



Design Technology IA

For first assessment May 2020

Pranjal Rai



SCHEDULE

40 hours at SL and 60 hours and HL.

The following are included in the hours allotted:

- time for the teacher to explain to students the requirements of the internal assessment
- time for consultation between the teacher and each student
- time to complete the design project
- time to review and monitor progress and to check authenticity.

(DT TSM, first assessment May 2020).

ASSESSMENT

Once the student's design project has been finalized, the teacher will assess it using the assessment criteria. It must be emphasized that the expectations of the four common criteria (A–D) are the same for both HL and SL students. HL design projects are also assessed using criteria E and F (DT TSM, first assessment May 2020).

Standard level	Higher level
Criterion A: Analysis of a design opportunity	Criterion A: Analysis of a design opportunity
Criterion B: Conceptual design	Criterion B: Conceptual design
Criterion C: Development of a detailed design	Criterion C: Development of a detailed design
Criterion D: Testing and evaluation	Criterion D: Testing and evaluation
	Criterion E: Detailed development of a commercial product
	Criterion F: Making choices for commercial production

Level	Maximum word count	Maximum page count
SL	3000	Recommended 34, Maximum 38
HL	4000	Recommended 52, Maximum 56

The following screenshots are taken from DT TSM, MY IB, first assessment May 2020.

STANDARD LEVEL

Analysis of a design opportunity	Conceptual design	Development of a detailed design	Testing and evaluation	Total
9	9	9	9	36
(25%)	(25%)	(25%)	(25%)	(100%)

Criteria		Maximum word count	Recommended pages
Criterion A: Analysis of a design opportunity			
A	The student:		
	<ul style="list-style-type: none"> describes an appropriate problem that leads to a design opportunity 	200	1
	<ul style="list-style-type: none"> develops a detailed brief that identifies the relevant parameters of the problem 	150	1
	<ul style="list-style-type: none"> develops a design specification that justifies the requirements, based on the outcomes of the research 	800	3
Criterion B: Conceptual design			
B	The student:		
	<ul style="list-style-type: none"> develops feasible ideas to meet appropriate specifications that explore solutions to the problem 	-	6
	<ul style="list-style-type: none"> uses concept modelling and analyses the outcomes to guide design development 	-	4
	<ul style="list-style-type: none"> justifies an appropriate idea for detailed development. 	300	1
Criterion C: Development of a detailed design			
C	The student:		
	<ul style="list-style-type: none"> justifies the choice of appropriate materials, components and manufacturing techniques to make the prototype 	400	2
	<ul style="list-style-type: none"> develops an accurate design proposal in sufficient detail for a third-party to manufacture the prototype 	-	9
	<ul style="list-style-type: none"> produces a detailed plan for the manufacture of the prototype. 	-	2
Criterion D: Testing and evaluation			
D	The student:		
	<ul style="list-style-type: none"> justifies a testing strategy to measure the success of the prototype 	200	1
	<ul style="list-style-type: none"> evaluates the success of the prototype against the design specification 	700	2
	<ul style="list-style-type: none"> demonstrates how the prototype could be improved, considering how individual improvements affect the design as a whole 	250	2
Totals for an SL design project		3000	34

10 HRS

10 HRS

10 HRS

10 HRS

HIGHER LEVEL

Analysis of a design opportunity	Conceptual design	Development of a detailed design	Testing and evaluation	Detailed development of a commercial product	Making choices for commercial production	Total
9 (16.67%)	9 (16.67%)	9 (16.67%)	9 (16.67%)	9 (16.67%)	9 (16.67%)	54 (100%)

First four criteria (A-D) are same for HL, followed by E & F.

Criterion E: Detailed development of a commercial product

The student:

• develops the design, addressing the required modifications for a commercially viable production process	-	5
• presents the developed commercial product comprehensively	-	1
• develops an accurate design proposal of the commercial product in sufficient detail for a third-party to manufacture the product.	-	9

E

10 HRS

Criterion F: Making choices for commercial production

The student:

• justifies the choice of materials and components appropriate for commercial production	350	1
• justifies the choice of manufacturing techniques appropriate for commercial production	350	1
• justifies an appropriate scale and volume of production, based on appropriate research and suitability for the product.	300	1

F

10 HRS

Totals for an HL design project

4000

52

DOCUMENTATION

- **Layout:** Portrait orientation, A4 page size, Narrow margin
- File **size:** Less than 50 MB
- **Font:** Arial/Times new roman or any other professional font.
- Font **size:** 11/12 for body text & 14/16 for headings.
- Put **page number** on each page
- **Cover page** should include: Project name, DT IA, session, Brief description, Page and word count. Do not include your/teacher/school name. The project document must be anonymous.
- **Cite** all secondary resource used in your project document, follow the IB referencing and citation guide.
- All written and graphic content should be within the **margin**. It should not touch the boundary of the page.
- Each page must have a **heading** as per the task objective.
- Scanned text/sketches must be clearly **visible** in the IA document.
- Use **white background** only, unless for specific requirements like highlighted information/mood board/cover page etc.

