



Industrial Technology

Stage 6

Syllabus

2008

PLEASE NOTE

The assessment and HSC examination requirements detailed in this syllabus refer to the 2009 HSC. New *Assessment and Reporting* information will apply to this syllabus for the 2010 HSC and beyond.

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1 The Higher School Certificate Program of Study

The purpose of the Higher School Certificate program of study is to:

- provide a curriculum structure which encourages students to complete secondary education;
- foster the intellectual, social and moral development of students, in particular developing their:
 - knowledge, skills, understanding and attitudes in the fields of study they choose
 - capacity to manage their own learning
 - desire to continue learning in formal or informal settings after school
 - capacity to work together with others
 - respect for the cultural diversity of Australian society;
- provide a flexible structure within which students can prepare for:
 - further education and training
 - employment
 - full and active participation as citizens;
- provide formal assessment and certification of students' achievements;
- provide a context within which schools also have the opportunity to foster students' physical and spiritual development.

2 Rationale for Industrial Technology in the Stage 6 Curriculum

Much of Australia's economic, social and cultural development can be related to the capacity of our industries to develop and use technology in the manufacture of goods and services. The effective and responsible application of industrial technologies has a direct bearing upon the quality of our lives. For this reason, the study of industrial technology and its role in industry is relevant and purposeful for many students.

The subject provides students with a choice of six different focus area industries, through which they can study the course. These focus areas have been chosen to cover a wide range of potentially accessible and locally available technologies.

Industrial Technology has been developed to incorporate content related to current and developing technologies. It offers students the opportunity to study the interrelationships of technologies, equipment and materials used by industry and to develop skills through the processes of design, planning and production.

Rapid technological change, particularly in the computer-based technologies, is influencing the nature of our industrial enterprises and the work that is undertaken in these enterprises. As a result, our industrial enterprises are becoming more globally competitive.

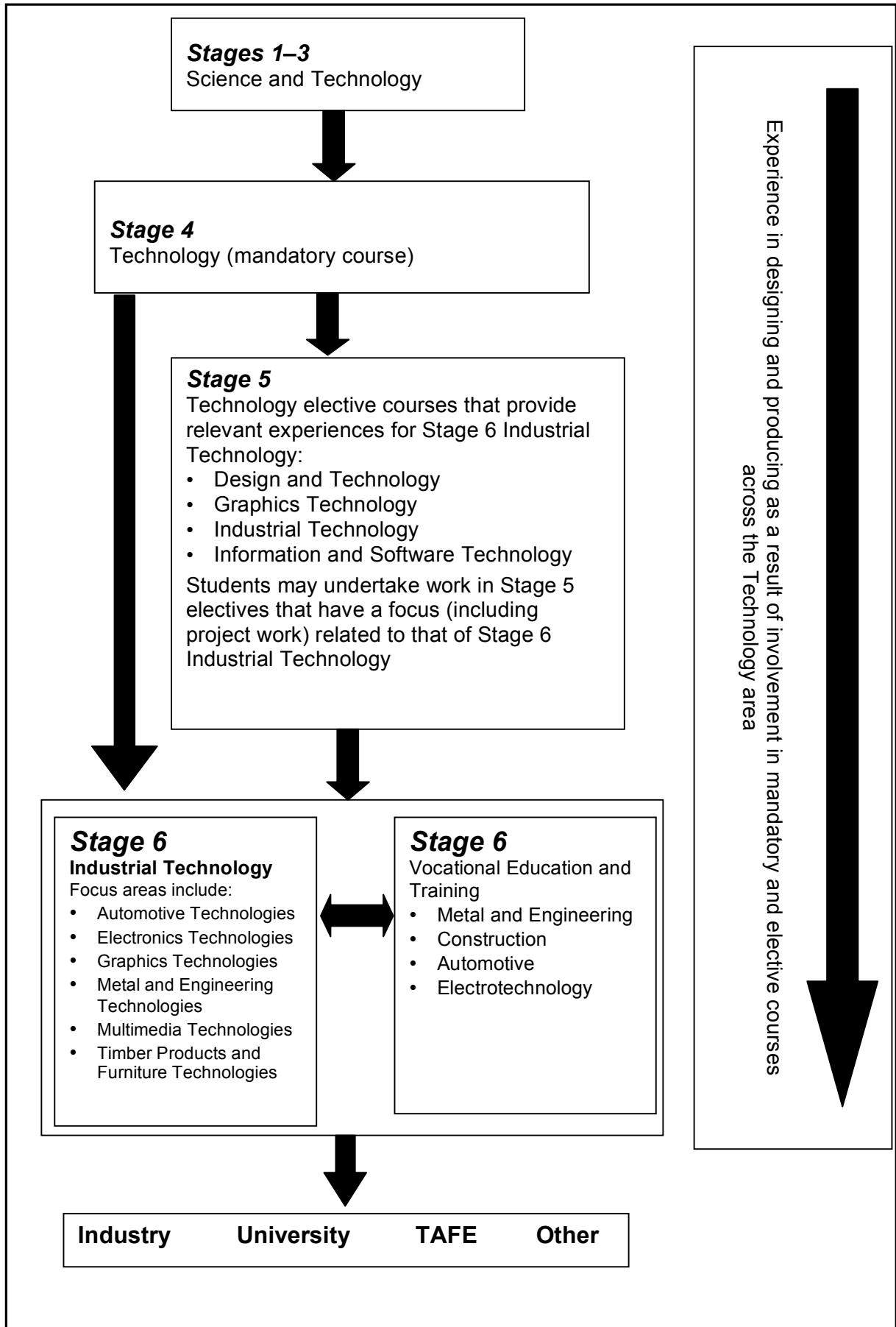
Industrial Technology seeks to raise students' awareness of the interaction between technology, industry, society and the environment, and to develop their ability to make value judgements about issues, decisions and problems arising from this interaction. Students achieve this by applying practical experiences to the study of the technology, management and organisation of industry.

The current Australian industrial workforce is diverse in nature, gender-inclusive and better educated through ongoing training and development.

Increasing retention rates within NSW schools have resulted in a need to link the senior school curriculum more closely with post-school vocational education and work options. This syllabus acknowledges the need to strengthen such links. Through a process of observing and analysing industry practice and through personal practical experiences, students will gain knowledge and skills together with appropriate attitudes about technology and industry.

The course has been designed to be inclusive of the needs, interests and aspirations of students and it provides opportunities for them to learn explicitly about gender issues relating to the industry studied. It also caters for students who wish to undertake further study in a related area at university level or to pursue further industry training. Therefore the skills and knowledge gained through the study of Industrial Technology Stage 6 will enable students to make positive contributions to Australian industry and society.

3 Continuum of Learning for Industrial Technology Stage 6 Students



4 Aim

Industrial Technology at Stage 6 is designed to develop in students a knowledge and understanding of the selected industry and its related technologies with an emphasis on design, management and production through practical applications.

5 Objectives

Students will develop:

- knowledge and understanding of the focus area industry and of manufacturing processes and techniques used by industry
- knowledge and understanding of safe and cooperative work practices and of the need for a safe and cooperative work environment
- competence in designing, managing and communicating within a relevant industry context
- knowledge and skills in producing quality products
- knowledge and skills in communication and information processing related to the industry focus area
- an appreciation of quality products and the principles of quality control
- an appreciation of the relationships between technology, the individual, society and the environment.

6 Course Structure

Industrial Technology Stage 6 has a Preliminary course and an HSC course.

The Preliminary course of 120 indicative hours consists of project work and an industry study that provide a broad range of skills and knowledge related to the focus area chosen and an introduction to processes, skills and practices relevant to the design, management, communication and construction of practical projects.

The HSC course of 120 indicative hours consists of the development, management and communication of a major practical project and folio that contribute to the development of knowledge, skills and understanding related to the focus area of study.

Students choose to study ONE of SIX focus areas. The same area is to be studied in both the Preliminary and HSC courses. The focus areas are:

- Automotive Technologies
- Electronics Technologies
- Graphics Technologies
- Metal and Engineering Technologies
- Multimedia Technologies
- Timber Products and Furniture Technologies.

Both the Preliminary and HSC courses are organised around four sections:

- A. Industry Study
- B. Design, Management and Communication
- C. Production
- D. Industry Related Manufacturing Technology.

<p align="center">Preliminary Course 120 indicative hours</p>	<p align="center">HSC Course 120 indicative hours</p>
<p>Industry Study 15% Study of the organisation and management of an individual business within the focus area, including:</p> <ul style="list-style-type: none"> • structural • technical • environmental • sociological • personnel • OHS issues 	<p>Industry Study 15% Study of the organisation and management of the industry related to the focus area, including:</p> <ul style="list-style-type: none"> • structural • technical • environmental • sociological • personnel • sectors within the industry • legislation • OHS issues • career opportunities • historical aspects • sales and marketing
<p>Design 10% Design and plan projects through the completion of associated folios</p> <ul style="list-style-type: none"> • elements and principles of design • types of design • quality • influences affecting design 	<p>Major Project 60% Design, Management and Communication</p> <ul style="list-style-type: none"> • application of design principles in the production of the Major Project: <ul style="list-style-type: none"> – design development – sketching and idea generation – prototyping, modelling and testing – production and working drawings – quality and ongoing evaluation – selection of appropriate materials, processes and other resources • application of management and communication skills to produce a related folio justifying: <ul style="list-style-type: none"> – research – design – analysis – evaluation including selection of appropriate materials, components, processes and technologies – ICT – OHS – presentation <p>Production</p> <ul style="list-style-type: none"> • applying knowledge and skills through the construction of a Major Project which reflects: <ul style="list-style-type: none"> – quality – evidence of a range of skills – degree of difficulty – links between planning and production – use of appropriate materials, components, processes and technologies – evidence of practical problem solving – OHS and safe work practices
<p>Management and Communication 20% Manage work through the completion of a management folio linked to each project produced</p> <ul style="list-style-type: none"> • development of a number of practical projects • development of management folios • development of skills related to research, analysis and evaluation • skills in managing projects • documentation skills in the preparation, planning and presentation of a management folio • skills in literacy through written reports, folio work • skills in computer-based technologies • numeracy skills related to sizing, costing, estimating, ordering and efficient resource usage • graphical skills related to the project work • knowledge and understanding of workplace safety and communication: <ul style="list-style-type: none"> – signage – OHS principles and requirements – personal protective equipment (PPE) – safe working practices – risk assessment 	

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Preliminary Course 120 indicative hours (continued)	HSC Course 120 indicative hours (continued)
Production 40% <ul style="list-style-type: none">developing knowledge and skills through the construction of a number of projectsacquisition of relevant practical skills	Industry Related Manufacturing Technology 25% <ul style="list-style-type: none">demonstrates knowledge and understanding of a range of materials, processes, tools, equipment, machinery and technologies related to the focus area industry through practical experiences, including the development of the Major Projectnew/emerging technologies associated with the industry
Industry Related Manufacturing Technology 15% <ul style="list-style-type: none">developing knowledge and understanding of a range of materials, processes, tools, equipment and machinery through the construction of a number of projects	

