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**Stage 1 and Stage 2**

**Design, Technology and Engineering Implementation**

**Workshop Booklet**

**2019**

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SACE Subject Renewal Principles

The SACE subject renewal process is guided by the following principles:

* Quality learning
* Engagement
* Innovation
* Quality assessment
* Manageability

Quality Learning

Worthwhile learning that is relevant and contemporary, and enables students to learn in contexts that are of interest to them. Quality learning connects subject knowledge with current social, economic and environmental issues, and global perspectives in meaningful ways. It provides opportunities for students to develop higher order thinking skills, including analysis, synthesis and evaluation that enable them to adapt and apply learning across subjects and in future pathways.

Engagement

Subjects are developed in flexible and responsive ways to accommodate the diversity of learners and the different learning styles of students in productive and interesting ways. This will support students to personalise their learning, and develop their knowledge and skills expertise in ways that reflect the diversity in their life experiences and cultures. Through the capabilities, students develop knowledge, skills and understanding for success in the SACE and future pathways.

Innovation

Students develop critical, creative and innovative thinking skills for learning at school, and in training and work. Students learn to research and evaluate information in coherent ways, and to use this information to build knowledge and generate ideas in innovative ways. Students identify problems or needs, then work collaboratively to create an innovative solution. Students learn with and through technology, using it as a source to access information and as a learning tool, and to show evidence of their learning.

Quality Assessment

Quality assessment includes school and external assessment that is fit for purpose, where assessment design leads to assessments that are valid, reliable and fair. It assesses knowledge, skills and capabilities in the context of student learning in a subject. Assessment that is valid and reliable generates evidence that reflects the importance of the SACE capabilities, knowledge expertise, and relevant and transferrable skills. Quality assessment values diversity of assessment types and formats, within and across subjects, and assessment that is meaningful to learning. In the case of examinations, careful design ensures that questions assess what the learning is in a subject. This makes certain that knowledge, skills, understanding and, capabilities are assessed in ways relevant and appropriate to the subject context.

Manageability

Manageability of assessment ensures student workload in learning and assessment is accessible and achievable across subjects. It values time for students to engage in deep learning, develop and apply their capabilities, and provide evidence of their engagement in ways that connect to their learning. Assessment is manageable in a variety of formats, including digital, online and electronic environments, and schools have the capacity to process students’ evidence of learning.

Stage 1

Design, Technology and Engineering

**LEARNING REQUIREMENTS**

The learning requirements summarise the knowledge, skills, and understanding that students are expected to develop and demonstrate through their learning in Stage 1 Design, Technology and Engineering.

In this subject, students engage in the **Design and Realisation Process** and are expected to:

1. review design features, processes, materials, and production techniques and apply creative thinking to the design of a solution
2. plan and develop design concepts and communicate potential features and solutions to a problem or challenge
3. apply knowledge and understanding of skills, engineering procedures, and techniques using technology to realise the solution
4. evaluate processes used in design development and realisation of the solution
5. research and discuss ethical, legal, economic and/or sustainability issues related to technology, materials selected, processes used and/or solution design

Stage 1 Assessment Design Criteria and Specific Features

Investigation and Analysis

The specific features are as follows:

I1 Review the design features of products, processes, materials, systems and/or production techniques.

I2 Research and discuss ethical, legal, economic and/or sustainability issues.

Design Development and Planning

The specific features are as follows:

D1 Communicate design concepts using technical language.

D2 Plan and develop design concepts and procedures.

Production

The specific features are as follows:

P1 Application of skills, processes, procedures and techniques to create a solution.

P2 Development of solutions to technical problems that arise during the solution realisation.

Evaluation

The specific features are as follows:

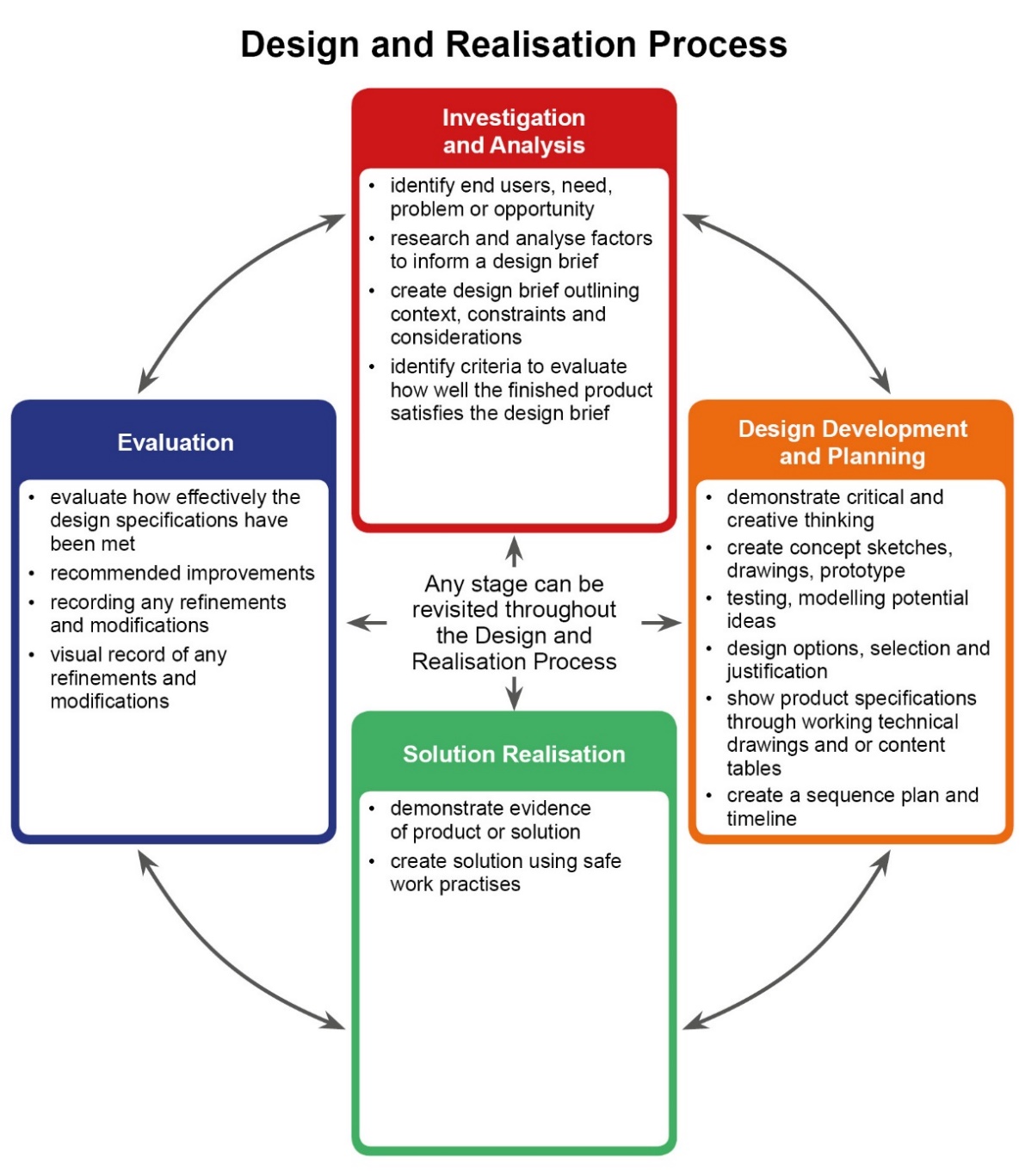
E1 Evaluation of the solution features and realisation process.

| Performance Standards for Stage 1 Design, Technology and Engineering | | | | |
| --- | --- | --- | --- | --- |
| Investigation and Analysis | Design Development and Planning | Production | Evaluation |
| Comprehensive and thoughtful review of the design features of products, processes, materials, systems and/or production techniques  Planned and thorough research and analysis of ethical, legal, economic and/or sustainability issues | Polished and comprehensive communication of design concepts using relevant technical language  Insightful planning and development of design concepts and procedures | Highly proficient application of skills, processes, procedures and techniques to create a solution  Comprehensive development of solutions to technical problems that arise during the solution realisation | Comprehensive and insightful evaluation of the solution features and realisation process |
| Logical and well-considered review of the design features of products, processes, materials, systems and/or production techniques  Detailed and considered research and analysis of ethical, legal, economic and/or sustainability issues | Thoughtful and well-considered communication of design concepts using relevant technical language  Well-considered planning and development of design concepts and procedures | Proficient application of skills, processes, procedures and techniques to create a solution  Thoughtful development of solutions to technical problems that arise during the solution realisation | Well-informed and detailed evaluation of the solution features and realisation process |
| Informed review of the design features of products, processes, materials, systems and/or production techniques  Research and discussion of ethical, legal, economic and/or sustainability issues | Clear communication of design concepts using technical language  Competent planning and development of design concepts and procedures | Competent application of skills, processes, procedures and techniques to create a solution  Development of solutions to technical problems that arise during the solution realisation | Considered evaluation of the solution features and realisation process |
| Identification of the design features of products, processes, materials, systems and/or production techniques  Some description of information about ethical, legal, economic and/or sustainability issues | Basic communication of design concepts using some technical language  Some planning and development of design concepts and/or procedures | Basic application of some skills, processes, procedures and techniques to create a solution  Some endeavour to develop solutions to technical problems that arise during the solution realisation | Some description of the solution features and realisation process |
| Attempted identification of the design features of products, processes, materials, systems and/or production techniques  Some accessing of information about ethical, legal, economic and/or sustainability issues | Superficial and simplistic communication of design concepts  Limited use of information to plan design concepts | Limited application of emerging skills  Attempted development of a solution to a technical problem | Emerging recognition of the solution features and realisation process |

Content

The Design and Realisation Process

The design and realisation process is a flexible framework and forms the structure of the subject. The following are components of a coherent and dynamic design progression. This process is rarely linear, and designing should be seen as cyclical with many possible solutions, rather than a simple step by step process.



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Investigation and Analysis

The design and realisation process should begin with the identification of a problem or opportunity followed by an initial investigation and research analysis. The creation of a design brief should specify constraints, considerations and propose creative and innovative solutions. Students define criteria to evaluate how well the finished solution meets the requirements of the design brief.

Possible investigation and analysis strategies or techniques may include, for example:

* collaborate with peers to use visual tools e.g. mind mapping to explore concepts, problems or opportunities
* investigating and interpreting solution design factors such as:
* technologies- tools, processes and manufacturing methods
* materials – characteristics and properties
* legal responsibilities- patents, safety requirements, intellectual property, creative commons
* economic considerations – time and cost
* sustainability – life cycle analysis, fair trade, customs, carbon footprint, environmental impact
* ethical application of the end product
* innovation and creativity- inventing or improving products
* target audience, end user and potential for entrepreneurship and marketing.

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* creating a written or multimodal design brief that includes key criteria and/or constraints such as function and/or aesthetics
* analysing existing product or system characteristics and features to inform the design and realisation process
* collecting and analysing data from target or end point users for a purpose e.g. survey, questionnaire
* researching and analysing ideas from different contexts such as the manufacturing sector or emerging technologies
* researching historical design, period influences or different cultural traditions
* acknowledging and correctly referencing sources of information and ideas
* conducting peer review and collecting feedback about the design brief
* critically analyse sources of information for reliability and validity.

Design Development and Planning

Another component of the design and realisation process is design development and planning in response to an established brief. This involves innovation, invention, iteration and creativity to develop a solution for a problem or opportunity. Students document their design ideas and make plans to use the available resources such as time, materials and technologies to realise the solution. They test, adapt and validate the design prior to realisation.

Possible design development and planning strategies or techniques may include, for example:

* use critical and creative thinking to devise a solution
* use ideation strategies such as adapting, modifying, substituting or rearranging to improve the solution
* creating a design brief showing specific aspects of the design development and planning
* creating working drawings, concept sketches, prototypes, story boards, flow charts, simulation or 3D modelling
* working collaboratively, face to face or online to develop imaginative, innovative, and enterprising outcomes e.g. with peers, industry, tertiary education or community
* applying interdisciplinary concepts e.g. artistic, scientific, mathematical and engineering concepts appropriate to the planning and designing of the product or system
* preparing timelines and procedures using visual organisers such as Gantt charts and tables showing sequencing

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* conducting and recording the results of testing ( e.g. photo essay, video, result tables, annotated images) of possible materials and processes through experimentation, trial and error or applying secondary research
* use critical and creative thinking to adapt the design development in response to results of testing and research
* justifying design solutions based on investigations and research analysis
* creating a table, chart or diagram to define product specifications eg measurement, materials to be used, processes required.
* applying the scientific method to the design and construction processes of the solution e.g. testing material characteristics or suitability
* using relevant digital technologies to communicate design intent.

Solution realisation

This component (stage) of the design and realisation process involves realising a solution. A solution is the outcome of applying technological skills to meet the requirements of a design and realisation brief.

