
- identify, remove and report blunt, dull or damaged tools and machinery appropriate to context
- conduct assessment and maintenance of tools and machinery, including cleaning and care processes appropriate to context

Safety

- correctly use personal protective equipment (PPE) where applicable
- conduct risk assessment for using specific tools/machinery
- demonstrate occupational safety and health practices appropriate to tasks being undertaken in workshops
- apply risk management strategies in the workshop/studio
- recognise need and purpose of materials safety data (MSD) with regard to storage and handling of hazardous substances and hazardous operations appropriate to situation

Production management

- manage a production plan
  - using tools, equipment and machinery to complete production
    - adhere to sequential instructions
    - apply safety and risk management
  - record changes to materials lists or costing
- use ongoing evaluation techniques: record ongoing progress/decision changes made to the project through client consultation

Metal context content

Materials

Nature and properties of materials

- identify the properties and structures of materials
  - non-ferrous – copper, aluminium
- describe the processes required to produce aluminium from bauxite
- investigate the properties of steel using a range of the following terms
  - malleable
  - ductile
  - hardness
  - compression strength
  - tensile strength
  - specific gravity
  - brittleness
  - fusibility
  - corrosion resistance
  - thermal conductivity
  - electrical conductivity
- identify less common metals by appearance, hardness, colour, weight and cost
  - copper
  - gold
  - silver
  - lead
  - tin
  - bronze
  - pewter
- identify thread types, taps and dies
- investigate and describe metal surface preparation for metal finishes
- investigate and describe applications of at least two of the following metal finishes
  - painting
  - galvanising
  - lacquering
  - enamelling
  - tin plating
  - electroplating
  - anodising
  - plastic or powder coatings

Materials in context

- research examples of sustainability with regards to:
  - sustainable metal materials
  - sustainable production processes

Use of technology

Skills and techniques

- handle and store sectional tube, bar and sheet metal and material correctly
- select and apply appropriate and accurate marking out tools and techniques for measuring and marking out in sheet metal, bar and tube projects
- ensure safety guards and devices are fitted correctly before operating a machine
- select and apply technical skills using a range of tools and machinery
- select and safely apply technical skills using a range of tools and machinery, that could include:
  - cutting, shaping and folding techniques
  - adjusting and changing components of machinery
  - welding equipment, both gas and electric
  - pedestal grinder
  - metal lathe and basic manual and/or automatic turning operations
- prepare metal surfaces for finishing
- apply a metal finish

Textiles context content

Materials

Nature and properties of materials

- identify fibre types and classification
  - natural fibres
    - cellulosic – cotton, linen
    - protein – wool, silk
  - manufactured fibres
    - regenerated – rayon, acetate
    - synthetic – polyester, nylon
- investigate fibres
  - synthetics fibres – polyester
  - regenerated fibres – rayon
    - classification and origin
    - microscopic structure
    - manufacture
    - properties
    - fabrics and fabric blends
    - care
    - environmental impacts
- morphology and structure
  - physical characteristics
  - microscopic appearance
- yarn structure and characteristics
  - spun staple yarns
  - filament yarns
- decorative techniques used to enhance appearance
  - dyeing
  - printing
- apply fabric testing techniques to determine performance and suitability to end use/purpose
  - aesthetic properties
  - physical properties
  - chemical properties

Materials in context

- research examples of sustainability, including recycling methods for different fabric materials
- investigate at least one use of sustainable materials in textiles

Use of technology

Skills and techniques

- demonstrate ICT, portfolio and communication skills
- apply drawing skills
- apply pattern skills
  - select, use and adapt commercial patterns and instructions
- operate sewing machine and overlocker
- investigate, select and apply construction and pressing techniques for manufacturing products
  - joining
  - shaping
  - closures
  - finishing
- investigate a range of embellishment and manipulation techniques
  - appliqué
  - shirring
  - gathering, pleating, tucking
  - beading
  - lace application
  - hand and machine embroidery
  - dyeing
  - patchwork
  - printing
  - quilting
  - felting

Wood context content

Materials

Nature and properties of materials

- identify the properties and characteristics of Western Australian hardwoods
  - jarrah
  - marri
  - karri
  - sheoak
- investigate the properties of timbers
  - density
  - hardness and softness
  - durability
  - weight
  - figure
  - texture
  - grain
  - moisture content
- explain seasonal growth
- describe the conversion of timber
  - live sawing
  - back sawing
  - quarter sawing
- describe stages of seasoning
  - in different methods of seasoning timber: air, kiln, combined, microwave
  - effects on timber at the cellular level
  - defects in timber caused by seasoning: collapsing, warping, cupping, twisting, splitting
- classify and describe types of finishes: water base, turps (oil) base, solvent base, epoxy base, oils, waxes and polishes to include:
  - physical appearance
  - physical properties
  - chemical properties
  - identify methods of application and uses of finishes

