Hong Kong Diploma of Secondary Education Examination 2020

DESIGN AND APPLIED TECHNOLOGY

SBA Project – Suggested Titles

Candidates are required to choose ONE project from the following:

Project 1：An automatic coins sorting and counting machine

Situation:

An international charity organisation wants to attract children to donate their spare change to support children in poverty. Donations will be used to provide education and medical services. You are commissioned by this organisation to design an automatic coins sorting and counting machine to be placed at shopping centres to collect donations.

Design Problem:

Design and make a prototype of the automatic coins sorting and counting machine. Your design ideas should be original and be able to meet the following basic requirements:

(i) incorporate appropriate technology to attract children to use the machine and to donate their spare change;
(ii) sort, by denomination, a pile of coins consisting of Hong Kong $10, $5, $2 and $1, and show the total number of coins counted for each denomination and the total amount of donation; and
(iii) use appropriate technological means to acknowledge the donor after counting.

The design of the automatic coins sorting and counting machine cannot contain any trademark or image with copyright, the main body 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 means that use technology to attract children to use the machine; identify three or more mechanisms for coins sorting and counting; identify three or more means that use technology to acknowledge the donors.

(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 alterative 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 model of the automatic coins sorting and counting machine;
- Illustrate the design of the automatic coins sorting and counting machine including the mechanisms and working principles of:

(1) the system for automatic coins sorting and counting;
(2) the system that shows the total number of coins counted for each denomination and the total amount of donation; and
(3) the system that acknowledges the donors using appropriate technological means.

- Prepare a time schedule that lists for each stage the planning, time and resources management 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 automatic coins sorting and counting machine.
- 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 home fitness device for the elderly

Situation:

Elderly people do less exercise as they get older resulting in the loss of muscle mass and physical strength. This reduction in physical activity will also increase their risks of injury, such as falling. A home fitness device is needed to encourage the elderly to do exercise of moderate intensity at home, so as to improve their mobility and to strengthen the muscle endurance of the lower limbs.

Design Problem:

Design and make a prototype of the home fitness device for the elderly. Your design ideas should be original and able to meet the following basic requirements:

(i) incorporate appropriate technology to encourage the elderly to do exercises at home;
(ii) help the elderly to do moderate intensity of joint and muscle movement exercise for their lower limbs, and provide strength training with adjustable levels of resistance according to their needs, so as to improve mobility and to strengthen the muscle endurance of the lower limbs; and
(iii) automatically record the amount of exercise done.

The design of the home fitness device cannot contain any trademark or image with copyright, the main body 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 means that use technology to encourage the elderly to do more exercise; identify three or more mechanisms that can provide strength training for the elderly and allow them to adjust the levels of resistance; identify three or more means that can use technology to automatically record the amount of exercise done.

(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 alterative 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 model of the home fitness device.
- Illustrate the design of the home fitness device including the mechanisms and working principles of:
  (1) the system for joint and muscle movement exercise of the lower limbs;
  (2) the system that provides strength training with adjustable levels of resistance; and
  (3) the system that automatically records the amount of exercise done.

- Prepare a time schedule that lists for each stage the planning, time and resources management 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 home fitness device.
- 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 game installation with mechanical movements

Situation:

Your school will soon hold a technology carnival that aims to promote technology education. Different mechanical game installations will be set up at the carnival for the public to interact with and to learn more about technology and its applications. As a member of the technology club, you are required to design a game installation with mechanical movements for the carnival.

Design Problem:

Design and make a prototype of the game installation with mechanical movements. Your design ideas should be original and able to meet the following basic requirements:

(i) incorporate appropriate technology to draw the public's attention while the game installation is idle;
(ii) have it operated by electric and/or pneumatic means; contain not less than two input devices and can allow two or more people to participate in the game to cooperate with other(s) to accomplish a game mission; and
(iii) be able to terminate the game automatically within the time limit of 3 minutes, so as to reduce the time for queuing.

The design of the game installation cannot contain any trademark or image with copyright, the main body 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 means that use technology to draw public's attention; identify three or more mechanisms and input devices that can be used in a game; identify three or more means that use technology to terminate a game automatically within a time limit.

  (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 alterative 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 model of the game installation.

- Illustrate the design of the game installation including the mechanisms and working principles of:
  (1) the input method that drives the mechanical movements;
  (2) the control system for the game that includes mechanical movements; and
  (3) terminating the game automatically within the time limit of 3 minutes.

- Prepare a time schedule that lists for each stage the planning, time and resources management 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 game installation.
- 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