7 Objectives and Outcomes

7.1 Table of Objectives and Outcomes

Objectives	Preliminary Outcomes	HSC Outcomes
Students will develop 1. knowledge and understanding of the focus area industry and of manufacturing processes and techniques used by industry	A student: P1.1 describes the organisation and management of an individual business within the focus area industry P1.2 identifies appropriate equipment, production and manufacturing techniques, including new and developing technologies	A student: H1.1 investigates industry through the study of businesses in one focus area H1.2 identifies appropriate equipment, production and manufacturing techniques and describes the impact of new and developing technologies in industry H1.3 identifies important historical developments in the focus area industry
2. knowledge and understanding of safe and cooperative work practices and of the need for a safe and cooperative work environment	P2.1 describes and uses safe working practices and correct workshop equipment maintenance techniques P2.2 works effectively in team situations	H2.1 demonstrates proficiency in the use of safe working practices and workshop equipment maintenance techniques
3. competence in designing, managing and communicating within a relevant industry context	P3.1 sketches, produces and interprets drawings in the production of projects P3.2 applies research and problem-solving skills P3.3 demonstrates appropriate design principles in the production of projects	H3.1 demonstrates skills in sketching, producing and interpreting drawings H3.2 selects and applies appropriate research and problem-solving skills H3.3 applies and justifies design principles through the production of a Major Project
4. knowledge and skills in producing quality products	P4.1 demonstrates a range of practical skills in the production of projects P4.2 demonstrates competency in using relevant equipment, machinery and processes P4.3 identifies and explains	H4.1 demonstrates competency in a range of practical skills appropriate to the Major Project H4.2 explores the need to outsource appropriate expertise where necessary to

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Objectives	Preliminary Outcomes	HSC Outcomes
	the properties and characteristics of materials/components through the production of projects	complement personal practical skills H4.3 critically applies knowledge and skills related to properties and characteristics of materials/components
5. knowledge and skills in communication and information processing related to the industry focus area	P5.1 uses communication and information processing skills P5.2 uses appropriate documentation techniques related to the management of projects	H5.1 selects and uses communication and information processing skills H5.2 examines and applies appropriate documentation techniques to project management
6. an appreciation of quality products and the principles of quality control	P6.1 identifies the characteristics of quality manufactured products P6.2 identifies and explains the principles of quality and quality control	H6.1 evaluates the characteristics of quality manufactured products H6.2 applies the principles of quality and quality control
7. an appreciation of the relationships between technology, the individual, society and the environment	P7.1 identifies the impact of one related industry on the social and physical environment P7.2 identifies the impact of existing, new and emerging technologies of one related industry on society and the environment	H7.1 explains the impact of the focus area industry on the social and physical environment H7.2 analyses the impact of existing, new and emerging technologies of the focus industry on society and the environment

All students in Industrial Technology will complete study in the following areas:

- A. **Industry Study**
- B. **Design, Management and Communication**
- C. **Production**
- D. **Industry Related Manufacturing Technology.**

The course outcomes together with the first two sections above are common to each industry focus area.

For each industry focus area, the Production and Industry Related Manufacturing Technology are listed separately.

It is essential that the content and the focus area outcomes be considered collectively when programming for the course in order to ascertain the depth and breadth of treatment of each topic.

The content in the Preliminary course and the HSC course within each focus area is differentiated in terms of depth of study and its application to the individual student's projects.

In the Preliminary study, the content is introductory and is related to a number of practical projects and the study of an individual business in the focus area. The aim of the Preliminary course is to prepare and equip the students with the necessary knowledge and skills to successfully complete the HSC Major Project and related folio.

The HSC content is centred on the application of design, research and manufacture of a Major Project and related folio, together with a more detailed study of the focus area industry.

7.2 Key Competencies

Industrial Technology Stage 6 provides a context within which to develop general competencies essential for students to become effective learners and make a positive contribution to their community.

During the course, students learn to:

- source, select and sequence information about issues in a selected industry, developing competence in **collecting, analysing, and organising information**
- debate, describe, discuss and explain issues in written, graphic and oral form, developing competence in **communicating ideas and information**
- plan, prepare and present project work and planning folio to meet a range of needs, developing competence in **planning and organising activities**
- cooperate with individuals and groups, developing competence in **working with others and teams**
- design, implement and evaluate solutions to practical situations in a specific focus industry, developing competence in **solving problems**
- plan, develop and modify projects including costing, quantities, measurement and time, developing competence in **using mathematical ideas and techniques**
- experiment with and prepare practical projects using appropriate materials and equipment, developing competence in **using technology**.

The course structure and pedagogy provide extensive opportunities to develop the key competencies.

8 Content: Industrial Technology Stage 6 Preliminary Course

Preliminary Course Outcomes and Content

Focus Area: All

It is essential that the content and the focus area outcomes be considered collectively in order to ascertain the depth and breadth of treatment for each topic.

Course Outcomes

A student:

- P1.1 describes the organisation and management of an individual business within the focus area industry
- P1.2 identifies appropriate equipment, production and manufacturing techniques, including new and developing technologies
- P2.1 describes and uses safe working practices and correct workshop equipment maintenance techniques
- P2.2 works effectively in team situations
- P3.1 sketches, produces and interprets drawings in the production of projects
- P3.2 applies research and problem-solving skills
- P3.3 demonstrates appropriate design principles in the production of projects
- P4.1 demonstrates a range of practical skills in the production of projects
- P4.2 demonstrates competency in using relevant equipment, machinery and processes
- P4.3 identifies and explains the properties and characteristics of materials/components through the production of projects
- P5.1 uses communication and information processing skills
- P5.2 uses appropriate documentation techniques related to the management of projects
- P6.1 identifies the characteristics of quality manufactured products
- P6.2 identifies and explains the principles of quality and quality control
- P7.1 identifies the impact of one related industry on the social and physical environment
- P7.2 identifies the impact of existing, new and emerging technologies of one related industry on society and the environment

Industry Study (Preliminary) (15%)

Students will study the organisation and management of an individual business related to the focus area.

Students learn about:	Students learn to:
<p>Structural factors</p> <ul style="list-style-type: none"> • organisation • marketing and sales • production • workplace environment <p>Technical factors</p> <ul style="list-style-type: none"> • tools • equipment/plant • production techniques, for example, mass production, mechanisation, specialisation <p>Environmental factors</p> <ul style="list-style-type: none"> • resources, alternatives, limitations, • recycling/reusing • pollution • government legislation <p>Sociological factors</p> <ul style="list-style-type: none"> • issues relating to a business • workplace cultures • the role of a business in the focus industry <p>Personnel issues</p> <ul style="list-style-type: none"> • industrial relations • entry level training requirements • roles of industry personnel <p>Occupational health and safety</p> <ul style="list-style-type: none"> • signage • OHS principles and requirements • personal protective equipment (PPE) • safe working practices • first aid • materials handling 	<ul style="list-style-type: none"> • investigate the organisation and structure of a business • identify the range of equipment, processes and techniques used by a business • identify how the resources and processes used in a business impact on environmental and sociological factors • identify the problems of pollution and any recycling of materials associated with a business • appreciate the impact of government legislation • describe how the business impacts on the focus industry • identify career opportunities and working conditions, including gender issues within a business • describe the various roles and requirements of key personnel within a business • identify relevant OHS factors in a business that ensure a safe working environment

Design (10%)

Students learn to design, plan and manage their work through the completion of a management folio linked to each project produced.

Students learn about:	Students learn to:
<p>Designing and planning practical projects through the completion of associated management folios</p> <p>Elements of design</p> <ul style="list-style-type: none"> • line, direction and style • shape and size • colour • texture <p>Principles of design</p> <ul style="list-style-type: none"> • proportion • balance • rhythm • emphasis • contrast, harmony and unity <p>Aspects of design</p> <ul style="list-style-type: none"> • functionality • aesthetics • factors determining appropriateness of design: <ul style="list-style-type: none"> – economics – environment – manufacturing techniques – sustainability – decoration – anthropometrics and ergonomics • material suitability and selection <p>Communication techniques Communication skills related to practical project work</p> <p><i>Graphical</i></p> <ul style="list-style-type: none"> • should include: <ul style="list-style-type: none"> – object drawing: views of items from different perspectives, including orthogonal (2D) and pictorial (3D) representations – sketching, rendering using a range of appropriate media – industry production drawing specifications: correct dimensions and proportions, accurate details on drawings and exploded views – CAD and presentation techniques 	<ul style="list-style-type: none"> • use a range of options available to them during the designing/modifying and planning stages of projects • experiment with and apply the elements and principles of design across a range of projects • describe and analyse principles of design for manufactured items • describe the relationship between function and aesthetics in a range of manufactured items within the focus technology • evaluate a range of manufactured items to determine appropriate design features, material suitability and choice within the focus technology • interpret and prepare appropriate drawings required for the graphical communication/presentation of projects • use a range of manual and computer-based graphical techniques to communicate design details of project development

Students learn about:	Students learn to:
<p>Information and communication technologies (ICT)</p> <ul style="list-style-type: none"> • appropriate tools to assist in design development, including: <ul style="list-style-type: none"> – word processing – spreadsheets – data bases – presentation – page layout – computer-aided design (CAD) 	<ul style="list-style-type: none"> • use appropriate ICT to assist in the development of projects and the preparation and completion of related folios

Management and Communication (20%)

Students will learn communication and information processing skills through the completion of a management folio linked to each project produced.

Students learn about:	Students learn to:
<p>Knowledge and understanding of project management</p> <ul style="list-style-type: none"> • skills in managing projects • development of management folios • development of skills related to research, analysis and evaluation <p>Project management</p> <ul style="list-style-type: none"> • planning • documentation <p>Literacy</p> <ul style="list-style-type: none"> • industry terminology • written reports using appropriate text types • material/component list • management folio • ICT <p>Numeracy</p> <ul style="list-style-type: none"> • related calculation skills: <ul style="list-style-type: none"> – ordering – sizing – quantities – costing – estimates <p>Communication</p> <ul style="list-style-type: none"> • reading and interpretation of technical drawings • industry standards • freehand drawing • sketching and annotations • production and working drawings • ICT • OHS signage 	<ul style="list-style-type: none"> • apply research, analysis and evaluation skills in planning a range of practical projects • use project development techniques to complete practical projects within a given time frame • compile reports using appropriate text types using information gathered • document relevant information into related folios • develop ICT skills in the preparation of related folios • use the appropriate numeracy skills relevant to a business, including calculating the need for and costs of materials/components • interpret and understand drawings • use sketches and freehand drawings to interpret ideas • prepare working drawings for the production of projects through both manual and ICT techniques • identify and apply signage

9 Content: Industrial Technology Stage 6 HSC Course

HSC Course Outcomes and Content

Focus Area: All

It is essential that the content and the focus area outcomes be considered collectively in order to ascertain the depth and breadth of treatment for each topic.