APPENDICES

- All supportive material for project (background research, collection and analysis of raw data, test for evaluation etc.) can go in **Appendices**. This is excluded from the page limit. Any **reference** to appendices must be clearly shown in the project.
- The appendices are not considered when marking or moderating. The appendices are **not included** as part of the ePortfolio for eMarking. The appendices are **not uploaded** as part of the ePortfolio or as supporting material. (IB DT Guide, First Assessment May 2020)
- Save your Appendices as a separate file from the ePortfolio.

A NOTE ON ANNOTATIONS (IB DT Guide, First Assessment May 2020)

- Annotations must not be more than **10 words** each. Any annotation more than 10 words will be considered as counting towards the word count.
- Annotations must be legible, preferably **typed**. Students and teachers should ensure annotations can be read clearly. Handwritten annotations must be clear and equivalent to Arial font size 11pt. To ensure clarity when scanned, black ink is strongly recommended.



DT IA CHECKLIST

Pranjal Rai

CRITERION A: ANALYSIS OF A DESIGN OPPORTUNITY

1150 WORDS LIMIT, APPROXIMATELY 5 PAGES

A.1 Describe an appropriate problem that leads to a design opportunity

200 words, 1 page limit

Steps	Tasks	Check	Topics linked
1	Describe the current situation which is the main focus of your design project. Support it with primary/secondary evidence.		
2	For the mentioned situation, outline the problem that affects the wider audience. Answer: Who does the problem affect and how does it affect. Support it with primary/secondary research proving the appropriateness of the problem. Include supporting images demonstrating the nature of the problem and where it occurs.		7
3	Conduct user and market research to identify and describe the design opportunity (important insight for design intervention).		5,7
4	Conduct a brief preliminary investigation (primary & secondary research) to guide the design development leading to a clear design brief. You may research on the following: user research, market research, test on human factors (anthropometrics, psychological, physiological factors), existing product analysis, material and manufacturing. Document the procedure and method of collecting data in the appendices, present the summary of outcomes in the project document.		1,2,4,5,7

GUIDANCE

- Primary/Secondary research may include - Photographs, extracts from magazine/newspaper, internet data, observation, questionnaire, survey, user test, user interview, self-appraisal, expert opinion etc.
- Market research may include sales pattern and market trends, customer behavior, shopping trend, trend forecast etc.
- Remember to analyze all information before hand and present only clear & meaningful write up in a short and concise manner.
- Any evidence of research process should be included in the appendices, only include the synthesis of research and key outcomes in the project document.
- Don't forget the citation of sources.

A.2 Develop a detailed brief that identifies the relevant parameters of the problem.

150 words, 1 page limit

Steps	Tasks	Check	Topics linked
1	Indicate how you are planning to solve the problem identified, how will your solution help. What kind of outcome you will create, what scale (size), where it will be used, what are the aesthetic features, how will the user buy it, how will you manufacture it, what possible materials you will use, how will it fit the market need? Outline the scope of your project – incremental or radical approach.		1,2,4,5,6
2	Ensure to present the broad requirements determined from initial research into the problem.		
3	Did you mention the goal, user, context and constraints (limitations)?		
4	Persona mapping - Visually present the persona of the target users.		

GUIDANCE

- A clear and concise design brief is important to guide your design project successfully. Ensure clarity in goals and objectives. Goals reflect the overarching purpose of your project, while objectives highlight the granular methods in achieving that goal.
- What can your design brief include - Goal & objective, what is the product, situation where it will be used, what problem it will solve, who is the target audience, standards, compliance, environmental, budget and timescale, any other constraints.
- Develop a solid understanding of the users who will be interacting with your product. Your audience persona should include demographics such as age and gender, as well as psychographics like lifestyle habits and trends.
- What is a persona - the aspect of someone's character that is presented to or perceived by others. Present it with exemplar images.
- Defining the competition helps to clarify the picture. It helps to clarify the strategy, too, so the designer can make savvy decisions about how to stand out from the crowd. After analyzing the competitors during research stage, include the learning outcomes into the design brief.
- You can consider presenting mood board to reflect on the look and feel of your design outcome?