A solution in this subject is an outcome of the design and realisation process in relation to the chosen context. A solution could be fully realised or a model, prototype, system, part, process (i.e. procedures to output a product) or product

Possible solution realisation strategies or techniques may include, for example:

* using appropriate processes and production techniques
* creating solutions to the planned design specifications
* developing practical and technological skills and applying them to a range of applications
* developing solutions to technical and engineering problems that may arise during realisation such as accuracy of machinery, quality of materials and components, understanding of software programs
* apply appropriate safety processes including physical and online environments.

Evaluation

The evaluation component of the design and realisation process involves judging the quality of the product against the criteria specified in the design brief and recommending improvements.

Possible evaluation strategies or techniques may include, for example:

* evaluating, individually and/or collaboratively, how effectively the requirements of the design brief specifications have been met
* reviewing criteria, standards, reliability, safety, quality, and cost-effectiveness
* reflecting on the solution to recommend modifying or redeveloping designs or ideas
* reflecting on the effectiveness of procedures used in the design and realisation process
* reflecting on personal learning e.g. project management, practical skills, capabilities
* testing of solution with end point users and recording feedback in written or multimodal form
* collecting feedback from peers or industry evaluation of the solution
* evaluating potential publishing or entrepreneurship opportunities e.g. patents, marketing and distribution, mass production, online publishing, crowd sourcing.
* evaluating the ethical, legal, economic and/or sustainability issues related to the product or solution.

Contexts

Stage 1 Design, Technology and Engineering is organised into four contexts: digital communication solutions, industry and entrepreneurial solutions, material solutions and robotic and electronic systems.

The contexts provide opportunities to develop design thinking, to investigate engineering solutions, to develop a plan, realise the solution and evaluate the outcome. The context is chosen by the school to meet student needs and interests, taking into account the resources available.

Each of these contexts: digital communication solutions, industry and entrepreneurial solutions, material solutions and robotic and electronic systems provides a separate enrolment option for students.

Digital Communication Solutions

This context involves using symbols, signs, behaviour, speech, light, images, sound, or other data to design and make products that communicate information. Students produce outcomes that demonstrate the knowledge and skills associated with manipulation of digital communication media.

Examples of contexts for digital solutions include:

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* graphics
* multimedia
* photography
* sound
* web design
* film making
* digital animation
* CAD / CAM
* App development.

Industry and Entrepreneurial Solutions

This context involves the designing of solutions to meet industry requirements or to invent an entrepreneurial product that meets a need or solves a problem. This could be achieved using design programs, such as computer aided design, to develop prototypes or products. Students demonstrate knowledge and skills associated with systems, processes and materials appropriate for the prototype and final solution.

Examples of contexts for Industry or entrepreneurial design solutions include:

* architecture
* construction
* transport (e.g. automotive)
* agricultural equipment
* fashion industry
* health and aged care equipment
* maritime equipment
* aerospace
* food industry
* product design
* media, entertainment and music industries

Material Solutions

This context involves the use of a diverse range of manufacturing technologies such as tools, machines, and/or systems to create a product using appropriate materials. Students produce outcomes that demonstrate the knowledge and skills associated with using systems, processes, and materials such as metals, plastics, wood, composites, ceramics, textiles, and foods.

Examples of contexts for material solutions include:

* timber
* metals
* jewellery manufacturing
* clothing and textiles
* food

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* polymers
* composite materials.

Robotic and Electronic Systems

In this context, students can use a variety of hardware (components) which may be combined with software to design and realise a solution such as a device or system. Students produce outcomes that demonstrate the knowledge and skills associated with using electronic, mechatronic, electrical or pneumatic systems. These can include electronic components, circuit design and assembly, robotic components, programming, wiring, gears, simulation or systems integration.

The solutions could be purely hardware, for example an electronic circuit, or a combination of hardware (components) and software (code).

Examples of contexts for electronic and robotic systems include:

* robotics (building a programmed, autonomous or remote controlled robot)
* electronic systems (including microcontroller boards such as Arduino and Picaxe)
* electronic circuits (Printed Circuit Boards)
* Internet of Things (IoT) – web connected sensors and devices (e.g. NodeMCU, WeMos, Raspberry Pi, etc.)
* electrical systems
* communication systems (e.g. radio telemetry, Bluetooth, etc)
* automated systems (e.g. Programmable Logic Controllers)
* renewable energy systems (eg. solar, wind, battery storage)
* autonomous vehicles (e.g. model robot cars)
* biomedical engineering
* mechanical systems (e.g. using a variety of gear mechanisms)
* pneumatic, hydraulic, or fluidic systems.

Stage 1 Assessment Overview

|  |  |  |
| --- | --- | --- |
| Stage1 | Assessment Type 1: Specialised Skills Task | Assessment Type 2: Design Process and Solution |
| 10 Credit  Three assessments  Each assessment type should have a weighting of at least 20 % | Students undertake one or more specialised skills tasks   * Evidence for each task presented should be completed in multimodal form to a maximum of three minutes. | Students undertake one Design process and solution task consisting of two parts;  Part 1 - Design development  Part 2 - Solution realisation   * The evidence for the design development should be a maximum of 1000 words if written or six minutes of recorded oral communication, or the equivalent in multimodal form. * The evidence for the solution realisation should be a maximum of 500 words if written or three minutes of recorded oral communication, or the equivalent in multimodal form. |
| 20 credit  Up to six assessments  Each assessment type should have a weighting of at least 20 % | Students undertake two or more specialised skills tasks   * Evidence for each task presented should be completed in multimodal form to a maximum of three minutes. | For a 20-credit subject, students create one or more design process tasks.   * For a 20-credit subject, the combined evidence for Assessment Type 2 should be a maximum of 3000 words if written or a maximum of 18 minutes of recorded oral communication, or the equivalent in multimodal form. |
| Assessment description | Students develop knowledge and skills through specialised skills tasks. They apply the skills, processes and techniques in the related context. This informs the design development for a solution in Assessment Type 2. Students evaluate and assess the development of their own skills in this assessment task. They review how these processes and techniques may influence their solution.  Students and teachers negotiate whether it would be appropriate to demonstrate these processes and techniques in a single session, or over a more extended period of time. This assessment could consist of one activity or a series of activities | Part 1 - Design development  Students show evidence of key design phases of investigation and analysis, design development and planning. This could be completed individually or as part of a collaborative task.  Part 2 - Solution realisation  Students create and evaluate the solution. The student provides evidence of the solution in the form of images or a video recording and evaluates the completed solution. Students should evaluate how well the requirements of the design brief have been met including what worked well, what did not go according to plan, and what was learnt. Students consider possible modifications to improve the outcome, and discuss how the solution is to be used. |



# Pre-approved Learning and Assessment Plan

Stage 1 Digital Communication Solutions

Pre-approved learning and assessment plans are for *school use only*.

* Teachers may make changes to the plan, retaining alignment with the subject outline.
* The principal or delegate endorses the use of the plan, and any changes made to it, including use of an addendum.
* The plan does not need to be submitted to the SACE Board for approval.

|  |  |  |  |
| --- | --- | --- | --- |
| School |  | Teacher(s) |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SACE school code | | |  | Year |  | Enrolment code | | | | |  | Program variant code (A–W) |
| Stage | Subject code | | | No. of credits (10 or 20) |
|  |  |  |  | **1** | **D** | **C** | **S** | **10** |  |

Addendum – changes made to the pre-approved learning and assessment plan

|  |
| --- |
| Describe any changes made to the pre-approved learning and assessment plan to support students to be successful in meeting the requirements of the subject. In your description, please explain:   * what changes have been made to the plan * the rationale for making the changes * whether these changes have been made for all students, or for individuals within the student group. |

**Endorsement**

The use of the learning and assessment plan is approved for use in the school. Any changes made to the plan support student achievement of the performance standards and retain alignment with the subject outline.

|  |  |  |  |
| --- | --- | --- | --- |
| Signature of principal or delegate |  | Date |  |

Stage 1 Digital Communication Solution (10-credits)

Assessment overview

The table below provides details of the planned tasks and shows where students have the opportunity to provide evidence for each of the specific features of all of the assessment design criteria.

Assessment Type 1:Specialised Skills Tasks

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Assessment details** | **Assessment design criteria** | | | | **Assessment conditions** (e.g. task type, word length, time allocated, supervision) |
| **I** | **D** | **P** | **E** |
| Digital Photography processing  Students demonstrate a range of skills in digital photography processing (e.g. use of camera RAW, manual settings – f stop; ISO; shutter speed, selection of lenses, contrast and curve adjustments, exposure adjustments, white balance, composition element). Students produce a contact sheet containing 10 images and then choose 6 of those images to produce as postcard prints. Students present images in multimodal form using appropriate technical language to explain processes, procedures and techniques used and any solutions to problems encountered. |  |  | 1, 2 | 1 | This task should be presented in multimodal form to a maximum of three minutes |
| Digital media manipulation  Using software available, investigate four different manipulation tools that alter or enhance images for use in an advertising campaign nominated by or negotiated with the teacher. Provide evidence of before and after digital manipulated images, outlining the skills and techniques used. Reflect on any problems encountered using the technical language of the software program. |  |  | 1, 2 | 1 | This task should be presented in multimodal form to a maximum of three minutes |

Assessment Type 2: Design Process and Product

| Assessment details | Assessment design criteria | | | | Assessment conditions  (e.g. task type, word length, time allocated, supervision) |
| --- | --- | --- | --- | --- | --- |
| I | D | P | E |
| Students produce a series of 4-25x20 cm photographs based on a selected theme. They produce a product record that has two parts.  **Part 1- Design development**  Students show evidence of key design phases:  ***investigation and analysis***  Students create a design brief   * outlining context, constraints and considerations identifying end-users needs, problems or opportunities. * research and analyse factors to inform design brief reviewing existing products, processes or techniques including printing options, and presentation techniques. * research and analyse an ethical, legal, economic or sustainability issue related to their design brief.   Students need to identify criteria to evaluate how well the finished product satisfies the design brief.  ***design development and planning***.  Students develop at least three design options for the brief and justify the selection. They show a sequence plan or timeline to undertake the product realisation to a maximum of one page using a table, Gantt or spreadsheet format. Any product specifications may be included. | 1, 2 | 1, 2 |  |  | The evidence for the design development should be a maximum of 1000 words if written or six minutes of recorded oral communication, or the equivalent in multimodal form. |
| **Part 2 – Solution realisation**  Students create and evaluate the solution. The student provides evidence of the solution in the form of images or a video recording and evaluates the completed solution. Students include:   * the final prints * a minimum of four prints that are rejected and reasons annotated * analysis of the final product and solution features (evaluate how well the requirements of the design brief have been met including what worked well, what did not go according to plan, and what was learnt.) * reflection on the effectiveness of the realisation process (this can include possible modifications to improve the outcome, and discuss how the solution is to be used.) |  |  | 1, 2 | 1 | The evidence for the solution realisation task should be a maximum of 500 words if written or three minutes of recorded oral communication, or the equivalent in multimodal form. |

*Four assessments. Please refer to the Stage 1 Design, Technology, and Engineering subject outline.*

Stage 2

Design, Technology and Engineering

**LEARNING REQUIREMENTS**

The learning requirements summarise the knowledge, skills, and understanding that students are expected to develop and demonstrate through their learning in Stage 2 Design, Technology and Engineering.

In this subject, students engage in the Design and Realisation Process and are expected to:

1. investigate and analyse design features, processes, materials, and production techniques and apply creative thinking to the design of a solution

2. plan, develop and test design concepts and communicate potential features and solutions to a problem or challenge

3. apply knowledge and understanding of skills, processes, engineering procedures, and techniques using technology to realise the solution

4. evaluate the solution with reference to the design brief and reflect on processes used in design development and realisation

5. analyse ethical, legal, economic and/or sustainability issues related to technology, materials selected, processes used and/or solution design.

Assessment Design Criteria and Specific Features

Investigation and Analysis

The specific features are as follows:

I1 Analyse the design features of products, processes, materials, systems and/or production techniques.

I2 Analyse ethical, legal, economic and/or sustainability issues related to a solution.

Design Development and Planning

The specific features are as follows:

D1 Communicate design concepts using technical language and visual representations.

D2 Plan, develop, test and validate concepts and procedures.

Production

The specific features are as follows:

P1 Application of skills, processes, procedures and techniques to create a solution.

P2 Development of solutions to technical problems or recommendations for improvement.

