

Hong Kong Diploma of Secondary Education Examination 2019
DESIGN AND APPLIED TECHNOLOGY

SBA Project – Suggested Titles

Candidates are required to choose ONE project from the following:

Project 1: A coin-operated vending machine toy

Situation:

Vending machines have a wide variety of functions and help customers to purchase goods at any time. We hope that children can increase their interest in learning design and technology and cultivate their creativity through exploring the working principles of vending machine toys.

Design Problem:

Design and make a coin-operated vending machine toy to help children understand how a real vending machine works, including the mechanisms and the working principles of the coin-operating system and product delivery system. The vending machine toy and the products sold should be designed for children. The design should be original and the main body of the vending machine toy should be made from raw materials and not be directly built using commercially available kits. However, commercially available mechanical components, control components and programming devices are permitted.

Part 1 Research, investigation and data collection (10% of subject mark)

(a) Problem identification – exploring problems and clarifying tasks

- Clarify design targets, identify potential clients and users, and outline all aspects of user needs.
- Prepare a design brief and a list of specifications. The specifications should be justified, and used as a basis for generating and developing ideas, and evaluating the final design solution in the evaluation plan.

(b) Research in technology

- Conduct a case study **OR** technological exploration related to the design problem. The case study or technological exploration report should include the following three main components:
 - (i) Define and explain the focus and scope of the inquiry, and show the inquiry plan. Explain clearly the relevance, applicability and significance to the design problem. For example, identify the product delivery mechanisms of three or more types of vending machine toys.
 - (ii) Describe the learning outcome gained from the inquiry. Analyse specific concepts and skills useful for tackling the design problem.
 - (iii) Discuss how to apply the results of the study to solving the design problem.

(c) Exploring preliminary design ideas

- Plan for a coherent and appropriate design strategy to generate and develop at least three different design ideas using annotated sketches/prototypes/computer 3D models.

Part 2 Design and make (30% of subject mark)

(a) Development and refinement of the design ideas

- Use annotated sketches/prototypes/computer 3D models to show the preliminary design ideas and alternative solutions. Analyse the feasibility, characteristics, merits and disadvantages of these ideas and solutions.
- Further develop and improve design ideas to reach a final design solution.
- Use appropriate media and format (engineering drawing/CAD) to produce assembly and working drawings (orthographic/pictorial/exploded view) of the proposed final solution, along with a parts list. The assembly and working drawings must include main measurements and construction details.

(b) Realisation of the final design solution

- Apply and demonstrate appropriate technology to make:
 - (1) A working physical model of the vending machine toy; **OR**
 - (2) A virtual 3D model of the vending machine toy plus a working partial physical model.
- Use appropriate media to demonstrate the design of the vending machine toy, including the mechanisms and the working principles of the coin-operating system and product delivery system.
- Prepare a time schedule that lists for each stage the time and resources required for the implementation of the final design solution.

(c) Testing and evaluation of the final design solution

- Develop an evaluation plan based on the requirements and specifications listed in the design brief. The plan should include ways of testing and evaluating the final design solution in terms of technology and design in the predetermined environment. Give a general conclusion stating the merits and areas for improvement of the final design solution.
- Discuss the positive and negative impacts of the final design solution on related issues, such as the economic, aesthetic, social, cultural, environmental, legal and ethical aspects.
- Evaluate and discuss how the final design solution can fulfil client/consumer requirements, such as incorporating client-oriented design strategies, observing social responsibility and displaying enterprising behaviour.

(d) Overall presentation

- Candidates are required to submit a working physical model of the vending machine toy **OR** a virtual 3D model plus a working partial physical model.
- Use an A4 or A3 size design folder to present the documents and drawings related to the project, including the project proposal and the management, development, realisation and evaluation processes and results.
- Use appropriate communication, modelling and information-processing skills, and technical terminology, standards, symbols and conventions, to present design ideas and research findings.

Project 2: A multi-functional pet feeder

Situation:

When pet owners are away from home, they need to feed their pets which have been left behind at home.

Design Problem:

Design and make a multi-functional pet feeder that can provide dry food and clean water for pets (except aquarium pets). The feeder should allow the pet owner to feed the pet in a preset manner, to adjust the feeding time and the quantity of dry food and clean water according to the needs of the pet at any time, and should remind the pet to eat. The design should be original and the main body of the pet feeder should be made from raw materials and not be directly built using commercially available kits. However, commercially available mechanical components, control components, and programming devices are permitted.

Part 1 Research, investigation and data collection (10% of subject mark)

(a) Problem identification – exploring problems and clarifying tasks

- Clarify design targets, identify potential clients and users, and outline all aspects of user needs.
- Prepare a design brief and a list of specifications. The specifications should be justified, and used as a basis for generating and developing ideas, and evaluating the final design solution in the evaluation plan.

(b) Research in technology

- Conduct a case study **OR** technological exploration related to the design problem. The case study or technological exploration report should include the following three main components:
 - (i) Define and explain the focus and scope of the inquiry, and show the inquiry plan. Explain clearly the relevance, applicability and significance to the design problem. For example, identify the working principles of three or more types of pet feeder.
 - (ii) Describe the learning outcome gained from the inquiry. Analyse specific concepts and skills useful for tackling the design problem.
 - (iii) Discuss how to apply the results of the study to solving the design problem.

(c) Exploring preliminary design ideas

- Plan for a coherent and appropriate design strategy to generate and develop at least three different design ideas using annotated sketches/prototypes/computer 3D models.