A.3 Develop a design specification that justifies the requirements, based on the outcomes of the research.

800 words, 3 page limit

Steps	Tasks	Check	Topics linked
1	<p>Develop the design specifications which are specific, smart and measurable.</p> <p>Aesthetics - look and feel, texture, pattern, color, shape etc.</p> <p>Target audience - user needs, ergonomics, human factor.</p> <p>Function - how will it work, where will it be used.</p> <p>Production constraints - manufacturing and production techniques .</p> <p>Material selection - possible material you will use and their properties.</p> <p>Size - How big the product and parts will be? Consider anthropometrics and physiological factors.</p> <p>Quantity - Consider the scale of production: one off, batch or mass.</p>		1,2,4,5,6
2	Prioritize the design specifications: High priority, Medium, Low; or devise another method to show priority.		
3	All specifications must be justified with reference to supporting research and citation of sources.		
4	All design specification must be developed from the design brief and research conducted earlier.		

GUIDANCE

- You may present this task in the form of a table with three columns: Design Specifications, Priority and Justification.
- Ensure that all design specifications have been derived from previous research and that they are specific and measurable, not generic in nature.
- Don't forget the citation of sources.

CRITERION B: CONCEPTUAL DESIGN

300 WORDS LIMIT, APPROXIMATELY 11 PAGES

B.1 Develop feasible ideas to meet appropriate specifications that explore solutions to the problem

No extended writing, 6 page limit

Steps	Tasks	Check	Topics linked
1	Develop a range of original concepts that are different from each other, innovative and original – quick sketch with minor details (6 minimum) . Ideas must be colored with annotation of key features. Use 1 page only for this task.		2,3,5,6
2	Select concepts to develop further (4 minimum iterations) to meet the specifications? Present them well using appropriate drawing techniques, well colored with outline, annotation and brief explanation of key features. At this stage undertake additional research required to inform development of ideas - annotate key points of additional research. Use 1 page each for a single concept drawing/sketch.		2,3,5,6,8
3	Do not include any extended writing to address this section.		
4	Ensure your ideas are feasible in terms of - solving the problem, following the specifications, possibility of manufacture, facilities you have access to, material and resource available, environmental impact, originality, relative advantage, complexity and compatibility.		2,5,8
5	Ensure all your sketches/drawings are well presented in your document - colored and outlined, scanned well and clearly visible,		

GUIDANCE

- For developing original quick concepts use freehand sketching - present your concepts in 3D.
- Appropriate techniques for detail development - Freehand drawing, Isometric, mix media, CAD, pictorial drawing, cross-sectional view, exploded drawing, perspective drawing, assembly drawing, tests, experiments.
- Use Computer Aided Drawing wherever possible.
- Any annotation more than 10 words will be counted towards the word count. Annotations must be legible, preferably typed. Handwritten annotations (in black ink and bold) must be clear and equivalent to Arial font size 11pt.

B.2 Use concept modelling and analyse the outcomes to guide design development

No extended writing, 4 page limit

Steps	Tasks	Check	Topics linked
1	Consider the most appropriate and feasible concepts from the last stage and use concept modelling techniques to test the validity in order to justify the final idea for prototype stage.		3
2	Consider the appropriate use of conceptual, graphical, physical and CAD models to test the design ideas if they will meet requirements like: aesthetic appeal, form, stability, function & performance, ability to be manufactured considering the available resources, assembly, ability to solve user's need, cost, environmental impact etc. You may take opinion from self/peers/expert/user to validate.		3,4
3	Provide clear feedback - indicate how the findings from concept modelling informs design development further. Ensure the feedback is scientific, technical and measurable not generic in nature.		
4	Do not include any extended writing to address this section.		

GUIDANCE

- You may use (but not limited to) these techniques for concept development according to the context of your design ideas:
 - ⇒ Graphical modelling - projection and scale drawings, formal drawing techniques, part and assembly drawings.
 - ⇒ Physical modelling - scale model, aesthetic model, mock-ups, prototype, instrumented model.
 - ⇒ Computer Aided Design - surface or solid model.
 - ⇒ Rapid prototyping - 3D printing, Laser cutting, CNC routing/milling/lathe etc.
- Remember there are no rules to concept modelling. Use any material and technique that does the job and can provide meaningful information to test the validity of your design ideas.
- Any intensive test procedure and data collection must be included in the Appendices, present the synthesis of testing in the project document and the key information only that is useful for guiding the design development.
- Any annotation more than 10 words will be counted towards the word count. Annotations must be legible, preferably typed. Handwritten annotations (in black ink and bold) must be clear and equivalent to Arial font size 11pt.