Evaluation

The specific features are as follows:

E1 Evaluation of the solution features and realisation process.

| - | Investigation and Analysis | Design Development and Planning | Production | Evaluation |
| --- | --- | --- | --- | --- |
| A | Comprehensive and insightful analysis of the design features of products, processes, materials, systems and/or production techniques  Purposeful research and critical analysis of ethical, legal, economic and/or sustainability issues | Insightful and comprehensive communication of design concepts using relevant technical language and visual representations  Insightful and thorough planning, development, testing and validation of design concepts and procedures | Highly proficient application of skills, processes, procedures and techniques to create a solution  Comprehensive development of solutions to technical problems that arise during the solution realisation | Comprehensive and insightful evaluation of the solution features and realisation process |
| B | Thoughtful and well-considered analysis of the design features of products, processes, materials, systems and/or production techniques  Detailed research and well-considered discussion of ethical, legal, economic and/or sustainability issues | Thoughtful and well-considered communication of design concepts using relevant technical language and visual representations  Well-considered planning, development, testing and validation of design concepts and procedures | Proficient application of skills, processes, procedures and techniques to create a solution  Thoughtful development of solutions to technical problems that arise during the solution realisation | Well-informed and detailed evaluation of the solution features and realisation process |
| C | Considered analysis of the design features of products, processes, materials, systems and/or production techniques  Research and some analysis of ethical, legal, economic and/or sustainability issues | Clear communication of design concepts using technical language and some visual representations  Competent planning, development, testing and validation of some design concepts and procedures | Competent application of skills, processes, procedures and techniques to create a solution  Development of solutions to technical problems that arise during the solution realisation | Considered evaluation of the solution features and realisation process |
| D | Identification of the design features of products, processes, materials, systems and/or production techniques  Some description of information about ethical, legal, economic and/or sustainability issues | Basic communication of design concepts using some technical language  Some planning and development of design concepts and/or procedures | Basic application of some skills, processes, procedures and techniques to create a solution  Some endeavour to develop solutions to technical problems that arise during the solution realisation | Some description of the solution features and realisation process |
| E | Attempted identification of the design features of products, processes, materials, systems and/or production techniques  Some accessing of information about ethical, legal, economic and/or sustainability issues | Superficial and simplistic communication of design concepts  Limited use of information to plan design concepts | Limited application of emerging skills  Attempted development of a solution to a technical problem | Emerging recognition of the solution features and realisation process |

Performance Standards for Stage 2 Design, Technology and Engineering

Content

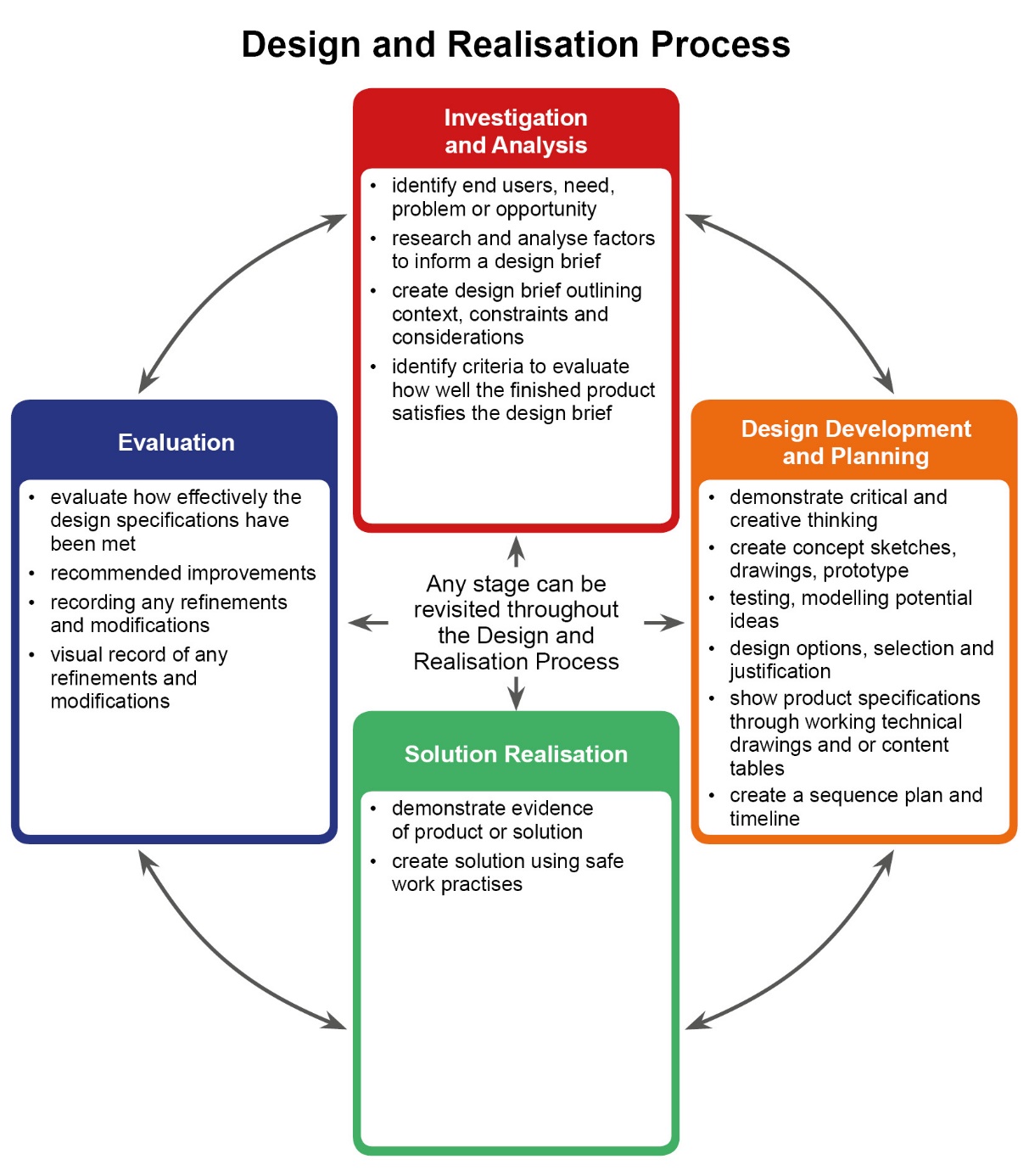
The Design and Realisation Process

The design and realisation process is a flexible framework and forms the structure of the subject. The following are components of a coherent and dynamic design progression. This process is rarely linear, and designing should be seen as cyclical with many possible solutions, rather than a simple step by step process.

A diagram to show the design process.

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Investigating and Analysis

The design and realisation process should begin with the identification of a problem or opportunity followed by an initial investigation and research analysis. The creation of a design brief must specify constraints, considerations and propose creative and innovative solutions. Students define criteria to evaluate how well the finished product meets the requirements of the design brief.

Possible investigation and analysis strategies or techniques may include, for example:

* use creative thinking techniques e.g. visualization, lateral thinking, brain storming to find the problem and seek solutions
* collaborate using visual tools e.g. mind mapping to explore concepts, problems or opportunities
* investigating and interpreting product design factors or issues such as:
* technologies: tools, processes and manufacturing methods

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* materials: characteristics and properties
* innovation and creativity- inventing or improving products
* sustainability: life cycle analysis, carbon footprint, potential to reuse or recycle, fair trade, customs, carbon footprint
* target audience, end user and potential for entrepreneurship and marketing
* ethical use and application of the end product
* ethical concerns related to health and safety, discrimination, social media, advertising, data, images, conflicts of interest,
* historical and cultural influences including social trends, the changing nature of work, technological change
* legal responsibilities- patents, safety requirements, intellectual property, creative commons, Australian International Standard , regulations and legislation including OH&S, safety of the product for the user
* economic considerations: costing of products including materials, labour and equipment and machinery, responsible use of resources, products built to last, time management and material availability.
* creating a written or multimodal design brief that includes key criteria and/or constraints such as function and/or aesthetics
* analysing existing product or system characteristics and features to inform the design and realisation process
* collecting and analysing data from a target audience e.g. survey, questionnaire
* researching and analysing information from different contexts such as the manufacturing sector or emerging advanced technologies
* researching historical design or period influences or different cultural traditions
* acknowledging and correctly referencing sources of information and ideas
* conducting peer review and feedback about the design brief
* critically analysing sources of information for reliability and validity.

Design Development and Planning

Another component of the design and realisation process is design development and planning in response to an established brief. This involves innovation, invention, iteration and creativity to develop a solution for an opportunity or unsolved problem. Students document their design ideas and make plans to use the available resources such as time, materials and technologies to realise the solution. They test, adapt and validate the design prior to realisation.

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Possible design development and planning strategies or techniques may include, for example:

* use ideation strategies such as adapting, modifying, substituting or rearranging to improve the solution
* creating a design brief showing specific aspects of the design development and planning
* creating working drawings, concept sketches, prototypes, story boards, flow charts, simulation or 3D modelling.
* working collaboratively face to face or online to develop imaginative, innovative, and enterprising outcomes e.g. with peers, industry, tertiary education or community
* applying interdisciplinary concepts e.g. artistic, scientific, mathematical and engineering skills appropriate to the planning and designing of the product or system
* preparing timelines and procedures using visual organisers such as Gantt charts and tables showing sequencing
* testing and recording ( e.g. photo essay, video, result tables, annotated images) possible materials and processes through experimentation, trial and error or applying secondary research
* collection of qualitative and quantitative data using scientific methodologies
* adapting the design development in response to results of testing and research
* justifying design solutions based on investigations and research analysis
* creating a table, chart or diagram to define product specifications e.g. measurement, materials to be used, processes required
* applying the scientific method to the design and construction processes of the product or system e.g. testing material characteristics or suitability
* using relevant digital technologies to communicate design intent.

Solution realisation

This component (stage) of the design and realisation process involves realising a solution. A solution is the outcome of applying technological skills to meet the requirements of a design and realisation brief.

A solution in this subject is an outcome of the design and realisation process in relation to the chosen context. A solution could be fully realised or a model, prototype, system, part, process (i.e. procedures to output a product) or product.

Possible solution realisation strategies or techniques may include, for example:

* production of a solution captured in multimodal form e.g. photo story or short film
* using appropriate processes and production techniques
* creating solutions to the planned design specifications
* developing skills and applying them to a range of applications
* create an annotated multimodal product record of the creation of the product
* developing solutions to technical and engineering problems that may arise such as accuracy of machinery, quality of materials and components, understanding of software programs
* apply appropriate safety processes including physical and online environments.

Evaluation

The final component of the design and realisation process is evaluation. Evaluation involves judging the quality of the product against the criteria specified in the design brief and recommending improvements

Possible evaluation strategies or techniques may include, for example:

* evaluating, individually and/or collaboratively, how effectively the requirements of the design brief specifications have been met
* reviewing criteria, standards, reliability, safety, quality, and cost-effectiveness
* reflecting on product or system outcomes to recommend modifying or redeveloping designs or ideas
* reflecting on the effectiveness of procedures used in the design and realisation process
* reflecting on personal learning e.g. project management, practical skills, capabilities
* testing of product or system with end point users and recording feedback in written or multimodal form
* collecting feedback from peers or industry evaluation of solution

**Confidential - not for circulation**

* creating a weekly journal to record the on-going evaluation of the process and product evaluating potential publishing or entrepreneurship opportunities e.g. patents, marketing and distribution, mass production, online publishing, crowd sourcing.
* evaluating the ethical, legal, economic and/or sustainability issues related to the product or solution.

CONTEXTS

Stage 2 Design, Technology and Engineering is organised into four contexts:

* digital communication solutions
* industry and entrepreneurial solutions
* material solutions
* robotic and electronic systems.

The contexts provide opportunities to develop design thinking, to investigate engineering solutions, to develop a plan, realise the solution and evaluate the outcome. The context is chosen by the school to meet student needs and interests, taking into account the resources available.

Each of these contexts: digital communication solutions, industry and entrepreneurial solutions, material solutions and robotic and electronic systems provides a separate enrolment option for students.

Stage 2 Assessment Overview from 2020

|  |  |  |  |
| --- | --- | --- | --- |
| **School Assessment** | | | |
| Assessment Type | Number of tasks | Evidence | Assessment Design Criteria |
| AT1: Specialised Skills Task  (20%) | two | Evidence for this assessment type should be provided in multimodal form to a maximum of six minutes, 1000 words in written form or a combination of these. | Production  Evaluation |
| AT2: Design Process and Solution  (50%) | One (comprising of up to three sections) | The task(s) should be up to a total maximum of 2000 words or the equivalent in multimodal form where six minutes is equivalent to 1000 words. The task must showcase and evaluate the solution or product. | Investigation and Analysis  Design development and Planning  Production  Evaluation |
| **External Assessment** | | | |
| AT3: Resource Study  (30%) | One (comprising of two parts) | Part1: Resource investigation (I1 and D2)  Part 2: Issues exploration (I2 and E1)  The Resource Study should be presented in written or multimodal form or a combination of both. It should be up to a maximum of 2000 words if written or the equivalent in multimodal form, where 1000 words is equivalent to six minutes. | Investigation and Analysis  Design development and Planning (D2)  Evaluation |

# 

# Pre-approved Learning and Assessment Plan

Stage 2 Digital Communication Solutions

Pre-approved learning and assessment plans are for *school use only*.