Materials in context

- research examples of sustainability with regard to:
  - sustainable timber materials
  - sustainable production processes

Use of technology

Skills and techniques

- demonstrate ICT, portfolio and communication skills
- apply drawing skills
- handle and store timbers and material correctly
- demonstrate correct procedures for setting up, adjusting and safely operating machinery
- identify and use correctly fitted dust extraction and safety guards
- identify different methods of fastening timbers
    - permanent fastening
    - semi-permanent/knock down fittings
- identify and use correct grades of abrasive necessary for a task
- demonstrate the basic operation and maintenance of a spray gun

School-based assessment

The *Western Australian Certificate of Education (WACE) Manual* contains essential information on principles, policies and procedures for school-based assessment that needs to be read in conjunction with this syllabus.

Teachers design school-based assessment tasks to meet the needs of students. The table below provides details of the assessment types for the Materials Design and Technology ATAR Year 11 syllabus and the weighting for each assessment type.

Assessment table – Year 11

Type of assessment	Weighting
Design (Practical portfolio) Research work in which students conduct and communicate an investigation. Students are assessed on how they: • investigate products or projects • devise, develop and modify design solutions throughout the technology process • present their findings in written, oral or multimedia form. Types of evidence can include: images, observation checklists, evaluation tools (self or peer), design proposals and project proposals using a range of communication strategies.	25%
Production (Practical) Extended and manufacturing project(s) where students control, evaluate and manage processes. Students are assessed on their: • understanding, confidence and competence when using skills in manufacturing processes and when managing production plans • manufactured product in terms of quality and finish. Types of evidence can include manufactured products, observation checklists and evaluation tools (self or peer) and on-balance judgements.	50%
Response (Written) Students apply their knowledge and skills in responding to a series of stimuli or prompts in the following formats: examinations, essays, oral responses, ICT visual responses and product evaluation reports.	25%

Teachers are required to use the assessment table to develop an assessment outline for the pair of units (or for a single unit where only one is being studied).

The assessment outline must:

- include a set of assessment tasks
- include a general description of each task
- indicate the unit content to be assessed
- indicate a weighting for each task and each assessment type

- include the approximate timing of each task (for example, the week the task is conducted, or the issue and submission dates for an extended task).

In the assessment outline for the pair of units, each assessment type must be included at least once over the year/pair of units. In the assessment outline where a single unit is being studied, each assessment type must be included at least once.

The set of assessment tasks must provide a representative sampling of the content for Unit 1 and Unit 2.

Assessment tasks not administered under test/controlled conditions require appropriate validation/authentication processes.

Grading

Schools report student achievement in terms of the following grades:

Grade	Interpretation
A	Excellent achievement
B	High achievement
C	Satisfactory achievement
D	Limited achievement
E	Very low achievement

The teacher prepares a ranked list and assigns the student a grade for the pair of units (or for a unit where only one unit is being studied). The grade is based on the student's overall performance as judged by reference to a set of pre-determined standards. These standards are defined by grade descriptions and annotated work samples. The grade descriptions for the Materials Design and Technology ATAR Year 11 syllabus are provided in Appendix 1. They can also be accessed, together with annotated work samples, through the Guide to Grades link on the course page of the Authority website at www.scsa.wa.edu.au.

To be assigned a grade, a student must have had the opportunity to complete the education program, including the assessment program (unless the school accepts that there are exceptional and justifiable circumstances).

Refer to the *WACE Manual* for further information about the use of a ranked list in the process of assigning grades.

Appendix 1 – Grade descriptions Year 11

A	**Design** Uses a clearly identifiable design process to independently generate and devise original ideas and develop solutions for others. Develops documentation which displays clear design progression, using concept sketches that are annotated with appropriate terminology and show the development of several different ideas. Includes evidence of investigation into, and explanation of, design fundamentals: function, cost, safety, aesthetics, environmental factors, ergonomics and anthropometric data. Presents a portfolio which contains fully developed, dimensioned working drawings, including 2D and 3D CAD where applicable in context. Provides a justification of materials selection against design elements and other considerations, and notes the effects that materials and processing technologies may have on the environment. Provides a clear and detailed production plan, including a complete materials list and budget, and a detailed evaluation of the design process and the end product against the client requirements and design fundamentals.
	Production Independently interprets and implements a detailed production plan and uses correct operational procedures to manufacture a product. Provides documentary evidence of regular, ongoing evaluation of processes and changes and/or modifications implemented, resulting from this evaluation. Achieves an excellent standard of finish in the manufacture of the product. Efficiently manages time and the working environment. Organises and independently uses tools and equipment with concern for the safety of self and others.
	Response Clearly and concisely presents fully-referenced research using course related terminology and a variety of suitable formats, including text, diagrams and images. Comprehensively details the impact of design decisions and materials selection and use on society and the environment, including justified materials choices and selection of manufacturing techniques. Identifies a range of common materials and their properties, and gives examples of appropriate practical applications in context. Comprehensively details the processing and manufacturing of materials, the properties of materials and the environmental impacts and sustainability of materials.