B.3 Justify an appropriate idea for detailed development

300 words, 1 page limit

Steps	Tasks	Check	Topics linked
1	Validate your ideas and models against design specifications to identify the most appropriate idea.		5
2	Refine the most appropriate idea (before final manufacture) and present it appropriately - 3D presentation drawing, colored, shaded, outlined, clear and well presented with brief explanation.		3
3	Annotate the presentation drawing of the final idea highlighting features.		
4	Write up with supporting images: Justify the final choice in relation with the design specifications.		5,6

GUIDANCE

- You may use (but not limited to) these factors to justify the selection of the final idea:
 - ⇒ Specification comparison table
 - ⇒ Self evaluation, expert appraisal, user feedback.
 - ⇒ Relative advantage, complexity and compatibility.
 - ⇒ Feasibility in terms of - effectiveness in solving the problem, possibility of manufacture, facilities you have access to, material and resource available, environmental impact, originality, time limitation etc.
- Any intensive evaluation procedure and data collection must be included in the Appendices, present the synthesis of evaluation in the project document and the key information only that is useful for justifying the final idea selection.
- Any annotation more than 10 words will be counted towards the word count. Annotations must be legible, preferably typed. Handwritten annotations (in black ink and bold) must be clear and equivalent to Arial font size 11pt.

CRITERION C: DEVELOPMENT OF A DETAILED DESIGN

400 WORDS LIMIT, APPROXIMATELY 13 PAGES

C.1 Justify the choice of appropriate materials, components and manufacturing techniques to make the prototype

400 words, 2 page limit

Steps	Tasks	Check	Topics linked
1	Label and number the different parts and components of your final idea, address accordingly when justifying the materials, components and manufacturing techniques.		
2	Identify materials , components , and manufacturing techniques to be used to create the prototype. Consider 2 or more options (if applicable) based on your requirements and then compare and analyze the best option suitable for the prototype.		2,4,10
3	Justify the final choice by giving valid reason/s of the materials, components and manufacturing techniques chosen based on the following aspects (as applicable): requirements of the prototype, cost, supply, physical and mechanical properties, functional aspect, manufacturing aspect, environmental requirement, user's need etc...		2,4,10
4	Include images of material, components and manufacturing techniques wherever applicable.		

GUIDANCE

- You may present it in the form of a table, including columns: Name of the part, component/material/manufacturing technique, justification for selection (remember to include images wherever necessary).
- Material examples: MDF, fiber board, acrylic, glass, canvas, synthetic leather, laminated veneer, composites, textiles etc... Components example: frames, channels, hinges, nut, bolts, screws, belts, tubes, gears, ball bearings etc... Manufacturing techniques example: acrylic bending, sheet cutting, die casting, injection molding, drilling, welding, brazing, Laminated object manufacturing (LOM), Laser cutting etc..
- Any intensive evaluation procedure, experiment and data collection must be included in the Appendices, present the synthesis of evaluation and the key information only in the IA project document that is useful for justifying the final materials, components and manufacturing techniques selection.

C.2 Develop an accurate design proposal in sufficient detail for a third-party to manufacture the prototype

No extended writing, 9 page limit

Steps	Tasks	Check	Topics linked
1	Develop designs to sufficient detail for a third party to be able to interpret them correctly: Develop the final idea into utmost detailing – 3D Isometric drawing, well colored and explained with annotation – including all sizes, construction, material, components, assembly and manufacturing details.		3
2	Appropriate technical drawings with sufficient detail for prototype manufacture: appropriate techniques and methods to finalize the details of the design (CAD, card model, close up drawing, cut section, exploded view etc.) wherever necessary to show the detailing.		3
3	Produce an orthographic drawing showing the front, side and plan view with dimensions in millimeters.		3
4	Present the detail bill of materials in the form of table that includes: Item number, Part name (example: handle, end cap, housing, Aluminum shaft), Part description and size (example: Aluminum shaft 300mm length, 8mm dia), Color, Quantity, Unit cost, Total cost. You can refer to several Bill of Material templates available free online.		4
5	Take feedback from a third party (user/client/expert) to check if they are able to interpret your design proposal correctly? Include the feedback in Appendices, amend your design proposal accordingly.		
6	Do not include any extended writing to address this strand.		