* Teachers may make changes to the plan, retaining alignment with the subject outline.
* The principal or delegate endorses the use of the plan, and any changes made to it, including use of an addendum.
* The plan does not need to be submitted to the SACE Board for approval.

|  |  |  |  |
| --- | --- | --- | --- |
| School |  | Teacher(s) |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SACE school code | | |  | Year |  | Enrolment code | | | | |  | Program variant code (A–W) |
| Stage | Subject code | | | No. of credits (10 or 20) |
|  |  |  |  | **2** | **D** | **C** | **S** | **20** |  |

**Addendum – changes made to the pre-approved learning and assessment plan**

|  |
| --- |
| Describe any changes made to the pre-approved learning and assessment plan to support students to be successful in meeting the requirements of the subject. In your description, please explain:   * what changes have been made to the plan * the rationale for making the changes * whether these changes have been made for all students, or for individuals within the student group. |

**Endorsement**

The use of the learning and assessment plan is approved for use in the school. Any changes made to the plan support student achievement of the performance standards and retain alignment with the subject outline.

|  |  |  |  |
| --- | --- | --- | --- |
| Signature of principal or delegate |  | Date |  |

# Assessment overview

Stage 2 Digital Communication Solutions — 20-credits

The table below provides details of the planned tasks and shows where students have the opportunity to provide evidence for each of the specific features of all of the assessment design criteria.

Assessment Type 1:Specialised Skills Tasks – 20%

| **Assessment details** | **Assessment design criteria** | | | | **Assessment conditions**  (e.g. task type, word length, time allocated, supervision) |
| --- | --- | --- | --- | --- | --- |
| **IA** | **D** | **P** | **E** |
| Task 1- Camera techniques;  Produce a set of 6 images to reflect skills in selected techniques of photography and present these in a personal photographic exhibition. The exhibition should reflect your interests, skills and abilities within the field of photography. The techniques of photography to use are:   * Long Depth of field * Short Depth of field * Frozen Motion * Blurred Motion (available light) * Panning * Flash   Students will use digital editing in the final production of prints. Students produce 6 A4 sized Exhibition Quality Prints. One image for each technique of photography is required.  Students then evaluate each photography technique used and the planning and processes used in the creation of the personal photographic exhibition. Students may (if applicable) review the photographic techniques used and planning or exhibition strategies be used in their solution for Assessment Type 2. |  |  | 1 | 1 | Evidence for this assessment type should be provided in multimodal form to a maximum of four minutes, 600 words in written form or a combination of these |
| Task 2- Manipulation of digital images;  Students will use Abode Photoshop, to create an A3 poster to advertise tourism in central Australia.  Students will be required to;   * Select at least six images supplied by the teacher (shared folder on Lannaps) * Accurately manipulate images to meet specified requirements that show evidence of importing images, resizing, cropping, selections, layers or layer masks and application of type. Images are to be montage together with added type to produce A3 poster. The poster will be printed via the coloured photocopier * Produce a concise work recorded showing stages in the poster construction   Students will evaluate the work completed and review how these processes and techniques may influence their solution in Assessment Type 2. |  |  | 1, 2 | 1 | Evidence for this assessment type should be provided in multimodal form to a maximum of two minutes, 400 words in written form or a combination of these. |

Assessment Type 2: Design Process and Product – 50%

| Assessment details | Assessment design criteria | | | | Assessment conditions  (e.g. task type, word length, time allocated, supervision) |
| --- | --- | --- | --- | --- | --- |
| IA | D | P | E |
| To design and produce a product to showcase photographic skills and techniques for a specified audience use. It may take the form of a calendar, coffee table book, website or a series of posters for an important issue.  Section 1. Create a design brief  Identifying end users’ needs and outline constraints and considerations that then establish the criteria to evaluate the product with.  Research and analyse factors to inform the design brief e.g. investigation and analysis of existing solutions (commercial calendars, coffee book tables, website or posters), collecting and analysing data from a target audience (questionaries or survey) or selection and validations of photographic equipment and techniques etc.  The amount of digital photographic images needed for the product will vary and need to be negotiated with the teacher. As a guide; 12 images for a calendar or website, 20+ images for a book and 6 posters.  Provide a description of your final product that include layout and technical information related to your product.  Section 2. Create your product  Create your product to your design brief specifications.  Provide evidence showing the major stages of production undertaken (work record) and your completed solution. This can be presented in multimodal form or as a written table format that include images of stages and comments that identify issues and solutions that arise during production.  The final product could be printed outside of the school.  Section 3 Evaluate your product  Evaluate your product against the criteria established in the design brief.  Indicate the changes you would make (if any) to the way in which your product was created and discuss any feedback provided from the specified audience. | 1, 2 | 1 | 1, 2 | 1 | Provide evidence for the three sections, using a document of a maximum 2000 words, or 12 minutes of multi-modal presentation |

Assessment Type 3: Resources Study – 30%

| Assessment details | Assessment design criteria | | | | Assessment conditions  (e.g. task type, word length, time allocated, supervision) |
| --- | --- | --- | --- | --- | --- |
| IA | D | P | E |
| **Part 1: Resource Investigation**  Students will investigate and analyse the functional characteristics and properties of two or more materials or components that you are considering for use in the creation of your solution. (E.g. camera equipment (camera types, lenses or lighting), camera settings, printing quality of paper, resolution of images etc.)  You will report on how this research into and testing of the functional characteristics and properties of these materials or components will affect their selection for use in the realisation of your solution.  **Part 2: Issues Exploration**  Students investigate and analyse ethical, legal, economic and/or sustainability issues related to their solution.  Issues relating to the genre is to be focused on and should include how these impact on individuals and communities. | 1, 2 | 2 |  | 1 | Evidence for this assessment type, Resource Study, (comprising of the two sections: Resource Investigation and Issues Exploration) should be provided in written or multimodal form or a combination of both. It should be up to a maximum of 2000 words if written or the equivalent in multimodal form, where 1000 words is equivalent to 6 minutes |

*Please refer to the Stage 2 Design, Technology, and Engineering subject outline.*

Stage 2 Digital Communication Solutions  
Design, Technology and Engineering

School Assessment

**Assessment Type 1: Specialised Skills Task 1**

Purpose

Students develop knowledge and skills through specialised skills tasks. They apply the skills, processes and techniques in the chosen context. This informs the design development for a solution in Assessment Type 2. Students evaluate and assess the development of their own skills in this assessment task. They review how these processes and techniques may influence their solution.

Description of task

**Camera techniques;**

Produce a set of 6 images to reflect skills in selected techniques of photography and present these in a personal photographic exhibition. The exhibition should reflect your interests, skills and abilities within the field of photography. The techniques of photography to use are:

* Long Depth of field
* Short Depth of field
* Frozen Motion
* Blurred Motion (available light)
* Panning
* Flash

Students will use digital editing in the final production of prints. Students produce 6 A4 sized Exhibition Quality Prints. One image for each technique of photography is required.

Students then evaluate each photography technique used and the planning and processes used in the creation of the personal photographic exhibition. Students may (if applicable) review the photographic techniques used and planning or exhibition strategies be used in their solution for Assessment Type 2.

Assessment conditions

Evidence for this assessment type should be provided in multimodal form to a maximum of 4 minutes, 600 words in written form or a combination of these.

For this assessment type, students provide evidence of their learning in relation to the following assessment design criteria:

* Production (P1)
* Evaluation (E1)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Investigations and Analysis | Design Development and Planning | Production | Evaluation |
| A | Comprehensive and insightful analysis of the design features of products, processes, materials, systems and/or production techniques  Purposeful research and critical analysis of ethical, legal, economic and/or sustainability issues | Insightful and comprehensive communication of design concepts using relevant technical language and visual representations  Insightful and thorough planning, development, testing and validation of design concepts and procedures | Highly proficient application of skills, processes, procedures and techniques to create a solution  Comprehensive development of solutions to technical problems that arise during the solution realisation | Comprehensive and insightful evaluation of the solution features and realisation process |
| B | Thoughtful and well-considered analysis of the design features of products, processes, materials, systems and/or production techniques  Detailed research and well-considered discussion of ethical, legal, economic and/or sustainability issues | Thoughtful and well-considered communication of design concepts using relevant technical language and visual representations  Well-considered planning, development, testing and validation of design concepts and procedures | Proficient application of skills, processes, procedures and techniques to create a solution  Thoughtful development of solutions to technical problems that arise during the solution realisation | Well-informed and detailed evaluation of the solution features and realisation process |
| C | Considered analysis of the design features of products, processes, materials, systems and/or production techniques  Research and some analysis of ethical, legal, economic and/or sustainability issues | Clear communication of design concepts using technical language and some visual representations  Competent planning, development, testing and validation of some design concepts and procedures | Competent application of skills, processes, procedures and techniques to create a solution  Development of solutions to technical problems that arise during the solution realisation | Considered evaluation of the solution features and realisation process |
| D | Identification of the design features of products, processes, materials, systems and/or production techniques  Some description of information about ethical, legal, economic and/or sustainability issues | Basic communication of design concepts using some technical language  Some planning and development of design concepts and/or procedures | Basic application of some skills, processes, procedures and techniques to create a solution  Some endeavour to develop solutions to technical problems that arise during the solution realisation | Some description of the solution features and realisation process |
| E | Attempted identification of the design features of products, processes, materials, systems and/or production techniques  Some accessing of information about ethical, legal, economic and/or sustainability issues | Superficial and simplistic communication of design concepts  Limited use of information to plan design concepts | Limited application of emerging skills  Attempted development of a solution to a technical problem | Emerging recognition of the solution features and realisation process |

Stage 2 Digital Communication Solutions  
Design, Technology and Engineering

School Assessment

**Assessment Type 1: Specialised Skills Task 2**

Purpose

Students develop knowledge and skills through specialised skills tasks. They apply the skills, processes and techniques in the chosen context. This informs the design development for a solution in Assessment Type 2. Students evaluate and assess the development of their own skills in this assessment task. They review how these processes and techniques may influence their solution.

Description of task

**Manipulation of digital images;**

Students will use Abode Photoshop, to create an A3 poster to advertise tourism in central Australia.

Students will be required to;

* Select at least six images supplied by the teacher (shared folder on Lannaps)
* Accurately manipulate images to meet specified requirements that show evidence of importing images, resizing, cropping, selections, layers or layer masks and application of type. Images are to be montage together with added type to produce A3 poster. The poster will be printed via the coloured photocopier
* Produce a concise work recorded showing stages in the poster construction

Students will evaluate the work completed and review how these processes and techniques may influence their solution in Assessment Type 2.

Assessment conditions

Evidence for this assessment type should be provided in multimodal form to a maximum of 2 minutes, 400 words in written form or a combination of these.

For this assessment type, students provide evidence of their learning in relation to the following assessment design criteria:

* Production (P1 & P2)
* Evaluation (E1)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Investigations and Analysis | Design Development and Planning | Production | Evaluation |
| A | Comprehensive and insightful analysis of the design features of products, processes, materials, systems and/or production techniques  Purposeful research and critical analysis of ethical, legal, economic and/or sustainability issues | Insightful and comprehensive communication of design concepts using relevant technical language and visual representations  Insightful and thorough planning, development, testing and validation of design concepts and procedures | Highly proficient application of skills, processes, procedures and techniques to create a solution  Comprehensive development of solutions to technical problems that arise during the solution realisation | Comprehensive and insightful evaluation of the solution features and realisation process |
| B | Thoughtful and well-considered analysis of the design features of products, processes, materials, systems and/or production techniques  Detailed research and well-considered discussion of ethical, legal, economic and/or sustainability issues | Thoughtful and well-considered communication of design concepts using relevant technical language and visual representations  Well-considered planning, development, testing and validation of design concepts and procedures | Proficient application of skills, processes, procedures and techniques to create a solution  Thoughtful development of solutions to technical problems that arise during the solution realisation | Well-informed and detailed evaluation of the solution features and realisation process |
| C | Considered analysis of the design features of products, processes, materials, systems and/or production techniques  Research and some analysis of ethical, legal, economic and/or sustainability issues | Clear communication of design concepts using technical language and some visual representations  Competent planning, development, testing and validation of some design concepts and procedures | Competent application of skills, processes, procedures and techniques to create a solution  Development of solutions to technical problems that arise during the solution realisation | Considered evaluation of the solution features and realisation process |
| D | Identification of the design features of products, processes, materials, systems and/or production techniques  Some description of information about ethical, legal, economic and/or sustainability issues | Basic communication of design concepts using some technical language  Some planning and development of design concepts and/or procedures | Basic application of some skills, processes, procedures and techniques to create a solution  Some endeavour to develop solutions to technical problems that arise during the solution realisation | Some description of the solution features and realisation process |
| E | Attempted identification of the design features of products, processes, materials, systems and/or production techniques  Some accessing of information about ethical, legal, economic and/or sustainability issues | Superficial and simplistic communication of design concepts  Limited use of information to plan design concepts | Limited application of emerging skills  Attempted development of a solution to a technical problem | Emerging recognition of the solution features and realisation process |

Stage 2 Digital Communication Solutions  
Design, Technology and Engineering

School Assessment

**Assessment Type 2: Design Process and Solution**

Purpose

Students produce up to three tasks in the design process and solution assessment type that together provide evidence of the stages of the Design Realisation Process.

Students create a design brief that provides the basis for the development of potential solutions. The importance of the design process as a preliminary to the realisation process is emphasised, as is ongoing evaluation of the solution. Students investigate, plan then create a solution.

A solution in this subject is an outcome of the design and realisation process in relation to the chosen context. A solution could be fully realised or a model, prototype, system, part, process (i.e. procedures to output a product) or product.