Course Outcomes

A student:

- H1.1 investigates industry through the study of businesses in one focus area
- H1.2 identifies appropriate equipment, production and manufacturing techniques and describes the impact of new and developing technologies in industry
- H1.3 identifies important historical developments in the focus area industry
- H2.1 demonstrates proficiency in the use of safe working practices and workshop equipment maintenance techniques
- H3.1 demonstrates skills in sketching, producing and interpreting drawings
- H3.2 selects and applies appropriate research and problem-solving skills
- H3.3 applies and justifies design principles effectively through the production of a Major Project
- H4.1 demonstrates competence in a range of practical skills appropriate to the Major Project
- H4.2 explores the need to outsource appropriate expertise where necessary to complement personal practical skills
- H4.3 critically applies knowledge and skills related to properties and characteristics of materials/components
- H5.1 selects and uses communication and information processing skills
- H5.2 examines and applies appropriate documentation techniques to project management
- H6.1 evaluates the characteristics of quality manufactured products
- H6.2 applies the principles of quality and quality control
- H7.1 explains the impact of the focus area industry on the social and physical environment
- H7.2 analyses the impact of existing, new and emerging technologies of the focus industry on society and the environment

Industry Study HSC (15%)

Students will undertake a broad study of industry related to the specific business studied in the Preliminary course.

Students learn about:	Students learn to:
<p>Structural considerations</p> <ul style="list-style-type: none"> • organisation • management (roles and levels) • marketing and advertising • production and efficiency • restructuring • quality control <p>Technical considerations</p> <ul style="list-style-type: none"> • mechanisation • specialisation/generalisation • mass production • automation • new and emerging technologies <p>Environmental and sociological considerations</p> <ul style="list-style-type: none"> • alternative resources: <ul style="list-style-type: none"> – power – material – processes – limitations • recycling and reusing • waste management and minimisation • pollution • sustainable development • rehabilitation of commercial sites • legislative requirements: <ul style="list-style-type: none"> – local – state – federal – environmental studies • location: <ul style="list-style-type: none"> – land costs and availability – transportation facilities – workforce – impact on surrounding population – resource availability – geographical factors – waste management <p>Personnel issues</p> <ul style="list-style-type: none"> • industrial relations: <ul style="list-style-type: none"> – equity/EEO – unions – group negotiated contracts – individual contracts 	<ul style="list-style-type: none"> • identify the organisation and structure of businesses related to the specific industry • identify structural factors/considerations that affect production, efficiency and quality control within the business studied • describe and evaluate the significance various technical factors/considerations have in the efficiency and viability of the business studied • describe and evaluate the approaches to the various environmental and sociological factors adopted by the industry studied • recognise and evaluate alternatives to traditional industrial practice especially in relation to power and resource management • discuss and justify the ramifications of legislative requirements on the development and sustainability of the industry • identify and describe how factors relating to location affect the viability and organisation of industry • describe the personnel issues that relate to industry • identify government legislation and

Students learn about:	Students learn to:
<ul style="list-style-type: none"> • career and training opportunities • specialisation and multi-skilling • roles of industry personnel • work practices <p>Occupational health and safety</p> <ul style="list-style-type: none"> • government legislation • industry requirements: <ul style="list-style-type: none"> – standards – policing – prosecution • risk assessment • safety training and human factors • workplace culture • OHS communication <p>Historical developments</p> <ul style="list-style-type: none"> • the significant developments that have occurred in the focus area industry and how they have impacted on the industry as a whole, including: <ul style="list-style-type: none"> – manufacturing processes – materials – work practices 	<p>policies that ensure the employees' rights and job protection</p> <ul style="list-style-type: none"> • discuss the importance of OHS in industry • identify government legislation and industry requirements that ensure a safe working environment <ul style="list-style-type: none"> • recognise how historical developments and practices have moulded the industry both positively and negatively

Major Project (HSC) (60%)

Students learn to refine and extend their project management skills in the following areas, largely through the development and completion of their Major Project management folio.

Students learn about:	Students learn to:
<p>Design, management and communication</p> <ul style="list-style-type: none"> • application of design principles in the production of the Major Project: <ul style="list-style-type: none"> – research – design development – sketching and idea generation – prototyping, modelling and testing – production and working drawings – quality and ongoing evaluation – selection of appropriate materials, processes and resources – development of time and finance plans • application of management and communication skills to produce a related folio justifying: <ul style="list-style-type: none"> – research – design – analysis – evaluation including selection of appropriate materials, components, processes and technologies – ICT – OHS – management – presentation <p>Production</p> <ul style="list-style-type: none"> • applying knowledge and skills through the construction of a Major Project which reflects: <ul style="list-style-type: none"> – quality – evidence of a range of skills – degree of difficulty – links between planning and production – use of appropriate materials, components, processes and technologies – evidence of practical problem solving – OHS and safe work practices 	<ul style="list-style-type: none"> • explain and justify decisions made during the designing/modifying and planning stages of the Major Project • refine skills in interpreting and creating drawings relevant to the Major Project • prepare all necessary sketches and working drawings required for the production of the Major Project • select and justify appropriate materials to be used in the Major Project • apply time and finance plans when completing the Major Project • utilise appropriate ICT in the development and production of the related folio • incorporate a range of presentation skills and techniques in the development and production of the related folio • combine the application design, management and communication with industry related manufacturing technology in the production of a quality Major Project

Industry Related Manufacturing Technology

Focus Area: Automotive Technologies (Preliminary)

Note: all repairs/modifications made to motor vehicles must conform to government and statutory regulations and guidelines.

Students learn about:	Students learn to:
<p>Fuels and lubricants</p> <ul style="list-style-type: none"> • petrol • diesel • oils <p>Engine types</p> <ul style="list-style-type: none"> • single cylinder 2 stroke • single cylinder in line 4 stroke • 4 cylinder engines • diesel engines <p>Engine systems</p> <ul style="list-style-type: none"> • engine operation • piston assembly <p>Cooling systems</p> <ul style="list-style-type: none"> • operation of the cooling system • coolants <p>Fuel systems</p> <ul style="list-style-type: none"> • principles of the carburettor system • principles of fuel injection system <p>Intake and exhaust systems</p> <ul style="list-style-type: none"> • types of air cleaners • components of an exhaust system <p>Manual transmission</p> <ul style="list-style-type: none"> • purpose of transmission • types of gears <p>Electrical ignition system</p> <ul style="list-style-type: none"> • battery • distributor • spark plugs <p>Body electrical systems</p> <ul style="list-style-type: none"> • electrical circuit diagrams • electrical symbols • lamp bulbs • headlights • exterior lights 	<ul style="list-style-type: none"> • discuss and differentiate between the characteristics and advantages/disadvantages of a range of fuels and lubricants • gain an awareness of the operation of an engine • use basic fault-finding techniques • conduct basic routine maintenance • dismantle and reassemble a variety of engine components • identify the engine and its related components • use basic fault-finding techniques • conduct basic routine maintenance • dismantle and reassemble a variety of chassis and related components • outline the basic automotive cooling systems • conduct basic routine maintenance • use basic fault-finding techniques • identify and discuss the principles of fuel systems • carry out basic repairs • identify and discuss the principles of intake and exhaust systems • carry out basic repairs • identify and discuss the principles of manual transmission • identify the components of an ignition system • conduct basic routine maintenance • use basic fault-finding techniques • identify the components of an electrical system • conduct basic routine maintenance • use basic fault-finding techniques

Students learn about:	Students learn to:
<ul style="list-style-type: none"> • interior lamps • turn signal indicators <p>Body</p> <ul style="list-style-type: none"> • panel repairs <p>Drive line systems</p> <ul style="list-style-type: none"> • front-wheel drive • rear-wheel drive • four-wheel drive • all-wheel drive <p>Wheels and tyres</p> <ul style="list-style-type: none"> • tyre construction • types of tyres • characteristics of tyres • tyre identification • tyre tread patterns <p>Braking systems</p> <ul style="list-style-type: none"> • drum brakes • disc brakes • parking brake <p>Suspension systems</p> <ul style="list-style-type: none"> • leaf springs • coil springs • shock absorbers <p>Steering systems</p> <ul style="list-style-type: none"> • components of a steering system <p>Tools and equipment</p> <ul style="list-style-type: none"> • the use and maintenance of tools and equipment involved in the processes associated with the engine, chassis, electrical system and body 	<ul style="list-style-type: none"> • identify and carry out basic repairs on body panels • identify and discuss the principles of drive systems • identify and discuss the principles of tyre construction • identify and discuss the different types of tyres and their uses • identify and discuss the principles of braking systems • conduct basic routine maintenance • identify and discuss the principles of vehicle suspension systems • conduct basic routine maintenance • identify the components of a steering system • conduct basic routine maintenance • use safely and correctly a variety of tools and equipment • appreciate safe working procedures and conditions

Industry Related Manufacturing Technology

Focus Area: Automotive Technologies (HSC)

Note: all repairs/modifications made to motor vehicles must conform to government and statutory regulations and guidelines including occupational health and safety requirements.

Students learn about:	Students learn to:
<p>Energy types, fuels and lubricants</p> <ul style="list-style-type: none"> • solar • electric • petrol • diesel • oils • LPG <p>Engine types</p> <ul style="list-style-type: none"> • single cylinder engines • multi-cylinder engines • diesel engines • rotary engines • electric motors • hybrid • alternative fuel <p>Engine and related components</p> <ul style="list-style-type: none"> • engine operation • cylinder heads • cylinder blocks • cylinder sleeves • piston assembly • valve and valve trains • crankshaft assembly <p>Cooling systems</p> <ul style="list-style-type: none"> • radiator • water pump • water jackets • radiator hoses • thermostat • fan • coolant <p>Fuel systems</p> <ul style="list-style-type: none"> • carburettor systems • fuel injection systems • emission control <p>Intake and exhaust systems</p> <ul style="list-style-type: none"> • EFI air cleaners • engine manifolds • mufflers • catalytic converters 	<ul style="list-style-type: none"> • discuss the principles and relative merits of a range of energy types, fuels and lubricants <ul style="list-style-type: none"> • apply the principles of engine type and its related systems through the use of proficient, routine maintenance procedures • select and apply appropriate fault-finding techniques, procedures and repairs <ul style="list-style-type: none"> • dismantle and re-assemble engine components • safely use a range of related tools and equipment • conduct routine maintenance procedures • select and apply appropriate fault-finding techniques, procedures and repairs <ul style="list-style-type: none"> • dismantle and re-assemble cooling system components • conduct routine maintenance procedures <ul style="list-style-type: none"> • dismantle and re-assemble fuel system components • conduct routine maintenance procedures <ul style="list-style-type: none"> • dismantle and re-assemble intake and exhaust system components • conduct routine maintenance procedures