GUIDANCE

- It is advised to use CAD to present your final design proposal.
- Ensure all your drawing are well presented and clearly visible including the dimensions and annotation.
- A Bill of Materials (BOM) is a comprehensive inventory of the raw materials and components including the quantities of each needed to manufacture a product. In a nutshell the complete list of all the items that are required to build a product. Consider the complexity of your prototype that may require a multilevel BOM. Example: for a Wheel Barrow, consider one part - wheel that has three components: axle, spacer, axle brackets.
- Example of appropriate techniques for technical drawings: Isometric, Assembly, Cross section, Orthographic, Exploded

C.3 Produce a detailed plan for the manufacture of the prototype

No extended writing, 2 page limit

Steps	Tasks	Check	Topics linked
1	Use the construction plan template to create the plan of manufacture. The template is a table with 5 columns: Processes, Equipment, Scheduling, Quality control, Risk assessment. Remember there must be no more than 10 words per cell in the construction plan template.		4,10
2	Start with the process column and outline sequentially the order of operations to follow to make the prototype.		4
3	Mention all equipment /tools/machines to be used to make the prototype according to each step of operation. Include relevant images wherever possible.		4
4	Scheduling may be the number of lesson(s) used for each step of operation. Do mention the duration of each lesson in minutes. At the end mention the time taken to manufacture the complete prototype. Be mindful of the time duration recommended for the IA.		
5	Consider Quality control and quality management needed to ensure efficient production, safe practices and quality outcome.		4,10
6	For the risk assessment include: Hazard identified, risk possible, risk level, people affected and control measures. Risk assessment data for most of the common processes are available on the internet.		

GUIDANCE

- The construction plan must be written before the prototype is manufactured; it must not be written retrospectively.
- There must be no more than 10 words per cell in the construction plan template.
- Do not include any extended writing to address this strand.
- Plan the manufacture meticulously considering the time and resources available. This includes if you are outsourcing any part(s) from the external manufacturer.

CRITERION D: TESTING AND EVALUATION

1150 WORDS LIMIT, APPROXIMATELY 5 PAGES

D.1 Justify a testing strategy to measure the success of the prototype

200 words, 1 page limit

Steps	Tasks	Check	Topics linked
1	What are the main parameters to measure the success of your prototype? Build quality, performance, price, user satisfaction...? Identify appropriate testing methods that will generate data to measure the success of a prototype.		5
2	Give a justification of why the chosen testing strategy is appropriate.		
3	Include the test method, procedure and evidence in the Appendices. Present the outcomes and conclusion only in the IA document.		
4	You may present the evidence for this strand in the form of a table that includes three columns: Success parameter, Test method, Justification of chosen strategy		

GUIDANCE

- A testing strategy comprises of a number of appropriate testing methods that will generate data to measure the success of a prototype.
- You may use the following testing methods: User testing, Usability testing, Testing for assembly and disassembly, Performance testing, Field test, Durability testing, Safety testing, Reliability testing, Compatibility testing, Load and stability testing, Scalability testing, Destructive testing, Testing against existing products, Life cycle analysis, Environmental impact, Expert appraisal.
- Data generated may be: table, graph, chart, illustration, write-up, statistics or graphical figures etc.
- Tools for gathering data: Observation, Questionnaire, Interview, Survey, Literature search etc.

D.2 Evaluate the success of the prototype against the design specification

700 words, 2 page limit

Steps	Tasks	Check	Topics linked
1	How will you measure the strength and weakness of the prototype against each aspect of the design specifications - Aesthetics, Target audience, Function, Production constraints, Material, Size, Quantity		
2	For each of the design specification outline the strength and weakness of your prototype along with the evidence of testing.		
3	Include the detail test procedure in the Appendices. Present the information gathered from testing the prototype in the IA document along with an indication of the extent to which the prototype matches the requirements of the design specification.		

GUIDANCE

- Evidence of testing could be in the form of annotated images, table, graph, chart, illustration, write-up, statistics or graphical figures etc.
- Tests may include following parameters: performance (does it fulfil the purpose), reliability, ease of use, health and safety check (is the product fail safe), aesthetics (is it aesthetically pleasing), materials (do the materials suit the purpose; are they used according to their properties,) ergonomics (ease and comfort of use, appropriate shape and size for the intended user), quality (durability and reliability), construction (is it well made and designed to suit the methods of production), Cost/Economics (the cost of material and manufacture must make the product affordable by the user group), wider impact (consequences of product design on individual, society and environment), user characteristics (special capabilities, requirements and limitations of the people who use the product).
- For testing methods refer to the guidance in previous strand D.1

D.3 Demonstrate how the prototype could be improved, considering how individual improvements affect the design as a whole

250 words, 2 page limit

Steps	Tasks	Check	Topics linked
1	Present the recommendations to address weaknesses identified through evaluation against the design specification.		
2	Demonstrate through a combination of graphical models and extended text to suggest how the prototype could be improved. Ensure that the improvements recommended are meaningful, necessary and impactful not just superficial.		3

GUIDANCE

- Be mindful of the impact on the design as a whole while recommending individual improvements.
- Improvements may be demonstrated using the following techniques: CAD, drawing, card model, annotated photographs, rapid prototyping, graphic modelling, physical modelling etc.