Description task

To design and produce a product to showcase photographic skills and techniques for a specified audience use. It may take the form of a calendar, coffee table book, website or a series of posters for an important issue.

**Section 1. Create a design brief**

Identifying end users’ needs and outline constraints and considerations that then establish the criteria to evaluate the product with.

Research and analyse factors to inform the design brief e.g. investigation and analysis of existing solutions (commercial calendars, coffee book tables, website or posters), collecting and analysing data from a target audience (questionaries or survey) or selection and validations of photographic equipment and techniques etc.

The amount of digital photographic images needed for the product will vary and need to be negotiated with the teacher. As a guide; 12 images for a calendar or website, 20+ images for a book and 6 posters.

Provide a description of your final product that include layout and technical information related to your product.

**Section 2. Create your product**

Create your product to your design brief specifications.

Provide evidence showing the major stages of production undertaken (work record) and your completed solution. This can be presented in multimodal form or as a written table format that include images of stages and comments that identify issues and solutions that arise during production.

The final product could be printed outside of the school.

**Section 3 Evaluate your product**

Evaluate your product against the criteria established in the design brief.

Indicate the changes you would make (if any) to the way in which your product was created and discuss any feedback provided from the specified audience.

Assessment conditions

Provide evidence of the above three sections, using a document of a maximum 2000 words, or 12 minutes of multi-modal presentation

For this assessment type, students provide evidence of their learning in relation to the following assessment design criteria:

* Investigating and Analysis (I1)
* Design Development and Planning (D1)
* Production ( P1 & P2)
* Evaluation ( E1)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Investigations and Analysis | | Design Development and Planning | Production | Evaluation |
| A | Comprehensive and insightful analysis of the design features of products, processes, materials, systems and/or production techniques  Purposeful research and critical analysis of ethical, legal, economic and/or sustainability issues | Insightful and comprehensive communication of design concepts using relevant technical language and visual representations  Insightful and thorough planning, development, testing and validation of design concepts and procedures | Highly proficient application of skills, processes, procedures and techniques to create a solution  Comprehensive development of solutions to technical problems that arise during the solution realisation | Comprehensive and insightful evaluation of the solution features and realisation process |
| B | Thoughtful and well-considered analysis of the design features of products, processes, materials, systems and/or production techniques  Detailed research and well-considered discussion of ethical, legal, economic and/or sustainability issues | Thoughtful and well-considered communication of design concepts using relevant technical language and visual representations  Well-considered planning, development, testing and validation of design concepts and procedures | Proficient application of skills, processes, procedures and techniques to create a solution  Thoughtful development of solutions to technical problems that arise during the solution realisation | Well-informed and detailed evaluation of the solution features and realisation process |
| C | Considered analysis of the design features of products, processes, materials, systems and/or production techniques  Research and some analysis of ethical, legal, economic and/or sustainability issues | Clear communication of design concepts using technical language and some visual representations  Competent planning, development, testing and validation of some design concepts and procedures | Competent application of skills, processes, procedures and techniques to create a solution  Development of solutions to technical problems that arise during the solution realisation | Considered evaluation of the solution features and realisation process |
| D | Identification of the design features of products, processes, materials, systems and/or production techniques  Some description of information about ethical, legal, economic and/or sustainability issues | Basic communication of design concepts using some technical language  Some planning and development of design concepts and/or procedures | Basic application of some skills, processes, procedures and techniques to create a solution  Some endeavour to develop solutions to technical problems that arise during the solution realisation | Some description of the solution features and realisation process |
| E | Attempted identification of the design features of products, processes, materials, systems and/or production techniques  Some accessing of information about ethical, legal, economic and/or sustainability issues | Superficial and simplistic communication of design concepts  Limited use of information to plan design concepts | Limited application of emerging skills  Attempted development of a solution to a technical problem | Emerging recognition of the solution features and realisation process |

|  |
| --- |
| Teacher comment:  Overall grade |

Stage 2 Digital Communication Solutions  
Design, Technology and Engineering

External Assessment

**Assessment Type 3: Resource Study**

Purpose

Students investigate and analyse design features, processes, materials, and production techniques and apply creative thinking to the design of a solution. Students apply critical problem solving skills and incorporate technologies to address design problems and challenges. Through this task students plan, develop, test and validate concepts and procedures.

Students analyse influences on a solution including ethical, legal, economic, and/or sustainability issues. They consider the practical implication of these issues on society or design solutions.

Description of task

Part One: Resource Investigation

You will investigate and analyse the functional characteristics and properties of two or more materials or components that you are considering for use in the creation of your solution. (E.g. camera equipment (camera types, lenses or lighting), camera settings, printing quality of paper, resolution of images etc.)

You will report on how this research into and testing of the functional characteristics and properties of these materials or components will affect their selection for use in the realisation of your solution.

**Components you will need to complete;**

* Identification of the genre related to the AT2: Design Process and Solution will influence your choice of investigation. Possible ideas include;
* Sport. Compare telephoto lenses to standard lenses. Field of view and aperture range. Image quality would be compared by Pixel-peeping parts of the image.
* Live music Photography. Compare the use of different ISO settings and the resultant noise that will occur using the higher settings. Also how do faster aperture lenses help this and how some cameras use smudging to reduce noise. Suggested settings could be ISO 200, 400, 800, 1600, 3200 and 6400. Image quality would be compared by Pixel-peeping parts of the image.
* Landscape Photography. Compare the different image quality effects that camera shake causes. What shutters speeds give satisfactory results Vs Tripod use? Use of modern technology such as Image Stabilization, in body and in lens. Image quality would be compared by Pixel-peeping parts of the image.
* Portraiture. Compare the different facial perspectives that the differing focal length lenses causes. What is the sweet spot and why? Also look at the different aperture and their effect on the softening of the background (Bokeh).
* Identify two or more materials or components to test, state the reasons clearly why these materials or components have been selected.
* Conduct relevant research, and identify important existing properties for the chosen materials or components.
* Outline the testing methods. (The use of images, diagrams, charts, simulations and videos is encouraged to show this evidence)
* Description of results or table/graph test results
* Analyse the results and draw conclusions
* Indicating how and when this knowledge can be used, if the technology of these materials and components have changed and what are the likely developments.
* Bibliography and correct referencing within the document.

The specific features of the assessment design criteria assessed in this part are:

* Investigation and Analysis 1 (I1)
* Design Development and Planning 2 (D2).

Part Two: Issues Exploration

Students investigate and analyse ethical, legal, economic and/or sustainability issues related to their solution.

Issues relating to the genre is to be focused on and should include how these impact on individuals and communities. Possible ideas include:

* Sport; the use of images of sports starts for promotional purposes
* Live music Photography; the use of mobile phones to photograph and film concerts
* Landscape Photography; the photographing of important and sacred sites relating to indigenous cultures
* Portraiture; the use of Photoshop to enhance images for magazines and advertising

Discuss your issues proposal with your teacher.

The specific features of the assessment design criteria assessed in this part are:

* Investigation and Analysis 2 (I2)
* Evaluation (E1).

Assessment conditions

Evidence for this assessment type, Resource Study, (comprising of the two sections: Resource Investigation and Issues Exploration) should be provided in written or multimodal form or a combination of both. It should be up to a maximum of 2000 words if written or the equivalent in multimodal form, where 1000 words is equivalent to 6 minutes.

The following specific features of the assessment design criteria for this subject are assessed in the Resource Study:

* Investigation and Analysis
* Design Development and Planning (D2)
* Evaluation

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Investigations and Analysis | Design Development and Planning | Production | Evaluation |
| A | Comprehensive and insightful analysis of the design features of products, processes, materials, systems and/or production techniques  Purposeful research and critical analysis of ethical, legal, economic and/or sustainability issues | Insightful and comprehensive communication of design concepts using relevant technical language and visual representations  Insightful and thorough planning, development, testing and validation of design concepts and procedures | Highly proficient application of skills, processes, procedures and techniques to create a solution  Comprehensive development of solutions to technical problems that arise during the solution realisation | Comprehensive and insightful evaluation of the solution features and realisation process |
| B | Thoughtful and well-considered analysis of the design features of products, processes, materials, systems and/or production techniques  Detailed research and well-considered discussion of ethical, legal, economic and/or sustainability issues | Thoughtful and well-considered communication of design concepts using relevant technical language and visual representations  Well-considered planning, development, testing and validation of design concepts and procedures | Proficient application of skills, processes, procedures and techniques to create a solution  Thoughtful development of solutions to technical problems that arise during the solution realisation | Well-informed and detailed evaluation of the solution features and realisation process |
| C | Considered analysis of the design features of products, processes, materials, systems and/or production techniques  Research and some analysis of ethical, legal, economic and/or sustainability issues | Clear communication of design concepts using technical language and some visual representations  Competent planning, development, testing and validation of some design concepts and procedures | Competent application of skills, processes, procedures and techniques to create a solution  Development of solutions to technical problems that arise during the solution realisation | Considered evaluation of the solution features and realisation process |
| D | Identification of the design features of products, processes, materials, systems and/or production techniques  Some description of information about ethical, legal, economic and/or sustainability issues | Basic communication of design concepts using some technical language  Some planning and development of design concepts and/or procedures | Basic application of some skills, processes, procedures and techniques to create a solution  Some endeavour to develop solutions to technical problems that arise during the solution realisation | Some description of the solution features and realisation process |
| E | Attempted identification of the design features of products, processes, materials, systems and/or production techniques  Some accessing of information about ethical, legal, economic and/or sustainability issues | Superficial and simplistic communication of design concepts  Limited use of information to plan design concepts | Limited application of emerging skills  Attempted development of a solution to a technical problem | Emerging recognition of the solution features and realisation process |

|  |
| --- |
| Teacher comment:  Overall grade |



# Pre-approved Learning and Assessment Plan

Stage 2 Material Solutions (furniture design)

Pre-approved learning and assessment plans are for *school use only*.

* Teachers may make changes to the plan, retaining alignment with the subject outline.
* The principal or delegate endorses the use of the plan, and any changes made to it, including use of an addendum.
* The plan does not need to be submitted to the SACE Board for approval.

|  |  |  |  |
| --- | --- | --- | --- |
| School |  | Teacher(s) |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SACE school code | | |  | Year |  | Enrolment code | | | | |  | Program variant code (A–W) |
| Stage | Subject code | | | No. of credits (10 or 20) |
|  |  |  |  | **2** | **X** | **X** | **X** | **20** |  |

Addendum – changes made to the pre-approved learning and assessment plan

|  |
| --- |
| Describe any changes made to the pre-approved learning and assessment plan to support students to be successful in meeting the requirements of the subject. In your description, please explain:   * what changes have been made to the plan * the rationale for making the changes * whether these changes have been made for all students, or for individuals within the student group. |

**Endorsement**

The use of the learning and assessment plan is approved for use in the school. Any changes made to the plan support student achievement of the performance standards and retain alignment with the subject outline.

|  |  |  |  |
| --- | --- | --- | --- |
| Signature of principal or delegate |  | Date |  |

# Assessment overview

Stage 2 Material Solutions (furniture design) — 20-credits

The table below provides details of the planned tasks and shows where students have the opportunity to provide evidence for each of the specific features of all of the assessment design criteria.

**Assessment Type 1:Specialised Skills Tasks – 20%**

| **Assessment details** | **Assessment design criteria** | | | | **Assessment conditions**  (e.g. task type, word length, time allocated, supervision) |
| --- | --- | --- | --- | --- | --- |
| **IA** | **D** | **P** | **E** |
| Students will produce a hall table that provides four joint systems under guided instruction from their teacher as well as orthogonal drawings.  The project will use a range of tools, machines and power tools. This skills task should give students a range of skills needed to produce their designed product. Students will evaluate the table and joint systems against the drawings and example. |  |  | 1 | 1 | 4-6 Week practical workshop task  500 word written or multimodal equivalent |
| Students will learn how to use Auto Inventor or other CAD Software to create a joints and parts of products. This task will support students to gain basic CAD skills or improve current skill sets. Students will evaluate the drawings and skills that they obtain and how effective they will be for their product. |  |  | 2 | 1 | 2-3 Week Computer based task  500 word written or multimodal equivalent |

**Assessment Type 2: Design Process and Product – 50%**

| **Assessment details** | **Assessment design criteria** | | | | **Assessment conditions**  (e.g. task type, word length, time allocated, supervision) |
| --- | --- | --- | --- | --- | --- |
| **IA** | **D** | **P** | **E** |
| Students will undertake a design process where they will:  **Investigate** and create a design brief. Investigate and analyse products that clearly connect to their design brief. Throughout the investigation students will explore product features such as function, aesthetics and constraints in direct relation to their brief.  **Design, develop and plan** concepts that they have analysed from their investigation. Create a variety of solutions for the brief using drawings and sketches. Validate a designed solution that best meets the brief and develop a series of CAD drawings to support their production process. Students will develop a materials and costing list for the product, as well as a procedure and schedule for the safe and timely manufacture of their product.  **Produce** a product by applying skills, processes, procedures and techniques to create the product that best meets their brief.  **Evaluate** the design process and product they have created in response to their design brief as well as their product realisation. | 1 | 1, 2 | 1, 2 | 1 | Design process documentation of maximum 2000 words or equivalent multimodal form  Video record of product  Mixture of practical workshop time and computer based.  14-16 weeks |

**Assessment Type 3: Resources Study – 30%**

| **Assessment details** | **Assessment design criteria** | | | | **Assessment conditions**  (e.g. task type, word length, time allocated, supervision) |
| --- | --- | --- | --- | --- | --- |
| **IA** | **D** | **P** | **E** |
| Students will Investigate and analyse the functional characteristics and properties of two or more materials of their choice. Students will create a series of tests to generate data on the functional characteristics of the materials. Students will also investigate the sustainability of the materials they test and explore ethical issues related to their designed solution in AT2. | 1, 2 | 2 |  | 1 | Written report  Maximum 2000 words  3-5 Weeks |

*Please refer to the Stage 2 Design, Technology, and Engineering subject outline.*

Stage 2 Material Solutions  
Design, Technology and Engineering

School Assessment

**Assessment Type 1: Specialised Skills Task 1**

Purpose

Students develop knowledge and skills through specialised skills tasks. They apply the skills, processes and techniques in the chosen context. This informs the design development for a solution in Assessment Type 2. Students evaluate and assess the development of their own skills in this assessment task. They review how these processes and techniques may influence their solution.