Students learn about:	Students learn to:
<p>Transmission</p> <ul style="list-style-type: none"> • transmission parts • transmission operation • manual transmission • automatic transmission <p>Drive line systems</p> <ul style="list-style-type: none"> • universal joints • constant velocity joints • differential <p>Wheels and tyres</p> <ul style="list-style-type: none"> • tyre wear • tyre rotation • wheel balance <p>Braking systems</p> <ul style="list-style-type: none"> • hydraulic systems • master cylinders • valves and devices in the hydraulic system • wheel cylinders • hydraulic brake fluid • power brake unit • brake shoe assemblies • antilock brake systems <p>Suspension systems</p> <ul style="list-style-type: none"> • suspension design • rear suspension – leaf and coil springs • front suspension – leaf and coil springs • torsion spring suspension <p>Steering systems</p> <ul style="list-style-type: none"> • rack and pinion system • steering systems with worm gearing • steering boxes • power steering • four-wheel steering <p>Ignition systems</p> <ul style="list-style-type: none"> • low-tension cables • ignition coil • distributor • high-tension cables • starter motor <p>Engine management systems</p> <ul style="list-style-type: none"> • manifold absolute pressure (MAP) sensor • computers • coolant temperature sensor • throttle control switch • airconditioning clutch 	<ul style="list-style-type: none"> • identify parts of a transmission system • identify appropriate transmission systems for a range of applications • conduct routine maintenance procedures • conduct routine maintenance procedures • apply the principles of braking systems • dismantle and re-assemble braking system components • conduct routine maintenance procedures • apply the principles of suspension systems • conduct routine maintenance procedures • conduct routine maintenance procedures • apply the principles of a range of electrical components and systems • dismantle and re-assemble ignition system components • conduct routine maintenance procedures • conduct routine maintenance procedures

Students learn about:	Students learn to:
<p>Body electrical systems</p> <ul style="list-style-type: none"> • lights: headlights, tail lights, reversing, direction indicators, interior • wiring systems • wiring harness • electric circuit components • relays • fuse and fusible links <p>Instrumentation and indicators</p> <ul style="list-style-type: none"> • instrument panels • mechanical gauges • digital electronic instruments • warning lights/sensors <p>Electrical accessories</p> <ul style="list-style-type: none"> • windscreen wipers • wiper motor circuit • windscreen washer • rear window demister • horns • central door locking • power windows • electric mirrors <p>Body</p> <ul style="list-style-type: none"> • structural and panel repairs • spray painting/finishing systems • trim and accessories <p>Tools and equipment</p> <ul style="list-style-type: none"> • use and maintenance of tools and equipment associated with automotive repairs and maintenance <p>Automotive design</p> <p><i>Safety</i></p> <ul style="list-style-type: none"> • seat belts • child restraints • airbags <p><i>Materials</i></p> <ul style="list-style-type: none"> • steels • plastics • composite materials • glass – laminated and tempered <p><i>Aerodynamics</i></p> <ul style="list-style-type: none"> • body shapes • wind resistance 	<ul style="list-style-type: none"> • conduct routine maintenance procedures • conduct routine maintenance procedures • conduct routine maintenance procedures • select and apply appropriate finishes • conduct basic repairs and procedures • safely use a range of related tools and equipment • conduct basic maintenance procedures on tools and equipment • discuss the implications of vehicle design

Students learn about:	Students learn to:
<p><i>Environmental factors</i></p> <ul style="list-style-type: none"> • recycling/reusing components • carbon emission • use of alternative fuels <p>Government and statutory regulations</p> <ul style="list-style-type: none"> • Australian Design Rule (ADR) 37 – Emission Control for Light Vehicles • registration • insurance • vehicle modifications 	<ul style="list-style-type: none"> • identify components for recycling/reusing • identify appropriate recycling processes <ul style="list-style-type: none"> • apply government and statutory regulations during any vehicle modification • accurately complete forms for registration and insurance of a motor vehicle

Industry Related Manufacturing Technology

Focus Area: Electronics Technologies (Preliminary)

Note: any project using or developing voltages in excess of 32V must be inspected and approved in writing as safe by a qualified and accredited person in accordance with appropriate Australian Standards. All projects need to conform to government and statutory regulations and guidelines including occupational health and safety requirements.

Students learn about:	Students learn to:
<p>Electrical principles</p> <p><i>Fundamentals</i></p> <ul style="list-style-type: none"> • electrical potential • current flow (AC/DC) • resistance • power • electromagnetism • units and measurement <p><i>Supply and safety</i></p> <ul style="list-style-type: none"> • sources of power • basic safety issues <p><i>Circuitry</i></p> <ul style="list-style-type: none"> • series and parallel circuits • basic calculations <ul style="list-style-type: none"> – Ohm's law – components in series and parallel – power <p><i>Components/materials/devices</i></p> <ul style="list-style-type: none"> • labeling and preferred values of common components • examples and applications of: <ul style="list-style-type: none"> – conductors, insulators, resistors: LDR, thermistor, fixed and variable • capacitors <ul style="list-style-type: none"> – different types, fixed and variable • inductive coils and relays • semiconductors <ul style="list-style-type: none"> – diodes: power, regulator, light emitting diode (LED) <p><i>Materials</i></p> <ul style="list-style-type: none"> • solder (tin/lead, lead free) • PCB materials • silicon and germanium semiconductors <p><i>Peripherals</i></p> <ul style="list-style-type: none"> • heat sinks/cooling • heat shrink/cable looming • enclosures 	<ul style="list-style-type: none"> • identify the fundamentals of electrical principles • compare sources of power and their environmental impact • outline safety issues with power sources • explain the principles of parallel and series circuits • apply basic knowledge to complete simple circuits • apply various formulae to circuit design • identify and appropriately select common components • explain and use conductors, insulators, resistors, both fixed and variable • identify thermistors and LDR • describe the different types of capacitors • explain inductive coils and relays • use the range of semiconductors • identify relevant materials and use them safely • identify peripherals and use them

Students learn about:	Students learn to:
<p>Processes</p> <ul style="list-style-type: none"> • use of tools and equipment • circuit assembly <ul style="list-style-type: none"> – prototyping techniques – PCB manufacture – component layout – testing and fault-finding techniques <p>Graphical communication</p> <ul style="list-style-type: none"> • schematic and circuit symbols • PCB design principles and tools 	<ul style="list-style-type: none"> • use appropriate tools and equipment in the processes listed • use different circuit assembly techniques • explain single PCB manufacture and component layouts • analyse and interpret schematic diagrams <ul style="list-style-type: none"> • recognise circuit symbols • communicate PCB design principles and use appropriate tools to produce simple circuits

Industry Related Manufacturing Technology

Focus Area: Electronics Technologies (HSC)

Note: any project using or developing voltages in excess of 32V must be inspected and approved in writing as safe by a qualified and accredited person in accordance with appropriate Australian Standards. All projects need to conform to government and statutory regulations and guidelines including occupational health and safety requirements.

Students learn about:	Students learn to:
<p>Electrical principles <i>Supply and safety</i></p> <ul style="list-style-type: none"> • electricity generation • rectification <p><i>Digital electronics</i></p> <ul style="list-style-type: none"> • current flow in analogue versus digital electronics • binary numbering system • basic logic gates and truth tables <p><i>Components</i></p> <ul style="list-style-type: none"> • review of conductors, resistors and capacitors • inductive coils and relays <ul style="list-style-type: none"> – transformers • semiconductors <ul style="list-style-type: none"> – diodes: signal, power, regulator, light emitting diode (LED), light sensitive, Zener • transistors: bipolar/field effect transistor (FET) • integrated circuits: <ul style="list-style-type: none"> – analogue – digital – microprocessors – VLSI • programmable integrated circuits: <ul style="list-style-type: none"> – PICAXE • thyristors • thermistors <p><i>Input/output devices</i></p> <ul style="list-style-type: none"> • solenoids • stepped motors • free running motors • speakers • buzzers • piezo devices • UHF transmitter/receivers • movement/vibration switches • microphones 	<ul style="list-style-type: none"> • select and use appropriate sources of power safely and correctly • explain the process of rectification of AC electricity • use analogue and digital circuitry where appropriate • read and apply binary numbering system to digital projects • explain and apply basic logic gates and truth tables • select and competently use conductors, insulators, resistors and capacitors, both fixed and variable • use inductive coils and relays • identify and discuss transformers • compare the different types of semiconductors • analyse and apply the most appropriate semiconductors for the production of circuits • discuss and use transistors • competently use a variety of integrated circuits • identify and discuss programmable integrated circuits • identify and discuss thyristors and thermistors • analyse the various input/output devices and competently select the appropriate one for practical situations • competently use the correct devices in practical exercises

Industry Related Manufacturing Technology

Focus Area: Electronics Technologies (HSC)

Students learn about:	Students learn to:
<p>Processes</p> <ul style="list-style-type: none"> • use of tools and equipment • circuit assembly <ul style="list-style-type: none"> – prototyping techniques – PCB manufacture – component layout – testing, fault-finding techniques <p>Circuitry</p> <ul style="list-style-type: none"> • series and parallel circuits • basic calculation <p>Graphical communication</p> <ul style="list-style-type: none"> • schematic and circuit symbols • PCB design principles and tools • circuit design software <p>Instruments and test equipment</p> <ul style="list-style-type: none"> • measurement equipment <ul style="list-style-type: none"> – analogue and digital meters – oscilloscope • testing equipment, eg in-circuit transistor tester • digital simulation of circuits • testing of circuits and models • applications of circuits <ul style="list-style-type: none"> – amplifiers, timers, detectors/sensors • applications of integrated circuits <ul style="list-style-type: none"> – oscillators – op amps – logic gates – displays – counters – programmable integrated circuits 	<ul style="list-style-type: none"> • use a range of tools and equipment during circuit assembly • apply sound techniques to circuit designs and assemblies • read and use circuit graphics • use PCB design • outsource appropriate expertise where necessary to complement personal practical skills <ul style="list-style-type: none"> • explain the principles of more complicated circuits • apply knowledge, skills and calculations when designing and making circuits <ul style="list-style-type: none"> • realise PCB designs using ICT • simulate circuits using software <ul style="list-style-type: none"> • select and use most appropriate testing equipment and instruments in testing circuits in practical projects

Industry Related Manufacturing Technology

Focus Area: Graphics Technologies (Preliminary)

Note: Students should develop a series of drawings around a product or theme to gain skills in the areas of engineering, product and architectural drawing. They should complete at least one project or theme in each area.