CRITERION E: DETAILED DEVELOPMENT OF A COMMERCIAL PRODUCT

NO EXTENDED WRITING, APPROXIMATELY 15 PAGES

E.1 Develop the design, addressing the required modifications for a commercially viable production process

No extended writing, 5 page limit

Steps	Tasks	Check	Topics linked
1	The design of a production system requires a complete understanding of a product, its function and the quality of finish. What changes you will make to your prototype (each part of the prototype) considering commercial production? Identify the viable commercial production process then develop your design accordingly to suit the production process.		4,10
2	Present drawings/modelling of ideas annotated to show the required modifications. Consider each part of your prototype. Present the current stage (prototype in Criterion C), then identify the viable commercial production process suitable for each part(s). Develop the design (multiple iterations if required) addressing the required modification for the commercially viable production process. Ensure the drawings are well presented and clearly visible including the annotations.		4, 10
3	Add annotations highlighting additional research and/or feedback enabling iterative development. Ensure annotations are legible. Include any intensive research data in the appendices.		4,10
4	Do not include any extended writing to address this strand.		

GUIDANCE

- Consider the following aspects of manufacturing when redesigning for commercial production: Additive techniques, Wasting/subtractive techniques, shaping and joining techniques.
- Consider the following aspects when redesigning for commercial production: What scale of production, craft production, mechanized production, automated production, assembly line, mass production, mass customization, computer numerical control CNC.
- Consider design for manufacture: material, process, assembly and disassembly.
- Production system selection criteria includes time, labour, skills and training, health and safety, cost, type of product, maintenance, impact on the environment and quality management.

E.2 Present the developed commercial production comprehensively

No extended writing, 1 page limit

Steps	Tasks	Check	Topics linked
1	Present the complete modified product as a whole - a presentation drawing of the commercial product.		3
2	Include annotations of the presentation drawing highlighting the key modifications required for commercial production. Annotate what did you change from the prototype stage in Criterion C.		4,10
3	Do not include any extended writing to address this strand.		

GUIDANCE

- Use Computer Aided Drawing wherever possible.
- Any annotation more than 10 words will be counted towards the word count. Annotations must be legible, preferably typed. Handwritten annotations (in black ink and bold) must be clear and equivalent to Arial font size 11pt.
- Ensure all your sketches/drawings are well presented in your document - colored and outlined, scanned well and clearly visible,

E.3 Present an accurate design proposal of the commercial product in sufficient detail for a third-party to manufacture the product

No extended writing, 9 page limit

Steps	Tasks	Check	Topics linked
1	Present the commercial product in sufficient detail for a third party to be able to interpret correctly. Present the final idea with utmost detailing – including all dimensions, construction details, material, components, assembly and manufacturing details.		3
2	Appropriate technical drawings with sufficient detail for commercial manufacture (CAD, close up drawing, cut section, exploded view, assembly drawing etc.) wherever necessary to show the detailing.		3
3	Create an orthographic drawing showing the front, side and plan view with dimensions in millimeters.		3
4	Produce the detail bill of materials in the form of table that includes: Item number, Part name (example: handle, end cap, housing, Aluminum shaft), Part description and size (example: Aluminum shaft 300mm length, 8mm dia), Color, Quantity, Unit cost, Total cost. You can refer to several Bill of Material templates available free online.		4,10
5	Present an assembly drawing of the commercial product.		3

GUIDANCE

- It is advised to use CAD to present your final design proposal and assembly drawing.
- Ensure all your drawing are well presented and clearly visible including the dimensions and annotation.
- A Bill of Materials (BOM) is a comprehensive inventory of the raw materials and components including the quantities of each needed to manufacture a product. In a nutshell the complete list of all the items that are required to build a product. Consider the complexity of your prototype that may require a multilevel BOM. Example: for a Wheel Barrow, consider one part - wheel that has three components: axle, spacer, axle brackets.
- An assembly drawing is used to show fit and function, and verify how a product is put together. It is needed for products that have more than one part. These drawings lists all parts and sub-parts that make the final product. The BOM lists each part number, name and quantity.
- Example of appropriate techniques for technical drawings: Isometric, Assembly, Cross section, Orthographic, Exploded