Description of task

Joining systems;

To manufacture frames or samples from drawings provided, using 4 joint types outlined by your teacher. The joint types can be negotiated with your teacher, to target possible use in Assessment Type 2.

Students present frames or samples demonstrating 4 joint types for assessment to teacher with a checklist.

Students also provide photographic or multimedia evidence of each joint type produced and an evaluation of their skills and review on how these processes and techniques may be used in their solution for Assessment Type 2. This can be in the form of a recorded discussion by the student with the teacher or the student verbally responding and recording or writing to the following questions.

For each joint type;

1. Explain the joint type and production methods you used
2. Discuss how well you executed the construction of the joint
3. Make judgements on the fit of each joint, squareness of the frame or sample, flatness/ without twist of the frame or sample
4. How well did you understood the technical drawings provided
5. Review if this joint type could be suitable for your solution for Assessment Type 2 and justify your decision.

Assessment conditions

Evidence for this assessment type should be provided in multimodal form to a maximum of 3 minutes, 500 words in written form or a combination of these.

For this assessment type, students provide evidence of their learning in relation to the following assessment design criteria:

* Production (P1)
* Evaluation (E1)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Investigations and Analysis** | **Design Development and Planning** | **Production** | **Evaluation** |
| **A** | Comprehensive and insightful analysis of the design features of products, processes, materials, systems and/or production techniques  Purposeful research and critical analysis of ethical, legal, economic and/or sustainability issues | Insightful and comprehensive communication of design concepts using relevant technical language and visual representations  Insightful and thorough planning, development, testing and validation of design concepts and procedures | Highly proficient application of skills, processes, procedures and techniques to create a solution  Comprehensive development of solutions to technical problems that arise during the solution realisation | Comprehensive and insightful evaluation of the solution features and realisation process |
| **B** | Thoughtful and well-considered analysis of the design features of products, processes, materials, systems and/or production techniques  Detailed research and well-considered discussion of ethical, legal, economic and/or sustainability issues | Thoughtful and well-considered communication of design concepts using relevant technical language and visual representations  Well-considered planning, development, testing and validation of design concepts and procedures | Proficient application of skills, processes, procedures and techniques to create a solution  Thoughtful development of solutions to technical problems that arise during the solution realisation | Well-informed and detailed evaluation of the solution features and realisation process |
| **C** | Considered analysis of the design features of products, processes, materials, systems and/or production techniques  Research and some analysis of ethical, legal, economic and/or sustainability issues | Clear communication of design concepts using technical language and some visual representations  Competent planning, development, testing and validation of some design concepts and procedures | Competent application of skills, processes, procedures and techniques to create a solution  Development of solutions to technical problems that arise during the solution realisation | Considered evaluation of the solution features and realisation process |
| **D** | Identification of the design features of products, processes, materials, systems and/or production techniques  Some description of information about ethical, legal, economic and/or sustainability issues | Basic communication of design concepts using some technical language  Some planning and development of design concepts and/or procedures | Basic application of some skills, processes, procedures and techniques to create a solution  Some endeavour to develop solutions to technical problems that arise during the solution realisation | Some description of the solution features and realisation process |
| **E** | Attempted identification of the design features of products, processes, materials, systems and/or production techniques  Some accessing of information about ethical, legal, economic and/or sustainability issues | Superficial and simplistic communication of design concepts  Limited use of information to plan design concepts | Limited application of emerging skills  Attempted development of a solution to a technical problem | Emerging recognition of the solution features and realisation process |

|  |
| --- |
| Teacher comment:  Overall grade |

**Stage 2 Material Solutions**

**Design, Technology and Engineering**

School Assessment

**Assessment Type 1: Specialised Skills Task 2**

Purpose

Students develop knowledge and skills through specialised skills tasks. They apply the skills, processes and techniques in the chosen context. This informs the design development for a solution in Assessment Type 2. Students evaluate and assess the development of their own skills in this assessment task. They review how these processes and techniques may influence their solution.

Description of task

CAD software

Students will use a CAD Software such as Fusion 360, to create drawings of the joints and assembly created in Task 1 or negotiated drawings for possible solution in Assessment Type 2. The choice of CAD software will be negotiated with your teacher.

Students will be required to produce:

* 4 completed 3D joint models or negotiated 3D possible solution drawing
* A render
* A 3rd angle orthogonal drawing as directed by the teacher
* A 3D scaled simple printed model of the frame or possible solution

Students will evaluate the CAD package in relation to creating renders, exporting geometry to 3D printers, and producing orthographic drawings and review their own skill development including problem solving and the new knowledge obtained in the process.

Assessment conditions

Evidence for this assessment type should be provided in multimodal form to a maximum of 3 minutes, 500 words in written form or a combination of these.

For this assessment type, students provide evidence of their learning in relation to the following assessment design criteria:

* Production (P1 & P2)
* Evaluation (E1)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Investigations and Analysis | Design Development and Planning | Production | Evaluation |
| A | Comprehensive and insightful analysis of the design features of products, processes, materials, systems and/or production techniques  Purposeful research and critical analysis of ethical, legal, economic and/or sustainability issues | Insightful and comprehensive communication of design concepts using relevant technical language and visual representations  Insightful and thorough planning, development, testing and validation of design concepts and procedures | Highly proficient application of skills, processes, procedures and techniques to create a solution  Comprehensive development of solutions to technical problems that arise during the solution realisation | Comprehensive and insightful evaluation of the solution features and realisation process |
| B | Thoughtful and well-considered analysis of the design features of products, processes, materials, systems and/or production techniques  Detailed research and well-considered discussion of ethical, legal, economic and/or sustainability issues | Thoughtful and well-considered communication of design concepts using relevant technical language and visual representations  Well-considered planning, development, testing and validation of design concepts and procedures | Proficient application of skills, processes, procedures and techniques to create a solution  Thoughtful development of solutions to technical problems that arise during the solution realisation | Well-informed and detailed evaluation of the solution features and realisation process |
| C | Considered analysis of the design features of products, processes, materials, systems and/or production techniques  Research and some analysis of ethical, legal, economic and/or sustainability issues | Clear communication of design concepts using technical language and some visual representations  Competent planning, development, testing and validation of some design concepts and procedures | Competent application of skills, processes, procedures and techniques to create a solution  Development of solutions to technical problems that arise during the solution realisation | Considered evaluation of the solution features and realisation process |
| D | Identification of the design features of products, processes, materials, systems and/or production techniques  Some description of information about ethical, legal, economic and/or sustainability issues | Basic communication of design concepts using some technical language  Some planning and development of design concepts and/or procedures | Basic application of some skills, processes, procedures and techniques to create a solution  Some endeavour to develop solutions to technical problems that arise during the solution realisation | Some description of the solution features and realisation process |
| E | Attempted identification of the design features of products, processes, materials, systems and/or production techniques  Some accessing of information about ethical, legal, economic and/or sustainability issues | Superficial and simplistic communication of design concepts  Limited use of information to plan design concepts | Limited application of emerging skills  Attempted development of a solution to a technical problem | Emerging recognition of the solution features and realisation process |

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| --- |
| Teacher comment:  Overall grade |

Stage 2 Material Solutions  
Design, Technology and Engineering

School Assessment

**Assessment Type 2: Design Process and Solution**

Purpose

Students produce up to three tasks in the design process and solution assessment type that together provide evidence of the stages of the Design Realisation Process.

Students create a design brief that provides the basis for the development of potential solutions. The importance of the design process as a preliminary to the realisation process is emphasised, as is ongoing evaluation of the solution. Students investigate, plan then create a solution.

A solution in this subject is an outcome of the design and realisation process in relation to the chosen context. A solution could be fully realised or a model, prototype, system, part, process (i.e. procedures to output a product) or product.

Description of task

Article of furniture for use inside or outside of a building, room or house.

Section 1. Create a design brief

Identifying end users’ needs and outline constraints and considerations that then establish the criteria to evaluate solution with.

Research and analyse factors to inform the design brief e.g. investigation and analysis of existing solutions (articles of furniture) or selections and validations of joining systems, finishing systems, hardware, etc.

Provide a description of your final solution that include technical drawings and specifications

Section 2. Create your solution

Create your article of furniture to your design brief specifications.

Provide evidence showing between 8-10 stages of construction is required and your completed solution. This can be presented in multimodal form or as a written table format that include images of stages and comments that identify issues and solutions that arise during construction.

Section 3 Evaluate your solution

Comment on the sustainability of your solution (i.e. life cycle analysis, carbon footprint, potential to reuse or recycle, fair trade, customs) and any legal responsibilities (patents, safety requirements, intellectual property, creative commons, Australian International Standard , regulations and legislation including OH&S, safety of the product for the user) you have identified.

Indicate the changes you would make (if any) to the way in which your solution was made, (e.g. material selections, assembly techniques, joining systems, hardware) and evaluate your solution against the criteria established in the design brief.

Assessment conditions

Provide evidence of the above three sections, using a document of a maximum 2000 words, or 12 minutes of multi-modal presentation

For this assessment type, students provide evidence of their learning in relation to the following assessment design criteria:

* Investigating and Analysis (I1 & I2)
* Design Development and Planning (D1)
* Production ( P1 & P2)
* Evaluation ( E1)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Investigations and Analysis | Design Development and Planning | Production | Evaluation |
| A | Comprehensive and insightful analysis of the design features of products, processes, materials, systems and/or production techniques  Purposeful research and critical analysis of ethical, legal, economic and/or sustainability issues | Insightful and comprehensive communication of design concepts using relevant technical language and visual representations  Insightful and thorough planning, development, testing and validation of design concepts and procedures | Highly proficient application of skills, processes, procedures and techniques to create a solution  Comprehensive development of solutions to technical problems that arise during the solution realisation | Comprehensive and insightful evaluation of the solution features and realisation process |
| B | Thoughtful and well-considered analysis of the design features of products, processes, materials, systems and/or production techniques  Detailed research and well-considered discussion of ethical, legal, economic and/or sustainability issues | Thoughtful and well-considered communication of design concepts using relevant technical language and visual representations  Well-considered planning, development, testing and validation of design concepts and procedures | Proficient application of skills, processes, procedures and techniques to create a solution  Thoughtful development of solutions to technical problems that arise during the solution realisation | Well-informed and detailed evaluation of the solution features and realisation process |
| C | Considered analysis of the design features of products, processes, materials, systems and/or production techniques  Research and some analysis of ethical, legal, economic and/or sustainability issues | Clear communication of design concepts using technical language and some visual representations  Competent planning, development, testing and validation of some design concepts and procedures | Competent application of skills, processes, procedures and techniques to create a solution  Development of solutions to technical problems that arise during the solution realisation | Considered evaluation of the solution features and realisation process |
| D | Identification of the design features of products, processes, materials, systems and/or production techniques  Some description of information about ethical, legal, economic and/or sustainability issues | Basic communication of design concepts using some technical language  Some planning and development of design concepts and/or procedures | Basic application of some skills, processes, procedures and techniques to create a solution  Some endeavour to develop solutions to technical problems that arise during the solution realisation | Some description of the solution features and realisation process |
| E | Attempted identification of the design features of products, processes, materials, systems and/or production techniques  Some accessing of information about ethical, legal, economic and/or sustainability issues | Superficial and simplistic communication of design concepts  Limited use of information to plan design concepts | Limited application of emerging skills  Attempted development of a solution to a technical problem | Emerging recognition of the solution features and realisation process |

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| Teacher comment:  Overall grade |

Stage 2 Material Solutions  
Design, Technology and Engineering

External Assessment

**Assessment Type 3: Resource Study**

Purpose

Students investigate and analyse design features, processes, materials, and production techniques and apply creative thinking to the design of a solution. Students apply critical problem solving skills and incorporate technologies to address design problems and challenges. Through this task students plan, develop, test and validate concepts and procedures.