Students learn about:	Students learn to:
<p>Processes</p> <p><i>Freehand drawing</i></p> <ul style="list-style-type: none"> • 2D and 3D <p><i>Pictorial, engineering, product and computer-aided drawing (CAD)</i></p> <ul style="list-style-type: none"> • isometric • oblique • perspective: mechanical, measuring point • orthographic projection • product drawing • engineering drawing <p><i>Architectural drawing</i></p> <ul style="list-style-type: none"> • brief history of Australian architecture • influences of American and European architecture • architectural styles • architectural drawing: <ul style="list-style-type: none"> – plans – elevations • architectural details <p><i>Principles of planes and coordinates</i></p> <p><i>Presentation techniques</i></p> <ul style="list-style-type: none"> • composition/balance • colour • rendering • modelling 	<ul style="list-style-type: none"> • sketch outlines and develop them into a variety of 2D and 3D drawings • use drawing instruments to produce drawings for a variety of purposes • use CAD programs to produce drawings for a variety of purposes • use appropriate rendering techniques to enhance drawings • develop skills in mechanical drawing and/or CAD techniques • produce orthogonal drawings to illustrate the shape and features of a variety of objects • construct pictorial drawings of simple product parts using mechanical and/or CAD techniques • plot or generate mechanical and measuring point perspective drawings and a range of computer-generated perspective drawings <ul style="list-style-type: none"> • recognise and sketch examples of Australian architectural styles and details from the early settlers to today • recognise the influences of American and European architectural styles and details on Australian architecture • construct pictorial drawings of simple architectural details using mechanical and CAD techniques <ul style="list-style-type: none"> • use planes and coordinates to plot outlines <ul style="list-style-type: none"> • recognise and apply good composition and balance in developing well presented drawings • use colour and rendering techniques as a means of defining texture, shape and colour of materials • use a range of materials to construct simple models of design

Students learn about:	Students learn to:
<p>Principles/standards</p> <ul style="list-style-type: none"> • third and first angle projection • AS1100 and AS1100.301 as it applies to: <ul style="list-style-type: none"> – section drawings – detail drawings – symbols – dimensions <p>Equipment</p> <ul style="list-style-type: none"> • to develop and present drawings <ul style="list-style-type: none"> – ICT – mechanical drafting equipment – photocopier – printers – laminators 	<ul style="list-style-type: none"> • interpret third and first angle projection in orthographic drawings • use AS1100 and AS1100.301 requirements when producing orthogonal drawings from engineering, product and architectural themes <ul style="list-style-type: none"> • operate at least one software package to communicate a design solution or design process through text or drawing • use a range of mediums and computer software programs to define and enhance drawings • use a range of equipment appropriate to processes undertaken

Industry Related Manufacturing Technology

Focus Area: Graphics Technologies (HSC)

Note: As part of the HSC, the Major Project should incorporate a set of related drawings around the design and planning of a product or structure.

Students learn about:	Students learn to:
<p>Processes</p> <p><i>Freehand drawing</i></p> <ul style="list-style-type: none"> • 2D and 3D <p><i>Pictorial drawing</i></p> <ul style="list-style-type: none"> • isometric projection • axonometric projection • oblique projection: <ul style="list-style-type: none"> – cavalier – cabinet • perspective: <ul style="list-style-type: none"> – mechanical – measuring point (single and two) <p><i>Engineering and product drawing</i></p> <ul style="list-style-type: none"> • orthographic projection • assembly drawing • mechanical drawing • product drawing • presentation drawing • engineering drawing <p><i>Architectural drawing</i></p> <ul style="list-style-type: none"> • brief history of Australian architecture • architectural styles • architectural details • architectural drawing: <ul style="list-style-type: none"> – plans – elevations – sections – footing details – plumbing, electrical and roofing details – council requirements – site plans – set backs – shadow diagrams – landscape plan – colour palette and material selection <p><i>Presentation techniques</i></p> <ul style="list-style-type: none"> • colour • ‘fly-throughs’ • rendering • prototypes • modelling 	<ul style="list-style-type: none"> • sketch and develop a variety of freehand orthogonal, isometric, oblique and perspective sketches • use freehand orthogonal and appropriate pictorial sketches to communicate design ideas as needed in the production of the Major Project • use orthogonal and a range of pictorial drawing types to communicate design ideas and solutions in the Major Project <ul style="list-style-type: none"> • use CAD and a variety of traditional drawing methods to produce drawings for the Major Project <ul style="list-style-type: none"> • describe and sketch examples of Australian architectural styles and details from the early settlers to today • analyse and use features of Australian architecture styles if applicable to the Major Project • understand the influences of other architectural styles on Australian architecture • identify the council requirements when submitting plans for a building or development application • use appropriate architectural drawings to illustrate aspects of the Major Project, where applicable <ul style="list-style-type: none"> • produce well-composed and balanced drawings using colour and rendering in the Major Project • use ‘fly-throughs’, models and prototypes to enhance the presentation of the Major Project (if applicable)

Students learn about:	Students learn to:
<p>Principles/standards</p> <ul style="list-style-type: none"> • third and first angle projection • scale • AS1100 and AS1100.301 as it applies to: <ul style="list-style-type: none"> – section drawings – detail drawings – symbols – types of lines – dimensions – architectural, engineering and product drawing – working and presentation drawings <p>Equipment</p> <ul style="list-style-type: none"> • for developing and presenting the Major Project, for example: <ul style="list-style-type: none"> – computer software packages – mechanical drafting equipment – photocopier – scanner – external hard drives – flash drives – printers – laminators – display folders – appropriate paper sizes – stationery 	<ul style="list-style-type: none"> • use third angle projection • select and use scales and relevant drawing standards in producing drawings for the Major Project <ul style="list-style-type: none"> • use a range of mediums and computer software programs to develop, enhance and present drawings in the production of the Major Project • use a range of equipment appropriate to developing, enhancing and presenting the Major Project • use a range of storage equipment appropriate to developing the Major Project

Industry Related Manufacturing Technology

Focus area: Metal and Engineering Technologies (Preliminary)

Note: Teachers must adequately supervise the design and manufacture of projects where welding is involved. Design of welded projects must consider loadings and weld positioning. The structural design should be such that the welds do not carry the full load.

Students learn about:	Students learn to:
<p>Materials</p> <ul style="list-style-type: none"> • properties of ferrous and non-ferrous metals in common usage: <ul style="list-style-type: none"> – strength – durability – ductility – malleability – lustre – hardness • applications and use of a range of ferrous and non-ferrous metals: <ul style="list-style-type: none"> – copper – brass – steel – silver – gold – aluminium • sections and shapes of ferrous and non-ferrous metals commonly used: <ul style="list-style-type: none"> – tube – wire – solid sections – bar – sheet <p>Processes, tools and machinery</p> <p>Occupational health and safety</p> <ul style="list-style-type: none"> • knowledge and understanding of workplace safety and communication <ul style="list-style-type: none"> – OHS requirements and considerations – signage – personal protective equipment (PPE) – safe work practices – risk assessment <p>Processes</p> <ul style="list-style-type: none"> • skills and methods used, for a variety of metals, in: <ul style="list-style-type: none"> – marking out – cutting – machining – fabricating – joining 	<ul style="list-style-type: none"> • identify the properties of a range of ferrous and non-ferrous metals • recognise and use a range of ferrous and non-ferrous metals • discuss the suitability of a particular metal for an application • discuss the uses of the various shapes and forms of ferrous and non-ferrous metals such as sheet, bar, wire and tube for particular applications • use various shapes and sections of metals in practical projects • respond to all aspects of OHS requirements when in the workshop and when working on practical projects • apply the practical skills and methods used, for a variety of metals, in marking out, cutting, machining, fabricating, joining, modifying properties, colouring and finishing • engage in a broad range of processes through a variety of practical projects

Students learn about:	Students learn to:
<ul style="list-style-type: none"> - casting - modifying properties - finishing - colouring <p>Tools and machinery</p> <ul style="list-style-type: none"> • the use and maintenance of the tools and machinery involved in the construction of practical projects such as: <ul style="list-style-type: none"> - pliers - squares - rules - dividers - snips - punches - scriber - files - shears - stakes - hammers and mallets - heat treatment equipment - welding/brazing/soldering equipment - forging and shaping equipment - clamps - jigs and vices - thread cutting equipment - saws – power and hand - pedestal drill - drill mill - finisher - magna bend - supershears - buff/grinder - lathe - CNC tools and equipment - portable power tools 	<p>using the most suitable processes</p> <ul style="list-style-type: none"> • use the appropriate industry processes, where possible, in the production of practical projects • gain an awareness of processes used in industry, appropriate to the practical projects being undertaken, which may not be possible in the school environment • identify and apply appropriate finishes to complete practical projects • identify and apply the various techniques to modify the properties of metals in practical projects <ul style="list-style-type: none"> • experience a range of tools and machines appropriate to the metal being used and the processes being carried out, to complete practical projects • safely use tools and machinery • perform basic maintenance procedures on tools and machinery • identify tools and machinery used by industry, not available in the school environment, but appropriate to the practical activities being undertaken

Industry Related Manufacturing Technology

Focus Area: Metal and Engineering Technologies (HSC)

Note: Teachers must adequately supervise the design and manufacture of projects where welding is involved. Design of welded projects must consider loadings and weld positioning. The structural design should be such that the welds do not carry the full load.

Students learn about:	Students learn to:
<p>Materials</p> <ul style="list-style-type: none"> • properties of ferrous and non-ferrous metals and alloys, for example: <ul style="list-style-type: none"> – copper – brass – steel – silver – gold – aluminium – bronze – solder • consideration of modification of the properties of ferrous and non-ferrous metals in common usage: <ul style="list-style-type: none"> – annealing – work hardening – drawing – upsetting – forging – corrosion resistance • mining, refining and producing a range of metals: <ul style="list-style-type: none"> – copper – brass – steel – silver – gold – aluminium • sections and shapes of metals commonly used: <ul style="list-style-type: none"> – tube – wire – bar – solid sections – sheet – pre-formed sections – extruded sections • additional materials for joining, sealing and decorating component parts: <ul style="list-style-type: none"> – hardware items – fasteners – solders – flux 	<ul style="list-style-type: none"> • identify the differences between ferrous and non-ferrous metals and use them in the Major Project appropriately • describe and analyse the modification of properties of a range of ferrous and non-ferrous metals • apply techniques to modify the properties of metals appropriate to the Major Project • recognise and describe the effect of corrosion in a range of ferrous and non-ferrous metals • modify the effect of corrosion in the metal(s) used in the Major Project • describe the process of mining, refining and producing a range of metals • select and use the most suitable shapes and sections of metal in the Major Project • select and apply the most appropriate items from additional materials for use in the Major Project

Students learn about:	Students learn to:
<ul style="list-style-type: none"> – pickle – adhesives – sealants – findings – decorative additions <ul style="list-style-type: none"> • finishing methods and surface treatment of metals for appearance and/or surface protection: <ul style="list-style-type: none"> – buffing – bobbing and polishing – hammering – planishing – painting – colouring <p>Processes, tools and machinery</p> <p>Occupational health and safety</p> <ul style="list-style-type: none"> • OHS and safe work practices and requirements <p>Processes</p> <p>Skills and methods used in:</p> <ul style="list-style-type: none"> • marking out • cutting: <ul style="list-style-type: none"> – hand – machine • machining <ul style="list-style-type: none"> – turning – milling – shaping • forming: <ul style="list-style-type: none"> – fabrication – casting – shaping • joining <ul style="list-style-type: none"> – mechanical – soldering – brazing – welding (MIG and TIG) – bonding • modification of properties <ul style="list-style-type: none"> – heat treatment – work hardening – alloying • finishing <ul style="list-style-type: none"> – buffing – polishing – painting – oiling – colouring – surface treatments 	<ul style="list-style-type: none"> • describe and use the finishing methods and surface treatments appropriate to the Major Project to achieve a quality finish <ul style="list-style-type: none"> • respond to all aspects of OHS <ul style="list-style-type: none"> • select and use appropriate industrial processes in the production of the Major Project • outsource appropriate expertise where necessary to complement the Major Project and justify the reasons • describe processes used in industry which may not be possible in the school environment • apply techniques to modify the properties of metals appropriate to the Major Project • identify and apply appropriate quality finishes to the Major Project