CRITERION F: MAKING CHOICES FOR COMMERCIAL PRODUCTION

1000 WORDS, APPROXIMATELY 3 PAGES

F.1 Justify the choice of materials and components appropriate for commercial production

350 words, 1 page limit

Steps	Tasks	Check	Topics linked
1	Label and number the different parts and components of your commercial product drawing, address accordingly when justifying the materials and components.		
2	Identify materials and components to be used to create the commercial product. Consider 2 or more options (if applicable) based on your requirements and then compare and analyze the best option suitable for the commercial product.		4,10
3	Justify the final choice of each material and components based on the required properties and characteristics (as applicable): requirements of the commercial production, cost, supply, availability, physical and mechanical properties, functional aspect, manufacturing aspect, environmental requirement, user's need, maintenance etc...		2,4,8,10
4	Include images of material and components wherever applicable.		

GUIDANCE

- You may present it in the form of a table, including columns: Name of the part, component/material/, justification for selection (remember to include images wherever necessary).
- Material examples: MDF, fiber board, acrylic, glass, canvas, synthetic leather, laminated veneer, composites, textiles etc... Components example: frames, channels, hinges, nut, bolts, screws, belts, tubes, gears, ball bearings etc...
- Any intensive evaluation procedure, experiment and data collection must be included in the Appendices, present the synthesis of evaluation and the key information only in the IA project document that is useful for justifying the final materials and components selection.

F.2 Justify the choice of manufacturing techniques appropriate for commercial production

350 words, 1 page limit

Steps	Tasks	Check	Topics linked
1	Label and number the different parts and components of your commercial product drawing, address accordingly when justifying the manufacturing techniques.		
2	Identify manufacturing techniques to be used to create the commercial product. Consider 2 or more options (if applicable) based on your requirements and then compare and analyze the best option suitable for the commercial manufacture.		4,10
3	Justify the final choice of each manufacturing technique based on the requirements of commercial manufacture - example (as applicable): requirements of the commercial production, cost, supply, physical and mechanical properties of the materials, functional aspect, manufacturing aspect, environmental requirement, user's need, maintenance etc...		2,4,8,10
4	Include images of manufacturing techniques wherever applicable.		

GUIDANCE

- Select appropriate manufacturing techniques based on material characteristics (form, melting/ softening point), cost, capability, scale of production, desired properties.
- You may present it in the form of a table, including columns: Name of the part, component/material/, justification for selection (remember to include images wherever necessary).
- Any intensive evaluation procedure, experiment and data collection must be included in the Appendices, present the synthesis of evaluation and the key information only in the IA project document that is useful for justifying the final materials and components selection.
- Example of some commercial manufacturing techniques: 3D printing, CNC machining, Polymer casting, Rotational molding, Vacuum forming, Injection molding, Extrusion, Blow molding, Knitting...etc.
- Consider packaging if important.

F.3 Justify an appropriate scale and volume of production, based on appropriate research and suitability for the product

300 words, 1 page limit

Steps	Tasks	Check	Topics linked
1	Identify the scale and volume of production appropriate for commercial manufacture based on the suitability of the product and appropriate research. Include any intensive research in the appendices, present only key points and analysis of research in the IA project document.		4,10
2	Based on your research justify why the chosen scale and volume of production is appropriate. Ensure the appropriate scale and volume of production is chosen after careful investigation and preparation, not just by superficial research or off the top of your head.		4,9,10

GUIDANCE

- Decisions on scale of production are influenced by the volume or quantities required, types of materials used to make the products and the type of product being manufactured. There are also considerations of staffing, resources and finance.
- 4 scales of production - One-off, batch production, mass production, continuous flow. You may also consider mass customization.
- Various factors that affect the volume of production—availability of natural resources and raw materials, technology, availability of capital, transport facilities, political conditions, climate, policies of the government, labour and market. These are some of the critical factors, you may consider more if applicable.
- You may consider economic viability and Economies of scale.
- Choice of scale and volume of production may also depend on corporate strategies.

DESIGN RELATED TED TALKS

50 must see TED Talks about creativity and design

<https://www.canva.com/learn/50-must-see-ted-talks-creativity-design/>

In these TED Talks, some of the world's greatest designers share their creative process. Hear from Philippe Starck, Frank Gehry, Stefan Sagmeister, Paula Scher, MoMA's Paola Antonelli and more.