Students analyse influences on a solution including ethical, legal, economic, and/or sustainability issues. They consider the practical implication of these issues on society or design solutions

Description of task

Part One: Resource Investigation

You will investigate and analyse the functional characteristics and properties of two or more materials or components that you are considering for use in the creation of your solution. (E.g. finishing systems, wood products, adhesives, etc.)

You will report on how this research into and testing of the functional characteristics and properties of these materials or components will affect their selection for use in the realisation of your solution.

**Components you will need to complete;**

* Identify the two or more materials to test, state the reasons clearly why these materials have been selected.
* Conduct relevant research, and identify important existing properties for the chosen materials, e.g. common uses, botanical and or chemical structures/classification (e.g. pored timbers/non-pored timbers, thermo plastic/thermo set), working characteristics etc.
* Design and conduct experiments/tests. State clearly the reasons for conducting the tests i.e. how the tests will actually make your choice of materials clearer? Show the set-up of the tests as clearly as you can, and record the testing procedure through video/screen capture.
* Result and graph the tests
* Analyse the results
* Draw conclusions

The use of diagrams, charts, simulations and videos is encouraged.

Correct referencing is required.

The specific features of the assessment design criteria assessed in this part are:

* Investigation and Analysis 1 (I1)
* Design Development and Planning 2 (D2).

Part Two: Issues Exploration

Students investigate and analyse ethical, legal, economic and/or sustainability issues related to their solution.

This task requires the identification of an issue related to your AT 2 solution. Discuss your issues proposal with your teacher.

You may choose to follow the outline below:

1. Brief statement to identify what the issue is, and how it relates to your AT2 solution
2. Clarification and researched, detailed explanation of the issue
3. Researched data relating to the issue, where possible
4. Your observations, analysis of the issue
5. Concise summary statement.

Diagrams, charts, simulations, videos etc., can be used effectively. Ensure all researched work requiring referencing, has been done in accordance with current SACE Policy.

The specific features of the assessment design criteria assessed in this part are:

* Investigation and Analysis 2 (I2)
* Evaluation (E1).

Assessment conditions

Evidence for this assessment type, Resource Study, (comprising of the two sections: Resource Investigation and Issues Exploration) should be provided in written or multimodal form or a combination of both. It should be up to a maximum of 2000 words if written or the equivalent in multimodal form, where 1000 words is equivalent to 6 minutes.

The following specific features of the assessment design criteria for this subject are assessed in the Resource Study:

Investigation and Analysis

Design Development and Planning (D2)

Evaluation

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Investigations and Analysis** | **Design Development and Planning** | **Production** | **Evaluation** |
| **A** | Comprehensive and insightful analysis of the design features of products, processes, materials, systems and/or production techniques  Purposeful research and critical analysis of ethical, legal, economic and/or sustainability issues | Insightful and comprehensive communication of design concepts using relevant technical language and visual representations  Insightful and thorough planning, development, testing and validation of design concepts and procedures | Highly proficient application of skills, processes, procedures and techniques to create a solution  Comprehensive development of solutions to technical problems that arise during the solution realisation | Comprehensive and insightful evaluation of the solution features and realisation process |
| **B** | Thoughtful and well-considered analysis of the design features of products, processes, materials, systems and/or production techniques  Detailed research and well-considered discussion of ethical, legal, economic and/or sustainability issues | Thoughtful and well-considered communication of design concepts using relevant technical language and visual representations  Well-considered planning, development, testing and validation of design concepts and procedures | Proficient application of skills, processes, procedures and techniques to create a solution  Thoughtful development of solutions to technical problems that arise during the solution realisation | Well-informed and detailed evaluation of the solution features and realisation process |
| **C** | Considered analysis of the design features of products, processes, materials, systems and/or production techniques  Research and some analysis of ethical, legal, economic and/or sustainability issues | Clear communication of design concepts using technical language and some visual representations  Competent planning, development, testing and validation of some design concepts and procedures | Competent application of skills, processes, procedures and techniques to create a solution  Development of solutions to technical problems that arise during the solution realisation | Considered evaluation of the solution features and realisation process |
| **D** | Identification of the design features of products, processes, materials, systems and/or production techniques  Some description of information about ethical, legal, economic and/or sustainability issues | Basic communication of design concepts using some technical language  Some planning and development of design concepts and/or procedures | Basic application of some skills, processes, procedures and techniques to create a solution  Some endeavour to develop solutions to technical problems that arise during the solution realisation | Some description of the solution features and realisation process |
| **E** | Attempted identification of the design features of products, processes, materials, systems and/or production techniques  Some accessing of information about ethical, legal, economic and/or sustainability issues | Superficial and simplistic communication of design concepts  Limited use of information to plan design concepts | Limited application of emerging skills  Attempted development of a solution to a technical problem | Emerging recognition of the solution features and realisation process |

|  |
| --- |
| Teacher comment:  Overall grade |



Pre-approved Learning and Assessment Plan

Stage 2 Robotic and Electronic Systems

Pre-approved learning and assessment plans are for *school use only*.

* Teachers may make changes to the plan, retaining alignment with the subject outline.
* The principal or delegate endorses the use of the plan, and any changes made to it, including use of an addendum.
* The plan does not need to be submitted to the SACE Board for approval.

|  |  |  |  |
| --- | --- | --- | --- |
| School |  | Teacher(s) |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SACE school code | | |  | Year |  | Enrolment code | | | | |  | Program variant code (A–W) |
| Stage | Subject code | | | No. of credits (10 or 20) |
|  |  |  |  | **2** | **R** | **E** | **S** | **20** |  |

Addendum – changes made to the pre-approved learning and assessment plan

|  |
| --- |
| Describe any changes made to the pre-approved learning and assessment plan to support students to be successful in meeting the requirements of the subject. In your description, please explain:   * what changes have been made to the plan * the rationale for making the changes * whether these changes have been made for all students, or for individuals within the student group. |

Endorsement

The use of the learning and assessment plan is approved for use in the school. Any changes made to the plan support student achievement of the performance standards and retain alignment with the subject outline.

|  |  |  |  |
| --- | --- | --- | --- |
| Signature of principal or delegate |  | Date |  |

Assessment overview

Stage 2 Robotic and Electronic Systems — 20-credits

The table below provides details of the planned tasks and shows where students have the opportunity to provide evidence for each of the specific features of all of the assessment design criteria.

**Assessment Type 1:Specialised Skills Tasks** – 20%

| Assessment details | Assessment design criteria | | | | **Assessment conditions**  (e.g. task type, word length, time allocated, supervision) |
| --- | --- | --- | --- | --- | --- |
| **IA** | **D** | **P** | **E** |
| **Specialised Skills task 1**  (breadboard circuit)  Students produce and test a breadboard electronic system controlled by a PICAXETM program as specified by the teacher.  This task assesses the students’ level of skills in designing, producing, and testing a PICAXETM simulated program based on a circuit concept given by the teacher. Students are expected to correctly simulate their design on a breadboard and download their program into a PICAXETM microcontroller to test it. |  |  | 1,2 | 1 | The combined evidence should be a maximum of 500 words if written, or the equivalent in multimodal form |
| **Specialised Skills task 2**  (printed circuit board)  Using CAD software students draw a printed circuit board layout for the circuit tested in specialised skills task 1.  This task assesses the students’ skills related to the use of CAD software in designing a printed circuit board layout which is then manufactured to form a satisfactorily operating circuit. |  |  | 1,2 | 1 | The combined evidence should be a maximum of 500 words if written, or the equivalent in multimodal form |

Assessment Type 2: Design Process and Product – 50%

| Assessment details | Assessment design criteria | | | | Assessment conditions  (e.g. task type, word length, time allocated, supervision) |
| --- | --- | --- | --- | --- | --- |
| IA | D | P | E |
| **Folio**  Students create a design folio, documenting their design from conception to realisation. The folio must include   * Investigation and Analysis * A design brief that outlines functional outcomes, aesthetic considerations, constraints and a statement of intent, and identification of criteria to evaluate the success of the solution * Investigation and critical analysis of existing products, materials and processes * Design Development and Planning * Sketches and technical drawings communicating design intent * A timeline outlining the sequence of the realisation process   **Evaluation**   * A critical comparison of the realised product with the criteria specified in the design brief, and an explanation and justification for any changes made * Reflection on outcomes with recommendations for possible improvement or redevelopment of designs or procedures * Evaluative observations about the student’s own skill development | 1 | 1 |  | 1 | The evidence should be a maximum of 1500 words if written, or 9 minutes recorded oral documentation, or the equivalent in multimodal form. |
| **Solution**  Students produce the solution as designed in their folio. They produce a video or photographic record that includes evidence of:   * Development of skills * Selection and use of appropriate processes and techniques * Modification to the design as a result of technical problems that arise * Ongoing reflection on ideas and procedures   The realised solution must be showcased in the video/photographic record |  | 2 | 1, 2 |  | The evidence for the solution realisation task should be a maximum of 500 words if written or 3 minutes of recorded oral communication, or the equivalent in multimodal form. |

Assessment Type 3: Resources Study – 30%

| Assessment details | Assessment design criteria | | | | Assessment conditions  (e.g. task type, word length, time allocated, supervision) |
| --- | --- | --- | --- | --- | --- |
| **IA** | **D** | **P** | **E** |
| Part one: Resource investigation  Students investigate and evaluate the types and properties of two or more components for a home security system. Components could include sensors, output systems, power systems, or other negotiated components The investigation involves practical testing, comparative evaluation and a summative evaluation. There should also be some information from secondary sources.  In negotiation with the teacher, students may select to present their findings in the form of tables, comparative examples, annotated displays, multimedia presentations or written reports. | 1 | 2 |  |  | The combined evidence should be a maximum of 2000 words if written, or a maximum of 12 minutes recorded oral documentation, analysis, and evaluation, or the equivalent in multimodal form. |
| Part Two: Issue Exploration  Students investigate and analyse ethical, legal, economic and/or sustainability issues specific to their solution.  Students may investigate and analyse one or more of the following strategies or approaches;   * Sustainability: life cycle analysis, carbon footprint, potential to reuse or recycle * Ethical: use and application of the end product, concerns related to health and safety, discrimination, conflicts of interest, cultural influences * Legal responsibilities: patents, safety requirements, intellectual property, creative commons, WHS legislation   Economic considerations: costing, responsible use of resources, time management | 2 |  |  | 1 |

*Please refer to the Stage 2 Design, Technology, and Engineering subject outline.*



Pre-approved Learning and Assessment Plan

Stage 2 Industrial or Entrepreneurial Design Solutions

Subs In Schools - Designing a submarine

Pre-approved learning and assessment plans are for *school use only*.

* Teachers may make changes to the plan, retaining alignment with the subject outline.
* The principal or delegate endorses the use of the plan, and any changes made to it, including use of an addendum.
* The plan does not need to be submitted to the SACE Board for approval.

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| School |  | Teacher(s) |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SACE school code | | |  | Year |  | Enrolment code | | | | |  | Program variant code (A–W) |
| Stage | Subject code | | | No. of credits (10 or 20) |
|  |  |  |  | **2** | **I** | **E** | **S** | **20** |  |

Addendum – changes made to the pre-approved learning and assessment plan

|  |
| --- |
| Describe any changes made to the pre-approved learning and assessment plan to support students to be successful in meeting the requirements of the subject. In your description, please explain:   * what changes have been made to the plan * the rationale for making the changes * whether these changes have been made for all students, or for individuals within the student group. |

Endorsement

The use of the learning and assessment plan is approved for use in the school. Any changes made to the plan support student achievement of the performance standards and retain alignment with the subject outline.

|  |  |  |  |
| --- | --- | --- | --- |
| Signature of principal or delegate |  | Date |  |

Assessment overview

Stage 2 Industrial or Entrepreneurial Design Solutions — 20-credits

The table below provides details of the planned tasks and shows where students have the opportunity to provide evidence for each of the specific features of all of the assessment design criteria.