B	**Design** Uses a clearly identifiable design process but requires some guidance to generate and devise individual ideas and develop solutions for others. Develops documentation which displays clear design progression. Prepares concept sketches that are annotated with suitable terminology, and which consider and compare several ideas. Shows evidence of investigation into design fundamentals: function, cost, safety, aesthetics, environmental factors, and ergonomics. Presents a portfolio which contains fully developed, dimensioned working drawings, including 2D and 3D CAD where applicable in context. Provides an explanation of the suitability of materials selected against the design elements and other considerations. Provides a planned sequence of manufacture including a materials list and costing; and an evaluation of design process and the end product against the design fundamentals, including functional, aesthetic and ergonomic criteria.
	Production Interprets and implements a production plan and uses correct operational procedures to manufacture a product. Provides documentary evidence of ongoing evaluation of processes and, with assistance, implements changes and modifications derived from this evaluation. Achieves a high standard of finish in the manufacture of the product. Requires occasional direction with time management and manufacturing techniques. Uses tools and equipment with concern for the safety of self and others.
	Response Presents research information using some references and course related terminology in suitable formats, including text, diagrams and images. Identifies some common materials, and their appropriate practical uses in context. Presents well-researched issues of the processing and manufacturing of materials, the properties of materials and the effects of these materials on society and the environment, including sustainability of materials.

C	**Design** Chooses and applies an identifiable design process with guidance, and with some assistance generates and devises ideas to develop solutions with consideration for others. Develops documentation which displays some design progression, using concept sketches that are partially annotated with common technical terms and which show a narrow development of one idea from others. Provides evidence of a superficial investigation into design fundamentals: function, cost, safety, aesthetics, environmental factors, and ergonomics. Presents a portfolio which contains working drawings, including 2D and 3D CAD where applicable in context, a list of materials, a simple sequence of manufacture and comments or brief notes in a limited evaluation of the final product.
	Production Implements a plan for production, requiring guidance in the correct operational procedures and use of equipment to manufacture a product. Provides limited documentary evidence of ongoing evaluation of processes. Requires assistance to implement changes and modifications derived from ongoing guided evaluation. Achieves a satisfactory standard of finish in the manufacture of the product. Requires regular direction with time management and manufacturing techniques. Uses tools and equipment with concern for the safety of self and others.
	Response Presents limited research, including text and images, using basic technical language and terminology with some evidence of referencing. Identifies some common materials and lists a number of suitable uses. Describes some processing and manufacturing of materials, identifies some properties of materials and describes general effects of materials on society and the environment. Presents general comments on sustainability.

D	**Design** Uses a highly scaffolded question and answer design process, generates and devises ideas, and develops a solution. Develops documentation which displays limited design progression for one idea, with limited use of concept sketches. Shows no evidence of investigation into design fundamentals: function, cost, safety, aesthetics, environmental factors or ergonomics. Provides drawings and/or sketches which are partially annotated with little use of common technical terms. Includes working drawings which are either incomplete, poorly dimensioned and/or lack detail. With assistance, includes a list of materials and a simple sequence of manufacture.
	Production Requires guidance to follow plans, and regular assistance to use equipment and correct operational procedures to manufacture a product. Provides no documentary evidence of ongoing evaluation of processes. Requires guidance and direction to implement given changes and modifications. Achieves a poor standard of finish in the manufactured of the product. Requires supervision with time management and assistance to use tools and equipment. Shows some concern for the safety of self and others.
	Response Uses basic technical language and terminology in the presentation of limited, unreferenced research. Lists some common materials and some uses in context. Describes some processing and manufacturing techniques, but is unclear about how these may affect the properties of the materials, and effects on society and the environment. Presents some understanding of sustainability through unclear generalisations.

E	Does not meet the requirements of a D grade and/or has completed insufficient assessment tasks to be assigned a higher grade.