<https://www.ted.com/topics/design>

DESIGN THINKING AND DESIGN PROCESS

Students of product design video series on you tube. Video tutorials on Innovation, rendering & sketching, prototyping and model making, presentation, and portfolio

[https://www.youtube.com/watch?](https://www.youtube.com/watch?v=wWCQTOTNnwc&list=PLEefXt0jkKvxG457mIvNSMip6pwuUn_T8)

[v=wWCQTOTNnwc&list=PLEefXt0jkKvxG457mIvNSMip6pwuUn_T8](https://www.youtube.com/watch?v=wWCQTOTNnwc&list=PLEefXt0jkKvxG457mIvNSMip6pwuUn_T8)

IDEOs Design Kit

<http://www.designkit.org/>

Gravity tank method cards. These cards were created as a reference for applying design and innovation skill sets to projects and with teams.

<http://boneducation.com/pds/wp-content/uploads/2017/04/Work-Differently-Method-Cards.pdf>

D School's design thinking boot camp, method cards

[https://static1.squarespace.com/static/57c6b79629687fde090a0fdd/](https://static1.squarespace.com/static/57c6b79629687fde090a0fdd/t/58890239db29d6cc6c3338f7/1485374014340/METHODCARDS-v3-slim.pdf)

[t/58890239db29d6cc6c3338f7/1485374014340/METHODCARDS-v3-slim.pdf](https://static1.squarespace.com/static/57c6b79629687fde090a0fdd/t/58890239db29d6cc6c3338f7/1485374014340/METHODCARDS-v3-slim.pdf)

Design for America's process guide. Resources to apply creativity, design, and innovation to social challenges

<http://designforamerica.com/resources/>

DESIGN THINKING AND DESIGN PROCESS

Do it yourself toolkit. Practical tools to trigger practical and social innovation.

<https://diytoolkit.org/media/DIY-Toolkit-Full-Download-A4-Size.pdf>

D School's crash course in design thinking

<https://dschool.stanford.edu/resources/virtual-crash-course-video>

Work differently: Videos for design methods (bottom of the web page)

<https://www.salesforce.com/workdifferently/resources/#video-lessons-scroll-tab>

Service design toolkit

<http://servicedesigntools.org/>

Service design books

<http://www.servicedesignbooks.org/>

Service design tool kit by One Design

<https://medium.com/capitalonedesign/service-design-tools-methods-6e7f62fcf881>

DESIGN AWARDS - EXEMPLARY DESIGN PROJECTS

Red dot design award

<https://www.red-dot.org/>

Good design award

<https://www.good-designawards.com/>

Core 77 design award

<https://designawards.core77.com/>

iF design award

<https://ifworldddesignguide.com/design-excellence>

A' design award

<http://www.competition.adesignaward.com/categories.html>

iDSA design excellence award

<https://www.idsa.org/IDEA>

DESIGN MAGAZINES

10 Design magazines everyone should read

<https://www.stackmagazines.com/art-design/10-design-magazines-everyone-should-read/>

Top 20 Industrial Design Blogs and Websites To Follow in 2019

https://blog.feedspot.com/industrial_design_blogs/

Popular design magazines

Yanko Design	https://www.yankodesign.com/
Core 77	https://www.core77.com/
Curve	https://www.curvelive.com/
Dezeen	https://www.dezeen.com/design/products/
Wired	https://www.wired.com/tag/industrial-design/

DESIGN PORTFOLIO

Coroflot <https://www.coroflot.com/>

DESIGN COLLEGES

Top colleges of the world

<https://rathoredesign.com/top-design-colleges-in-world/>

2019 best design colleges in America

<https://www.educationcorner.com/top-design-colleges.html>

Top Art and Design Schools in 2017

<https://www.topuniversities.com/university-rankings-articles/university-subject-rankings/top-art-design-schools-2017>

Worlds best design schools ranked

<https://qz.com/645890/uk-and-us-schools-dominate-design-school-rankings/>

There are many other reputed Design Universities which are not there in this list.

Works cited

Cover page design thinking illustration	https://www.bbva.com/en/can-world-banking-learn-design-thinking/
Schedule and Assessment, page 2	DT TSM, My IB https://ibpublishing.ibo.org/server2/rest/app/tsm.xql?doc=d_4_deste_tsm_1410_1_e&part=8&chapter=1
Checklist image page 6	https://cpfa.org/retirement/

Best wishes for the successful DT IA project and a bright future ahead

Pranjal Rai