Part 2 Design and make (30% of subject mark)

(a) Development and refinement of the design ideas

- Use annotated sketches/prototypes/computer 3D models to show the preliminary design ideas and alternative solutions. Analyse the feasibility, characteristics, merits and disadvantages of these ideas and solutions.
- Further develop and improve design ideas to reach a final design solution.
- Use appropriate media and format (engineering drawing/CAD) to produce assembly and working drawings (orthographic/pictorial/exploded view) of the proposed final solution, along with a parts list. The assembly and working drawings must include main measurements and construction details.

(b) Realisation of the final design solution

- Apply and demonstrate appropriate technology to make:
 - (1) A working physical model of the pet feeder; **OR**
 - (2) A virtual 3D model of the pet feeder plus a working partial physical model.
- Use appropriate media to demonstrate the design of the pet feeder, including the method of operating the pet feeder, mechanism and working principles related to the overall control system.
- Prepare a time schedule that lists for each stage the time and resources required for the implementation of the final design solution.

(c) Testing and evaluation of the final design solution

- Develop an evaluation plan based on the requirements and specifications listed in the design brief. The plan should include ways of testing and evaluating the final design solution in terms of technology and design in the predetermined environment. Give a general conclusion stating the merits and areas for improvement of the final design solution.
- Discuss the positive and negative impacts of the final design solution on related issues, such as the economic, aesthetic, social, cultural, environmental, legal and ethical aspects.
- Evaluate and discuss how the final design solution can fulfil client/consumer requirements, such as incorporating client-oriented design strategies, observing social responsibility and displaying enterprising behaviour.

(d) Overall presentation

- Candidates are required to submit a working physical model of the pet feeder **OR** a virtual 3D model plus a working partial physical model.
- Use an A4 or A3 size design folder to present the documents and drawings related to the project, including the project proposal and the management, development, realisation and evaluation processes and results.
- Use appropriate communication, modelling and information-processing skills, and technical terminology, standards, symbols and conventions, to present design ideas and research findings.

Project 3: A stair-climbing robot for delivering goods

Situation:

To improve delivery efficiency, a logistics company plans to introduce robots to assist in the delivery of goods. The company commissions you to develop and design a prototype of a stair-climbing robot capable of delivering goods in order to show the design concepts involved.

Design Problem:

Design and make a prototype of a stair-climbing robot capable of carrying and unloading goods. The robot prototype should be able to carry six tennis balls securely and climb up stairs. When the robot has reached the upper landing of the stairs, it should unload all the tennis balls on the ground. The design should be original and the main body of the robot should be made from raw materials and not be directly built using commercially available kits. However, commercially available mechanical components, control components, and programming devices are permitted.

Part 1 Research, investigation and data collection (10% of subject mark)

(a) Problem identification – exploring problems and clarifying tasks

- Clarify design targets, identify potential clients and users, and outline all aspects of user needs.
- Prepare a design brief and a list of specifications. The specifications should be justified, and used as a basis for generating and developing ideas, and evaluating the final design solution in the evaluation plan.

(b) Research in technology

- Conduct a case study **OR** technological exploration related to the design problem. The case study or technological exploration report should include the following three main components:
 - (i) Define and explain the focus and scope of the inquiry, and show the inquiry plan. Explain clearly the relevance, applicability and significance to the design problem. For example, identify three or more types of mechanisms of stairs-climbing robots.
 - (ii) Describe the practical learning outcome gained from the inquiry. Analyse specific concepts and skills useful for tackling the design problem.
 - (iii) Discuss how to apply the results of the study to solving the design problem.

(c) Exploring preliminary design ideas

- Plan for a coherent and appropriate design strategy to generate and develop at least three different design ideas using annotated sketches/prototypes/computer 3D models.

Part 2 Design and make (30% of subject mark)

(a) Development and refinement of the design ideas

- Use annotated sketches/prototypes/computer 3D models to show the preliminary design ideas and alternative solutions. Analyse the feasibility, characteristics, merits and disadvantages of these ideas and solutions.
- Further develop and improve design ideas to reach a final design solution.
- Use appropriate media and format (engineering drawing/CAD) to produce assembly and working drawings (orthographic/pictorial/exploded view) of the proposed final solution, along with a parts list. The assembly and working drawings must include main measurements and construction details.

(b) Realisation of the final design solution

- Apply and demonstrate appropriate technology to make a working physical prototype of the robot.
- Use appropriate media to demonstrate the design of the robot including the mechanisms and working principles of the stair-climbing and unloading system.
- Prepare a time schedule that lists for each stage the time and resources required for the implementation of the final design solution.

(c) Testing and evaluation of the final design solution

- Develop an evaluation plan based on the requirements and specifications listed in the design brief. The plan should include ways of testing and evaluating the final design solution in terms of technology and design in the predetermined environment. Give a general conclusion stating the merits and areas for improvement of the final design solution.
- Discuss the positive and negative impacts of the final design solution on related issues, such as the economic, aesthetic, social, cultural, environmental, legal and ethical aspects.
- Evaluate and discuss how the final design solution can fulfil client/consumer requirements, such as incorporating client-oriented design strategies, observing social responsibility and displaying enterprising behaviour.

(d) Overall presentation

- Candidates are required to submit a working physical prototype of the robot.
- Use an A4 or A3 size design folder to present the documents and drawings related to the project, including the project proposal and the management, development, realisation and evaluation processes and results.
- Use appropriate communication, modelling and information-processing skills, and technical terminology, standards, symbols and conventions, to present design ideas and research findings.

Remarks: The HKDSE Examination Regulations stipulate that a candidate may be liable to disqualification from part or the whole of the Examination or suffer a mark or grade penalty for breaching the regulations. For details, please refer to the SBA Teachers' Handbook for Design and Applied Technology:

http://www.hkeaa.edu.hk/en/sba/sub_info_sba/dse_subject.html?10