Assessment Type 1:Specialised Skills Tasks – 20%

| Assessment details | Assessment design criteria | | | | Assessment conditions  (e.g. task type, word length, time allocated, supervision) |
| --- | --- | --- | --- | --- | --- |
| IA | D | P | E |
| **Pressure hull design challenge:**  Using all your skills in computer aided design, design a holder that will sit inside the pressure pipe and hold all of the components for your submarine. This could include the battery, air pumps, servo motors and the ESC. There may also be others that need to be accommodated into your design. You will need to create a table with all the parts listed and find out the width, length and height of each part to be fitted. Constraints;   * It needs to fit internally in the pressure hull * It must have room for the wires of the electronics to run * The parts must function normally and not be hindered in any way by the solution.   The prototype can be printed and tested for fit, form and function. |  | D2 | P1, P2 |  | Evidence for the task should be in multimodal form, to a maximum of three minutes or 500 words in written format. |
| **CFD analysis on a part of the submarine:**  Use Autodesk CFD to analyze a component of your submarine design for optimization. This could be the shape of the control planes, the conning tower or the propeller. Explain the results that you obtain and how you may use the data to improve your design.  Conducting the tests allows students to demonstrate their understanding of computational fluid dynamics and the science, particularly physics that is provided in the solutions and the setup of the CFD tests.  Students document what happens in each of the iterations of the testing and design phases and explain the results for each test. A conclusion based on these results should be reached and documented. | I1 | D1, D2 |  | E1 | Evidence for the task should be in multimodal form, to a maximum of three minutes or 500 words in written format. |

Assessment Type 2: Design Process and Product – 50%

| Assessment details | Assessment design criteria | | | | Assessment conditions  (e.g. task type, word length, time allocated, supervision) |
| --- | --- | --- | --- | --- | --- |
| IA | D | P | E |
| **Produce a model Submarine – Investigation and Analysis**  Produce a design brief based on your project. The design brief should outline the following: the problem or intended design, aesthetic considerations, functional considerations, constraints from the competition regulations.  Consider the following dot points;   * identify end users, need, problem or opportunity * research and analyse factors to inform a design brief * create design brief outlining context, constraints and considerations * Identify criteria to evaluate how well the finished product satisfies the design brief | I1 |  |  |  | The task must include a showcase and evaluation of the solution or product in the form of a video or photographic record. The rest of the evidence may be completed in written or multimodal form. The task should be up to a maximum of 2000 words or the equivalent in multimodal form where 6 minutes is equivalent to 1000 words. |
| **Produce a model submarine – Design development and planning**  Students begin to develop possible solutions to the brief; including design and form, how it may function (internal systems), linking to outcomes from the skills task 2 CFD modelling, the use of resources – materials, machinery and tools and human resources through mentors that may be available. The design for the submarine must meet the requirements listed (competition regulations) but you can freely design the allowable parts your own way.  Testing, validating and adapting components before the final product realization.   * Consider the following dot points: * Create concept sketches, drawings, prototypes, testing, modelling potential ideas * Design options, selections and justification * Show product specifications through working technical drawings and or content tables * Create a sequence plan and timeline |  | D1, D2 |  |  |
| **Produce a model Submarine - Solution**  Using Autodesk Fusion 360 model a submarine based on the design constraints discussed with the regulations booklet from the Subs in Schools competition and from information developed during the development and planning stage. Your model should reflect the design brief developed, it should also support the findings from your various investigations. It is expected that you support your own model with evidence in the form of screen shots and entries in your design solutions folio.  Consider the following dot points:   * Construct product * Students demonstrate evidence of product or solution |  |  | P1, P2 |  |
| **Produce a model Submarine - Evaluation**  Evaluate the finished product solutions against the design brief and the constraints of the competition.  Explanation of and the justification of any changes that have been made to the model. Reflection of possible improvements to the design and /or changes to the manufacturing processes that have been used.  Self-reflection on the students own skill development in the solution to the product.  Consider the following dot points:   * Evaluate individually how effectively the design specifications have been met * Recommended improvements * Recording any refinements and modifications * Visual record of any refinements and modifications |  |  |  | E1 |  |

Assessment Type 3: Resources Study – 30%

| Assessment details | Assessment design criteria | | | | Assessment conditions  (e.g. task type, word length, time allocated, supervision) |
| --- | --- | --- | --- | --- | --- |
| IA | D | P | E |
| **Part One - Resource Investigation**  Students investigate and analyse the functional characteristics and properties of two or more materials or components they are considering for use in the creation of their solution. They report on how their research into and testing of the functional characteristics and properties of these materials or components will affect their selection for use in the realisation of their solution.  An example might be the examination of 3D printing filaments.  Students investigate the properties of two or more 3D printing filaments. They look at the chemical properties as well as the physical properties of the materials. They gather qualitative and quantitative data about the materials and draw conclusions about the results.  **Part Two - Issues Exploration**  Students investigate and analyse ethical, legal, economic and/or sustainability issues specific to their solution.  Students may investigate and analyse using one or more of the following strategies or approaches;  ethical use and application of the end product   * ethical concerns related to health and safety, discrimination, social media, advertising, data, images, conflicts of interest * sustainability: life cycle analysis, carbon footprint, potential to reuse or recycle, fair trade, customs, carbon footprint * target audience, end user and potential for entrepreneurship and marketing * economic considerations: costing of products including materials, labour and equipment and machinery, responsible use of resources, products built to last, time management and material availability * legal responsibilities- patents, safety requirements, intellectual property, creative commons, Australian International Standard , regulations and legislation including OH&S, safety of the product for the user * historical and cultural influences including social trends, the changing nature of work, technological change | I1, I2 | D2 |  | E1 | The Resource Study should be presented in written or multimodal form or a combination of both. It should be up to a maximum of 2000 words if written or the equivalent in multimodal form, where 1000 words is equivalent to 6 minutes. |

*Please refer to the Stage 2 Design, Technology, and Engineering subject outline.*



Pre-approved Learning and Assessment Plan

Stage 2 Material Solutions (metal)

Pre-approved learning and assessment plans are for *school use only*.

* Teachers may make changes to the plan, retaining alignment with the subject outline.
* The principal or delegate endorses the use of the plan, and any changes made to it, including use of an addendum.
* The plan does not need to be submitted to the SACE Board for approval.

|  |  |  |  |
| --- | --- | --- | --- |
| School |  | Teacher(s) |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SACE school code | | |  | Year |  | Enrolment code | | | | |  | Program variant code (A–W) |
| Stage | Subject code | | | No. of credits (10 or 20) |
|  |  |  |  | **2** | **M** | **R** | **S** | **20** |  |

Addendum – changes made to the pre-approved learning and assessment plan

|  |
| --- |
| Describe any changes made to the pre-approved learning and assessment plan to support students to be successful in meeting the requirements of the subject. In your description, please explain:   * what changes have been made to the plan * the rationale for making the changes * whether these changes have been made for all students, or for individuals within the student group. |

Endorsement

The use of the learning and assessment plan is approved for use in the school. Any changes made to the plan support student achievement of the performance standards and retain alignment with the subject outline.

|  |  |  |  |
| --- | --- | --- | --- |
| Signature of principal or delegate |  | Date |  |

Assessment overview

Stage 2 Material Solutions (metal) — 20-credits

The table below provides details of the planned tasks and shows where students have the opportunity to provide evidence for each of the specific features of all of the assessment design criteria.

Assessment Type 1:Specialised Skills Tasks – 20%

| Assessment details | Assessment design criteria | | | | Assessment conditions  (e.g. task type, word length, time allocated, supervision) |
| --- | --- | --- | --- | --- | --- |
| IA | D | P | E |
| **Specialised Skills Task 1**  Metal Specialised welding: Produce an aluminium toolbox using a supplied working plan and specialised MIG and/or TIG welding.  The construction allows the students to demonstrate the following application of skills and techniques, resources, equipment and materials to create the product safely:   * use of machinery * use of different aluminium sections and plate * welding of aluminium at all intersections for maximum strength * use of sheet steel with the corners joined to maximise strength.   Students document skill development in practise welding activities through photographic evidence with recorded oral discussion or written comments. Student evaluate their learning in undertaking the task through one or more capabilities and state its relevance in the design and realisation process. |  |  | 1 | 1 | Evidence for each task should be provided in multimodal form to a maximum of three minutes or 500 words in written format |
| **Specialised skills task 2**  Use pieces of scrap metal to demonstrate proficiency at the following techniques using a metal lathe: Chamfering, Parting, Threading, Boring, Drilling, and Knurling.  The construction requires the students to demonstrate safe application of skills and techniques, resources, equipment and materials to create a product.  Students evaluate their skill development for each technique undertaken and provide recommendations for improvements. Photographic evidence of the completed technique is required. Student evaluate their learning in undertaking the task through one or more capabilities and state its relevance in the design and realisation process. |  |  | 1, 2 | 1 | Evidence for each task should be provided in multimodal form to a maximum of three minutes or 500 words in written format |

Assessment Type 2: Design Process and Product – 50%

| Assessment details | Assessment design criteria | | | | Assessment conditions  (e.g. task type, word length, time allocated, supervision) |
| --- | --- | --- | --- | --- | --- |
| IA | D | P | E |
| ***Task 1; Design brief with evidence of investigation and analysis*** *(refer to content: design and realisation process diagram and explanation of components pages 31 of subject outline)*  The design brief should include a statement of intent, identification of a problem or opportunity, functional outcomes, aesthetic considerations, and constraints. It can be presented in dot point form. Students define criteria to evaluate how well the finished product meets the requirements of the design brief.  Students select one strategy below for investigating an aspect or aspects related to their design brief that will inform their design development;   * analysing existing product or system characteristics and features to inform the design and realisation process * collecting and analysing data from a target audience e.g. survey, questionnaire * researching and analysing information from different contexts such as the manufacturing sector or emerging advanced technologies * researching historical design or period influences or different cultural traditions * conducting peer review and feedback about the design brief. * critically analysing sources of information for reliability and validity. | 1 | 1 |  |  | The task(s) must include a showcase and evaluation of the solution or product in the form of a video or photographic record. The rest of the evidence may be completed in written or multimodal form. The task(s) should be up to a total maximum of 2000 words or the equivalent in multimodal form where six minutes is equivalent to 1000 words. |
| **Task 2; Design development and planning**  Students document their design ideas and make plans to use the available resources such as time, materials and technologies to realise the product or system. They test, adapt and validate the design prior to product realisation  Students select one strategy below to show design development and planning required:   * creating working drawings, concept sketches, prototypes, story boards, flow charts, simulation or 3D modelling. * working collaboratively face to face or online to develop imaginative, innovative, and enterprising outcomes e.g. with peers, industry, tertiary education or community * applying interdisciplinary concepts e.g. artistic, scientific, mathematical and engineering skills appropriate to the planning and designing of the product or system * preparing timelines and procedures using visual organisers such as Gantt charts and tables showing sequencing * creating a table, chart or diagram to define product specifications e.g. measurement, materials to be used, processes required. |  | 2 |  |  |
| ***Task 3 : Product realisation and evaluation***  Students produce the product/ solution that they designed. Students must showcase and evaluate the solution or product in the form of a video or photographic record. Evidence required needs to focus on:   * development of skills * selection and use of appropriate components, specialised processes, and production techniques * application of knowledge and understanding to create the product * safe and accurate use of appropriate equipment and processes * modification of the design brief as a result of technical problems that arise * use of materials with appropriate characteristics and properties * ongoing reflection on ideas and procedures.   The evaluation should include:   * a critical comparison of the realised product with the criteria specified in the design brief, and an explanation of and justification for any changes made * a review of criteria, standards, reliability, safety, quality, and cost-effectiveness of product * reflection on outcomes, with recommendations for possible improvement or redevelopment of designs or procedures * evaluative observations about the student’s own skill development. |  |  | 1, 2 | 1 |

Assessment Type 3: Resources Study – 30%

| Assessment details | Assessment design criteria | | | | Assessment conditions  (e.g. task type, word length, time allocated, supervision) |
| --- | --- | --- | --- | --- | --- |
| IA | D | P | E |
| **Part One: Resource Investigation**  Students investigate and analyse the functional characteristics and properties of two or more materials or components they are considering for use in the creation of their solution. They report on how their research into and testing of the functional characteristics and properties of these materials or components will affect their selection for use in the realisation of their solution.  e.g. Properties and testing of TIG and MIG welds  Students investigate the properties of welds produced by the two different welding processes: Tungsten Inert Gas welding and Metal Inert Gas welding. They look at the chemical properties of the metal and gases involved, and the implications for the type of weld produced. | 1 | 2 |  |  |  |
| **Part 2: Issues exploration**  Students investigate and analyse ethical, legal, economic and/or sustainability issues specific to their solution  Students may investigate and analyse using one or more of the following strategies or approaches;   * sustainability: life cycle analysis, carbon footprint, potential to reuse or recycle, fair trade, customs, carbon footprint * ethical use and application of the end product * ethical concerns related to health and safety, discrimination, social media, advertising, data, images, conflicts of interest, * historical and cultural influences including social trends, the changing nature of work, technological change * legal responsibilities- patents, safety requirements, intellectual property, creative commons, Australian International Standard , regulations and legislation including OH&S, safety of the product for the user * economic considerations: costing of products including materials, labour and equipment and machinery, responsible use of resources, products built to last, time management and material availability   Students evaluate this information and respond to potential publishing or entrepreneurship opportunities of their product or solution e.g. patents, marketing and distribution, mass production, online publishing, crowd sourcing | 2 |  |  | 1 | The Resource Study should be presented in written or multimodal form or a combination of both. It should be up to a maximum of 2000 words if written or the equivalent in multimodal form, where 1000 words is equivalent to 6 minutes. |

*Please refer to the Stage 2 Design, Technology, and Engineering subject outline.*

Codes for Design, Technology and Engineering

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| --- | --- | --- |
|  | **Stage 1** | **Stage 2** |
| **Digital Communication Solutions** | 1DCS10  1DCS20 | 2DCS20 |
| **Industry and Entrepreneurial Solutions** | 1IES10  1IES20 | 2IES20 |
| **Material Solutions** | 1MRS10  1MRS20 | 2MRS20 |
| **Robotic and Electronic Systems** | 1RES10  1RES20 | 2RES20 |