Students learn about:	Students learn to:
<p>Tools and machinery</p> <ul style="list-style-type: none"> • the use and maintenance of the tools and machinery • tools and machinery used in industry that may not be available in the school, including: <ul style="list-style-type: none"> – multi-head lathes – hydraulic presses – pan brake – TIG welding – extrusion machine – rolling machine – stamping machine – CNC machines – laser cutting equipment – high-pressure water-cutting equipment 	<ul style="list-style-type: none"> • describe machines used in the school and explain their use and application • use machines appropriate to the Major Project • use tools and machinery safely and correctly • perform maintenance procedures on tools and machinery • describe tools and machinery used by industry, not available in the school environment, but appropriate to the Major Project

Industry Related Manufacturing Technology

Focus Area: Multimedia Technologies (Preliminary)

Students learn about:	Students learn to:
<p>Processes, tools and machines</p> <p>Multimedia computer systems</p> <ul style="list-style-type: none"> • processor speed • RAM • graphics cards • storage • motherboards • screen type and resolution • sound cards <p>Operating a computer system</p> <ul style="list-style-type: none"> • basic system operation • select and operate computing packages – manipulate data between applications • input devices, including: <ul style="list-style-type: none"> – keyboard – mouse – joystick – game controller – graphics tablet – microphone – scanners • output devices: <ul style="list-style-type: none"> – screens – printers (ink-jet and laser) – projectors • internal and external storage devices: <ul style="list-style-type: none"> – USB drives – compact disc – digital video disc – hard drives • cameras: <ul style="list-style-type: none"> – digital/analog – still/video • communication devices: <ul style="list-style-type: none"> – modems – ethernet – bluetooth – wireless – infra-red – firewire – USB 	<ul style="list-style-type: none"> • recognise computer hardware typically used in multimedia computer systems • identify computers and related hardware components • describe multimedia software and related memory, processing and storage requirements • understand and apply the procedures associated with the correct use of a computer system • manipulate and integrate data between a range of software applications • identify and use input and output devices in conjunction with specific multimedia software • identify and use a range of printers and scanners • identify and use a range of storage devices • set up and operate basic still and video cameras for use in small media production • identify and use modems and communication devices • investigate and use a range of software suitable for the creation, editing and publishing of multimedia projects

Students learn about:	Students learn to:
<ul style="list-style-type: none"> • appropriate software relevant to the project in the areas of: <ul style="list-style-type: none"> – authoring – publishing – sound creation/capture/editing – image creation/capture/editing – video creation/capture/editing – text creation/capture/editing – animation creation/capture/editing – 2D/3D drawing – web page design • Multimedia design in relation to: <ul style="list-style-type: none"> • storyboarding <ul style="list-style-type: none"> – types: <ul style="list-style-type: none"> - linear - non-linear - hierarchical - composite – applications • image creation/editing/conversion <ul style="list-style-type: none"> – bitmap – vector – scanning – formats – compression • sound creation/editing <ul style="list-style-type: none"> – wave – MIDI – podcasts – compression formats/codecs • video and still cameras <ul style="list-style-type: none"> – operation – lighting – angles/composition • data integration • OHS <ul style="list-style-type: none"> – workplace procedures – safe handling of equipment – risk identification and hazard reduction strategies 	<ul style="list-style-type: none"> • investigate and use a range of software tools and techniques used in the development and publishing of websites • identify and use planning processes related to a range of multimedia presentations • investigate and discuss the processes of obtaining, creating and modifying images, sound and text • produce and manipulate digital images • plan and develop an audio podcast • use presentation techniques and strategies in multimedia • author a multimedia product • apply principles of design in the planning and production of multimedia presentations • recognise workplace health and safety procedures • safely use computing equipment and associated materials

Industry Related Manufacturing Technology

Focus Area: Multimedia Technologies (HSC)

Students learn about:	Students learn to:
<p>Multimedia elements</p> <p><i>Text</i></p> <ul style="list-style-type: none"> • fonts: <ul style="list-style-type: none"> – serif – sans serif – decorative • formatting: <ul style="list-style-type: none"> – bold – italics – underline – alignment – indents – bullets – numbers – size – colour • stroke and fill • headings, subheadings • formatting paragraphs and document • pagination <p><i>Graphics</i></p> <ul style="list-style-type: none"> • graphic images: <ul style="list-style-type: none"> – vector – bitmap • resolution: <ul style="list-style-type: none"> – image size – colour depth – binary digits (bits), eg 8-bit, 16-bit, 24-bit • file size: in relation to screen size and colour depth • file formats: <ul style="list-style-type: none"> – TIFF – BMP – PCX/PICT – JPEG – GIF – PNG • importing images: <ul style="list-style-type: none"> – clip art – screen capture – scanning – graphics tablet – cameras <ul style="list-style-type: none"> - still - video – image libraries – stock photographs 	<ul style="list-style-type: none"> • author a multimedia Major Project • select and competently use a range of input and output devices, printers, cameras and scanners in the production of the Major Project • investigate and use a range of multimedia components in the development and publishing of the Major Project • competently plan all processes and stages required to complete the Major Project • apply principles of design in the planning and production of the Major Project • produce storyboards to plan presentations and the Major Project • produce multimedia elements, identify scope of authoring software, produce and evaluate prototypes

Students learn about:	Students learn to:
<ul style="list-style-type: none"> • object layering: <ul style="list-style-type: none"> – text – other images • image enhancements: <ul style="list-style-type: none"> – filters – special effects – anti-aliasing • image manipulation: <ul style="list-style-type: none"> – stretch – skew – rotate – colour adjustment <p><i>Audio</i></p> <ul style="list-style-type: none"> • sound waves: <ul style="list-style-type: none"> – analogue and digital wave patterns – volume – frequency • mono/stereo/surround sound • converting analogue to digital sound • sampling: <ul style="list-style-type: none"> – sample rate – sample size – 8-bit – 16-bit • relationship to file size: file compression • file formats: <ul style="list-style-type: none"> – WAV – AIFF – MP3 – WMA – MIDI <p><i>Video</i></p> <ul style="list-style-type: none"> • video types: <ul style="list-style-type: none"> – analogue – digital • file size considerations: <ul style="list-style-type: none"> – frame rate – image size – colour depth • video compression: <ul style="list-style-type: none"> – lossy – lossless – image quality – software • video players • file types: <ul style="list-style-type: none"> – MPEG – avi – MP4 • video editing: <ul style="list-style-type: none"> – import/export – transitions – titles 	<ul style="list-style-type: none"> • obtain, create and modify images, sound and text • compose camera shots and operate still and video cameras • transform prototypes into a final product • select from a wide range of industry techniques and apply them in the production and presentation of the Major Project • obtain, create and modify images, sound and text • outsource appropriate expertise where necessary to complement personal practical skills • utilise the features of a range of storage devices • identify requirements of memory, processing speed, storage and peripherals to complete Major Project • outsource appropriate expertise where necessary to complement personal practical skills

Students learn about:	Students learn to:
<ul style="list-style-type: none"> - special effects, eg: <ul style="list-style-type: none"> - twisting - zooming - rotating - slow motion - time lapse - distorting • synchronising sound • filters: <ul style="list-style-type: none"> - colour balance - brightness - contrast - blurring - morphing <p>Animation</p> <ul style="list-style-type: none"> • 2D animation <ul style="list-style-type: none"> - cel animation (stop motion, claymation) - path animation - behaviour animation - morphing and tweening - frame rates - transitions - looping • 3D animation <ul style="list-style-type: none"> - modelling - wire frame - rendering - morphing - warping - motion capture • virtual reality <ul style="list-style-type: none"> - simulators - walkthroughs - navigable scenes <p>World Wide Web (www)</p> <ul style="list-style-type: none"> • history and development <ul style="list-style-type: none"> - appropriate usage - targeted audience - age controls - censorship: <ul style="list-style-type: none"> - violence - sex - language • implications of the World Wide Web on multimedia design relating to: 	<ul style="list-style-type: none"> • identify and discuss animation requirements, scope of 2/3D animation software • evaluate the characteristics and features of a range of animation techniques • analyse and describe the technology associated with the World Wide Web

Students learn about:	Students learn to:
<p><i>Text</i></p> <ul style="list-style-type: none"> • font compatibility, font sets, font substitution • text as a graphic element • embedded text, eg: <ul style="list-style-type: none"> – open type – true type • cascading style sheets (CSS) • hyperlinks • scroll bars and buttons • drop-down lists • animated text: <ul style="list-style-type: none"> – scrolling – distorting • .pdf files <p><i>Graphics</i></p> <ul style="list-style-type: none"> • file size and compression, eg: <ul style="list-style-type: none"> – GIF – JPEG – PNG • progressive loading of images: <ul style="list-style-type: none"> – interlaced GIF – progressive JPEG • animated GIF • thumbnails <p><i>Sound</i></p> <ul style="list-style-type: none"> • sound quality • file size and compression • streaming • media players <p><i>Video</i></p> <ul style="list-style-type: none"> • video transfer: <ul style="list-style-type: none"> – hypertext transfer protocol (HTTP) – real-time streaming protocol (RTSP) • connection speed • web casting • buffering/streaming <p>Major Project</p> <ul style="list-style-type: none"> • appropriate software relevant to the Major Project in the areas of: <ul style="list-style-type: none"> – authoring – publishing – sound creation/capture/editing – image creation/capture/editing – video creation/capture/editing – text creation/capture/editing – animation creation/capture/editing – 2D/3D drawing • documentation <ul style="list-style-type: none"> – online help and manuals – user documentation 	<ul style="list-style-type: none"> • increase and update knowledge of the multimedia industry • discuss the impact of changing technology • solve problems through accessing and using online help and manuals • investigate and competently use a range of suitable software in the creation, editing and publishing of the Major Project • apply a wide range of industry terminology, techniques and processes • prepare documentation to support the development of the Major Project

Students learn about:	Students learn to:
<p>Intellectual property and ethics</p> <ul style="list-style-type: none"> • copyrights and multimedia • ethical use • ease of copying, manipulation and incorporating multimedia objects <ul style="list-style-type: none"> • OHS <ul style="list-style-type: none"> – workplace procedures – safe handling of equipment – risk identification and hazard reduction strategies 	<ul style="list-style-type: none"> • obtain, modify and use a range of pre-existing components • consider legal and ethical issues in the development of multimedia presentations • use computers, associated materials and accessories safely and responsibly • identify specific OHS issues associated with the production of the Major Project

Industry Related Manufacturing Technology

Focus Area: Timber Products and Furniture Technologies (Preliminary)

Students learn about:	Students learn to:
<p>Materials</p> <p><i>Timber and timber products</i></p> <ul style="list-style-type: none"> • structure: <ul style="list-style-type: none"> – sapwood – heartwood – earlywood – latewood – cambium layer – growth ring – pith – xylem and phloem – bark – photosynthesis • properties and characteristics of hardwoods or softwoods: <ul style="list-style-type: none"> – figure – grain direction – texture – colour – strength – durability – weight – hardness – weathering • timber industry terms relating to: <ul style="list-style-type: none"> – grade – sizes: <ul style="list-style-type: none"> - timber boards - manufactured boards • timber defects <ul style="list-style-type: none"> – splits – checks – warping – shakes – bowing – knots – twists and winds • manufactured boards, their manufacture, properties and use <ul style="list-style-type: none"> – plywoods – medium density fibreboards (MDF) – particle boards <p><i>Fittings and allied materials</i></p> <ul style="list-style-type: none"> • hardware <ul style="list-style-type: none"> – screws – nails 	<ul style="list-style-type: none"> • describe the growth of trees and identify and recognise the various parts of a tree • identify the properties of hardwoods and softwoods and apply them to practical projects • discuss the properties of hardwoods and softwoods and apply them to practical projects • discuss and use timber industry terms in relation to timber sizes and selection • identify the range of sizes of timber boards and manufactured boards and make economical use of them in practical projects • apply the properties of manufactured boards and use them in practical projects • describe the range of manufactured boards available • identify and select appropriate fittings and allied materials to use in practical projects

Students learn about:	Students learn to:
<ul style="list-style-type: none"> - nuts - bolts - knockdown fittings - hinges - handles - knobs - staples/staple guns • other materials <ul style="list-style-type: none"> - composite materials - glass - metal - polymers - upholstery materials - adhesives <p>Processes, tools and machinery</p> <p><i>Processes</i></p> <ul style="list-style-type: none"> • planning <ul style="list-style-type: none"> - sketches - working drawings - materials lists - calculations - costing • preparation of timber <ul style="list-style-type: none"> - dressing - thicknessing - face - edge • manufacture of individual components as part of a project: <ul style="list-style-type: none"> - legs - rails - drawers - doors - tops - panels • widening joints <ul style="list-style-type: none"> - dowelled butt - tongue and groove - rebate - groove and feather - biscuit • framing joints <ul style="list-style-type: none"> - mitre - halving joints - dowelled - box pin - mortise and tenon joints - bridle joints • carcass joints <ul style="list-style-type: none"> - rebate - scribed - dovetail - housing 	<ul style="list-style-type: none"> • use a broad range of processes through a variety of practical projects • identify and apply appropriate finishes to completed projects • use the appropriate industry processes, where possible, in the production of projects • discuss processes used in industry, appropriate to the practical activities being undertaken, which may not be possible in the school

Students learn about:	Students learn to:
<ul style="list-style-type: none"> • construction techniques, including: <ul style="list-style-type: none"> – sawing – drilling – edge treatments – nailing and screwing – sanding – scraping • other construction techniques <ul style="list-style-type: none"> – turning – carving – inlaying – marquetry – veneering – parquetry and intarsia – laminating – bending – routing • assembly of components, including: <ul style="list-style-type: none"> – test, fit and check joints – dry clamp – use of cramps – testing for square and flatness • finishing <ul style="list-style-type: none"> – preparation – staining – filling – oils – finishes (oil and water-based) – shellac – french polish – spray finishes <p>Tools and machinery</p> <ul style="list-style-type: none"> • the use and maintenance of the tools and machinery involved in the processes listed above 	<ul style="list-style-type: none"> • safely and competently use a wide a range of tools and machinery • conduct basic maintenance procedures on tools and machinery • describe tools and machinery used by industry, not available in the school, but appropriate to the practical activities being undertaken

Industry Related Manufacturing Technology

Focus Area: Timber Products and Furniture Technologies (HSC)

Students learn about:	Students learn to:
<p>Materials</p> <ul style="list-style-type: none"> • terminology associated with the timber industry • timber recovery and conversion <ul style="list-style-type: none"> – sawing: <ul style="list-style-type: none"> - live - quarter - back – flitches and burls – stability – seasoning: <ul style="list-style-type: none"> - air - kiln – equilibrium moisture content (EMC) • timber selection considerations <ul style="list-style-type: none"> – plantation timbers – exotic timbers – recycling/reusing timbers – ‘green’ timbers – economical usage/waste minimisation – environmental issues/pollution – sustainability – OHS issues • manufactured boards <ul style="list-style-type: none"> – construction and manufacture, veneers, plywood, particle board, fibre boards, block and lamiboards – glues – environmental/OHS issues <p><i>Fittings and allied materials</i></p> <ul style="list-style-type: none"> • hardware and fittings <ul style="list-style-type: none"> – screws – nails – nuts – bolts – knockdown fittings – hinges – handles – knobs 	<ul style="list-style-type: none"> • understand and use timber industry terms when selecting and using timber and timber products for the Major Project • describe how timber is recovered and converted into boards • select the most appropriate timber boards and apply them to the Major Projects • describe the considerations and issues related to selecting appropriate timbers for the Major Project • describe and apply principles of economical use, sustainability, plantation and ‘green’ timbers, minimising waste and pollution • apply the considerations and issues related to selecting appropriate timbers to the Major Project • describe the cutting of veneers • describe the manufacture of various boards • select and use the most appropriate manufactured boards • discuss the environmental issues related to the manufacture, use and disposal of manufactured boards • select and competently use the most appropriate hardware items in the Major Project

Students learn about:	Students learn to:
<ul style="list-style-type: none"> - staples/staple guns - drawer runners - table clips - latches - catches - shelf hangers <ul style="list-style-type: none"> • additional materials applied to timber and timber-based projects <ul style="list-style-type: none"> - glass - metal - polymers - upholstery materials - composite materials • adhesives: <ul style="list-style-type: none"> - PVA - epoxy resin - hot melt - urea-formaldehyde - resorcinol - contact <p>Processes, tools and machinery</p> <p><i>Processes</i></p> <ul style="list-style-type: none"> • planning <ul style="list-style-type: none"> - sketches - working drawings - materials lists - calculations - costing • preparation of timber <ul style="list-style-type: none"> - dressing - thickening - face - edge • manufacturing individual components as part of a project <ul style="list-style-type: none"> - legs - rails - drawers - doors - tops - panels • widening joints <ul style="list-style-type: none"> - dowelled butt - tongue and groove - rebate - groove and feather - biscuit 	<ul style="list-style-type: none"> • describe additional materials and their application in timber projects • competently use and justify the selection of the most appropriate additional materials in the Major Project • competently use and justify the selection of the most appropriate adhesives in the Major Project • plan the Major Project thoroughly before commencing construction, using appropriate planning techniques • identify and use appropriate preparation techniques for the Major Project • select and construct component parts of a project using appropriate techniques • select and construct appropriate widening joints for the Major Project

Students learn about:	Students learn to:
<ul style="list-style-type: none"> • framing joints <ul style="list-style-type: none"> – mitre – halving joints – dowelled – box pin – mortise and tenon joints – bridle joints • carcass joints <ul style="list-style-type: none"> – rebate – scribed – dovetail – housing • construction techniques, including: <ul style="list-style-type: none"> – sawing – drilling – edge treatments – nailing and screwing – sanding – scraping • other construction techniques <ul style="list-style-type: none"> – turning – carving – inlaying – marquetry – veneering – parquetry and intarsia – laminating – bending – routing • construction techniques using manufactured boards <ul style="list-style-type: none"> – economical sheet layout – cutting sheet material – handling sheet material – assembly of components • assembly of components, including: <ul style="list-style-type: none"> – test, fit and check joints – dry clamp – use of cramps – testing for square and flatness • finishing <ul style="list-style-type: none"> – preparation, staining, filling, oils, finishes (oil and water-based), shellac, french polish, spray finishes – environmental issues associated with finishing – industrial processes 	<ul style="list-style-type: none"> • select and construct appropriate framing joints for the Major Project • select and construct appropriate carcass joints for the Major Project • select and use construction techniques appropriate for timber projects • identify, select and use other techniques to construct the Major Project as appropriate • select and use construction techniques appropriate for manufactured boards • describe and sketch different parts of the assembly process and explain their importance • select and apply assembly techniques suitable to the Major Project • select and apply finishing techniques suitable to the Major Project as appropriate • identify the environmental issues relating to the use, application and cleaning up of finishes

Students learn about:	Students learn to:
<p>Tools and machinery</p> <ul style="list-style-type: none"> • the use and maintenance of the tools and machinery involved in the processes listed above • tools and machinery used in industry that are not available in the school 	<ul style="list-style-type: none"> • use appropriate machines to complete the Major Project • use tools and machinery safely and correctly • recognise the need for, and perform, maintenance procedures on tools and machinery as required • describe tools and machinery used by industry, not available in the school, but appropriate to the Major Project • outsource appropriate expertise where necessary to complement personal practical skills to complete the Major Project

10 Course Requirements

The course requirements are:

- a Preliminary and HSC course, each of 120 hours indicative time.
- exclusions exist between Industrial Technology and some Vocational Education and Training Curriculum Frameworks, and some Content Endorsed Courses. For details of these exclusions refer to the current ACE Manual.

The Preliminary course, of 120 indicative hours, consists of project work and an industry study that provide a broad range of skills and knowledge related to the focus area chosen and an introduction to industrial processes and practices.

The HSC course, of 120 indicative hours, consists of the development of a Major Project and industry study.

Students choose to study ONE of SIX focus areas. The same area is to be studied in both the Preliminary and HSC courses. The focus areas are:

- Automotive Technologies
- Electronics Technologies
- Graphics Technologies
- Metal and Engineering Technologies
- Multimedia Technologies
- Timber Products and Furniture Technologies.

Both the Preliminary and HSC courses are organised around four sections:

- A. Industry Study
- B. Design, Management and Communication
- C. Production
- D. Industry Related Manufacturing Technology

11 Post-school Opportunities

The study of Industrial Technology Stage 6 provides students with knowledge, understanding and skills that form a valuable foundation for a range of courses at university and other tertiary institutions.

In addition, the study of Industrial Technology Stage 6 assists students to prepare for employment and full and active participation as citizens. In particular, there are opportunities for students to gain recognition in vocational education and training. Teachers and students should be aware of these opportunities.

11.1 Recognition of Student Achievement in Vocational Education and Training (VET)

Wherever appropriate, the skills and knowledge acquired by students in their study of HSC courses should be recognised by industry and training organisations. Recognition of student achievement means that students who have satisfactorily

completed HSC courses will not be required to repeat their learning in courses in TAFE NSW or other Registered Training Organisations (RTOs).

Registered Training Organisations, such as TAFE NSW, provide industry training and issue qualifications within the Australian Qualifications Framework.

The degree of recognition available to students in each subject is based on the similarity of outcomes between HSC courses and industry training packages endorsed within the Australian Qualifications Framework (AQF). Training packages are documents that link an industry's competency standards to AQF qualifications. More information about industry training packages can be found on the National Training Information Service (NTIS) website (www.ntis.gov.au).

Recognition by TAFE NSW

TAFE NSW conducts courses in a wide range of industry areas, as outlined each year in the TAFE NSW Handbook. Under current arrangements, the recognition available to students of Industrial Technology in relevant courses conducted by TAFE is described in the HSC/TAFE Credit Transfer Guide. This guide is produced by the Board of Studies and TAFE NSW and is distributed annually to all schools and colleges. Teachers should refer to this guide and be aware of the recognition available to their students through the study of Industrial Technology Stage 6. This information can be found on the TAFE NSW website (www.tafensw.edu.au/mchoice).

Recognition by other Registered Training Organisations

Students may also negotiate recognition into a training package qualification with another Registered Training Organisation. Each student will need to provide the RTO with evidence of satisfactory achievement in Industrial Technology Stage 6 so that the degree of recognition available can be determined.

12 Assessment and Reporting

PLEASE NOTE

The assessment and HSC examination requirements detailed in this syllabus refer to the 2009 HSC. *New Assessment and Reporting* information will apply to this syllabus for the 2010 HSC and beyond.

12.1 Requirements and Advice

The information in this section of the syllabus relates to the Board of Studies' requirements for assessing and reporting achievement in the Preliminary and HSC courses for the Higher School Certificate.

Assessment is the process of gathering information and making judgements about student achievement for a variety of purposes.

In the Preliminary and HSC courses those purposes include:

- assisting student learning
- evaluating and improving teaching and learning programs
- providing evidence of satisfactory achievement and completion in the Preliminary course
- providing the Higher School Certificate results.

Reporting refers to the Higher School Certificate documents that are used by the Board to report to students both the internal and external measures of achievement.

Higher School Certificate results comprise:

- an assessment mark derived from the mark submitted by the school and produced in accordance with the Board's requirements for the internal assessment program
- an examination mark derived from the HSC external examinations
- an HSC mark, which is the average of the assessment mark and the examination mark
- a performance band, determined by the HSC mark.

Results will be reported using a course report containing a performance scale with bands describing standards of achievement in the course.

The use of both internal assessment and external examination of student achievement allows measurements and observations to be made at several points and in different ways throughout the HSC Industrial Technology course. Taken together, the external examination and internal assessment marks provide a valid and reliable assessment of the achievement of the knowledge, understanding and skills described for each course.

The Board of Studies uses a standards-referenced approach to assessing and reporting student achievement in the Higher School Certificate.

The standards in the HSC are:

- the knowledge, skills and understanding expected to be learnt by students – the *syllabus standards*
- the levels of achievement of the knowledge, skills and understanding – the *performance standards*.

Both *syllabus standards* and *performance standards* are based on the aims, objectives, outcomes and content of a course. Together they specify what is to be learnt and how well it is to be achieved.

Teacher understanding of standards comes from the set of aims, objectives, outcomes and content in each syllabus together with:

- the performance descriptions that summarise the different levels of performance of the course outcomes
- HSC examination papers and marking guidelines
- samples of students' achievement, collected in the Standards Packages.

12.2 Internal Assessment

The internal assessment mark submitted by the school will provide a summation of each student's achievements measured at points throughout the course. The marks for each course group at a school should reflect the rank order of students and relative differences between students' achievements.

Internal assessment provides a measure of a student's achievement based on a wider range of syllabus content and outcomes than may be covered by the external examination alone. The assessment components and weightings to be applied to internal assessment are identified on pages 60–61. They ensure a common focus for internal assessment in the course across schools, while allowing for flexibility in the design of tasks. A variety of tasks should be used to give students the opportunity to demonstrate outcomes in different ways and to improve the validity and reliability of the assessment.

12.3 External Examinations

In Industrial Technology Stage 6, the external examinations consist of a written examination and a Major Project. The specifications for the HSC examination in Industrial Technology are on pages 62–64.

The external examination provides a measure of student achievement in a range of syllabus outcomes that can be reliably measured in an examination setting.

The external examination and its marking and reporting will relate to syllabus standards by:

- providing clear links to syllabus outcomes
- enabling students to demonstrate the levels of achievement outlined in the course performance scale
- applying marking guidelines based on established criteria.

12.4 Board Requirements for the Internal Assessment Mark in Board Developed Courses

The Board requires schools to submit an assessment mark for each candidate in the HSC Industrial Technology course. The Board requires that the assessment tasks used to determine the internal assessment mark must comply with the components and weightings specified in the table on page 61.

The collection of information for the HSC internal assessment mark must not begin prior to the completion of the Preliminary course.

Schools are required to develop an internal assessment program that:

- specifies the various assessment tasks and the weightings allocated to each task
- provides a schedule of the tasks designed for the whole course.

The standards-referenced approach to assessment for the HSC involves schools ensuring that in the design and marking of tasks:

- assessment tasks are designed to focus on outcomes
- the types of assessment tasks are appropriate for the outcomes being assessed
- students are given the opportunity to demonstrate their level of achievement of the outcomes in a range of different task types
- tasks reflect the weightings and components specified in the relevant syllabus
- students know the assessment criteria before they begin a task
- marking guidelines for each task are linked to the standards by including the wording of syllabus outcomes and relevant performance descriptions
- marks earned on individual tasks are expressed on a scale sufficiently wide to reflect adequately the relative differences in student performances.

In feedback and reporting:

- students receive meaningful feedback about what they are able to do and what they need to do in order to improve their level of performance
- the ranking and relative differences between students result from different levels of achievement of the specified standards
- marks submitted to the Board for each course are on a scale sufficiently wide to reflect adequately the relative differences in student performances.

Note that:

- measures of objectives and outcomes that address values and attitudes should not be included in school-based assessments of students' achievements. As these objectives are important elements of any course, schools may decide to report on them separately to students and parents, perhaps using some form of descriptive statements
- measures that reflect student conduct should not be included.

12.5 Assessment Components, Weightings and Tasks

Assessment should include a range of tasks.

Preliminary Course

The suggested components, weightings and tasks for the Preliminary course are set out below.

Component	Weighting	Tasks might include:
Industry Study	15	Tasks might include: <ul style="list-style-type: none"> • research • industry report • partial design, management report • tests • measuring and costing activities • working drawings • folio presentation • written test • practical skills test • research relevant industrial processes
Design	10	
Management and Communication	20	
Production	40	
Industry Related Manufacturing Technology	15	
Total	100	

There should be a balance between the assessment of:

- knowledge and understanding outcomes and course content
and
- skills outcomes and course content.

HSC Course

The internal assessment mark for Industrial Technology Stage 6 is to be based on the HSC course only. Final assessment should be based on a range and balance of assessment instruments. Aspects of the Major Project that are used for school-based assessment should not use the HSC examination marking criteria for internal assessment.

Component	Weighting	Tasks might include
Industry Study	15	Tasks might include: <ul style="list-style-type: none"> • broad industry report • document research activities relevant to folio development • research and application of a range of processes and technologies to the development of the Major Project
Major Project	60	
Industry Related Manufacturing Technology	25	
Total	100	

There should be a balance between the assessment of:

- knowledge and understanding outcomes and course content
and
- skills outcomes and content.

One task may be used to assess several components. It is suggested that 3–5 tasks are sufficient to assess the HSC course outcomes.

12.6 HSC External Examination Specifications

Industrial Technology Stage 6

The examination will consist of a written paper worth 40% and a Major Project worth 60%.

Written Paper (40 marks)

Time allowed: 1 hour and 30 minutes (plus 5 minutes reading time)

- There will be a separate written paper for each of the SIX Industry Focus Areas.

The written paper will consist of THREE sections: Section I, Section II and Section III.

Section I (10 marks)

- There will be objective response questions to the value of 10 marks.
- Questions will be based on the Industry Related Manufacturing Technology section of syllabus and will be specific to the focus area studied.

Section II (15 marks)

- There will be short-answer questions.
- The questions in this section will be specific to the focus area studied.

Section III (15 marks)

- There will be an extended response question.
- The question will be based on the Industry Study section of the syllabus.
- This question will be common to all SIX written examination papers.

The Major Project (60 marks)

The Major Project is the principal means of examining the outcomes of the HSC course, including the content of the candidate's identified focus area.

Each candidate must present a Major Project consisting of a product and an accompanying management folio, which will be examined in conjunction with one another by Board of Studies appointed examiners.

The Major Project must be completed by a date to be notified annually by the Office of the Board of Studies. It is not to be commenced until the beginning of the HSC course.

The Major Project:

- (i) may consist of one or more related items and must be individually produced by the candidate. Group projects are not permitted
- (ii) must be certified on the appropriate form, provided by the Board of Studies, as the original work of the candidate and be identifiable only through the candidate and centre numbers
- (iii) may have parts completed by the candidate externally to the school. These must be monitored by the supervising teacher and documented in the folio to ensure certification as to being the original work of the candidate.

Any aspect of the Major Project undertaken by other persons or agencies must be documented in the folio. Candidates will not be given credit for work completed by others

- (iv) must include evidence of the range and depth of skills and knowledge developed in the course
- (v) may incorporate materials, processes and components drawn from other focus areas where appropriate
- (vi) must include a management folio where the use of computer software applications is evident.

The management folio will document the development of the project. Included in the folio will be a statement of intent and details relating to design, planning, management, workplace communication and evidence of skills and knowledge associated with the focus areas.

The examiners have the right to call for a demonstration of particular aspects of the Major Project. This must be provided by a person other than the candidate responsible for the Major Project.

Major Project Examination Criteria

The Major Project consists of a product and a folio, which will be examined in conjunction with one another. The criteria for examining the Major Project are shown below:

Marks	Criteria	Description
20	Design	<ul style="list-style-type: none"> • statement of intent • research • development of ideas • selection and justification of materials, components, processes and other resources
	Management and communication	Documentation of the Major Project from conception to completion, including: <ul style="list-style-type: none"> • timeline plan – projected order of production and estimate of time allocation • finance plan – projected cost of materials and services (if applicable) • use of appropriate industrial processes and equipment • evidence of safe working practices and OHS issues • evidence of ongoing evaluation • appropriateness of design and/or design modification • student's evaluation of the Major Project and its relationship to the statement of intent • evidence of a range of communication techniques • evidence of a range of computer applications, for example, word processing, spreadsheets, CAD, multimedia
40	Production	<ul style="list-style-type: none"> • quality of the product • evidence of a range of skills • degree of difficulty • links between planning and production • evidence of industrial processes • use of appropriate materials • use of industrial technologies • evidence of solutions to problems in production

12.7 Summary of Internal and External Assessment

External Assessment	Weighting	Internal Assessment	Weighting
Written examination based on: <ul style="list-style-type: none"> • Industry Related Manufacturing Technology • Industry Study 	40	Industry Study	15
		Major Project and accompanying management folio	60
		Industry Related Manufacturing Technology	25
The Major Project – a product and accompanying management folio	60		
	100		100

12.8 Reporting Student Performance against Standards

Student performance in an HSC course will be reported against standards on a course report. The course report contains a performance scale for the course describing levels (bands) of achievement, an HSC examination mark and the internal assessment mark. It will also show, graphically, the statewide distribution of examination marks of all students in the course.

Each band on the performance scale (except for band 1), includes descriptions that summarise the attainments typically demonstrated in that band.

The distribution of marks will be determined by students' performances against the standards and not scaled to a predetermined pattern of marks.