Diploma Programme subject outline—Group 4: sciences

School name	Haganässkolan Älmhult, IB Diploma Programme	**School code**	0510587
Name of the DP subject *(indicate language)*	Design Technology		
Level *(indicate with X)*	Higher: X — Standard completed in two years: X — Standard completed in one year *:		
Name of the teacher who completed this outline	Etienne Stefansson	**Date of IB training**	February 2020
Date when outline was completed	May 2020	**Name of workshop** *(indicate name of subject and workshop category)*	IBICUS CAT 2 Design Technology at the International School of Prague, Prague, Czechia on 18 - 20 February 2020

* All Diploma Programme courses are designed as two-year learning experiences. However, up to two standard level subjects, excluding languages ab initio and pilot subjects, can be completed in one year, according to conditions established in the *Handbook of procedures for the Diploma Programme*.

1. Course outline

- Use the following table to organize the topics to be taught in the course. If you need to include topics that cover other requirements you have to teach (for example, national syllabus), make sure that you do so in an integrated way, but also differentiate them using italics. Add as many rows as you need.
- This document should not be a day-by-day accounting of each unit. It is an outline showing how you will distribute the topics and the time to ensure that students are prepared to comply with the requirements of the subject. – This outline should show how you will develop the teaching of the subject. It should reflect the individual nature of the course in your classroom and should not just be a “copy and paste” from the subject guide.
- If you will teach both higher and standard level, make sure that this is clearly identified in your outline.

Course outline moved to following page due to formatting.

	Topic/unit (as identified in the IB subject guide) *State the topics/units in the order you are planning to teach them.*	Contents	Allocated time One class is 100 minutes. In one week there are 2 classes.	Assessment instruments to be used	Resources *List the main resources to be used, including information technology if applicable.*
Year 1	1, 3, 4, 5, 6	Human factors and ergonomics Modelling Raw materials to final production Innovation and design Classic design	Design Technology guide p.17 contains allocated times, all in accordance with Syllabus outline.	Ongoing classroom discussions Traditional assessment Written examinations (~5x) Summaries (~4x) Collaborative assessment Presentation (3x) Practical assessment 1x "Mini-IA" (Year 1, Term 1) 2x Submission of CAD-files Oral assessment 1x Compulsory Additional assessment based on demand and need Pre-Mock exams (1x) Inofficial mock exams (~2x) Official mock exams (1x) Past exams always available Internal Assessments: 1x Group 4 Project (DP1, Nov) 2x Individual Investigation/Project (DP1, T2, April to Sept) And (DP2, T1, Sept to Dec) Grade Descriptors External Assessment	Design & Technology 2nd Ed. (Metcalfe & Metcalfe) Given materials from IBO Design Technology Guide First Assessment 2020 Design Technology Teacher Support Material Assessed student work Design Technology by Ruth Trumpold Khan Academy Thamesmead Design Technology Materials and litterature from LTH-course KOO095 – Functional Mateirals: Askeland, D R, Phulé, P P: Essentials of Materials for Science and Engineering, 1st edition. Thomson Engineering 2004. ISBN: 0534253091. Fried, J R: Polymer Science and Technology. Prentice Hall Ptr. 2003. ISBN: 0-13-018168-4. YouTube: 3Blue1Brown Applied Science Bozeman Science CNC Kitchen Crash Course Day9TV Flan Blanche Gamers Nexus How To Make Everything Hydraulic Press Channel Kurzgesagt Learn Engineering Level1Techs Minutephysics Practical Engineering Real Engineering SciShow Scott Manley SmarterEveryDay Steve Mould The Royal Institution This Old Tony Veritasium Software: Arduino IDE Audacity Blender CHITUBOX Formware Fusion360 Meshmixer Photogrammetry software (WIP) Simplify3D SketchUp 2019 waifu2x Video: Battlebots BBC (assorted) Carl Sagan's Cosmos How It's Made Mythbusters
	3, 1, 2, 7	Modelling Human factors and ergonomics Resource management & sustainable production AHL: Innovation and design			
	3, 8, 9 Group 4 Project (Nov/Dec, decided with other G4 subjects)	Modelling Sustainability Innovation & markets			
	10, IA One Start (April) Mock exam (Feb to March)	Commercial production Internal Assessment Start			

Year 2	IA One Finish IA Two Start Mock exam				
	IA Two Finish Mock exam				
	Repetition SL	Repetition of SL-content.			
	Repetition HL Mock exam	Repetition of SL- and AHL-content.			

The group 4 project

As the IB guides say, "The group 4 project is a collaborative activity where students from different group 4 subjects work together on a scientific or technological topic, allowing for concepts and perceptions from across the disciplines to be shared in line with aim 10—that is, to 'encourage an understanding of the relationships between scientific disciplines and the overarching nature of the scientific method.'" Describe how you will organize this activity. Indicate the timeline and subjects involved, if applicable.

This activity has historically been organized together with the other Group 4-subjects.

A fair amount of freedom was given in student choice regarding the topic, students nominate one or two topics each, the topics are vetted, the students are then allowed to voted on the remaining topics.

Multiple sessions are scheduled over the course of one month, which has historically occurred in December. Collapse day may be included if applicable.

Project was historically demonstrated in exhibition-form during Open House. Expected a repeat of this, if circumstances allow.

2. IB practical work and the internal assessment requirement to be completed during the course

As you know, students should undergo practical work related to the syllabus.

- Physics, chemistry and biology: 40 hours (at standard level) or 60 hours (at higher level)
- Computer science: 40 hours (at standard level) or 40 hours (at higher level)
- Design technology: 60 hours (at standard level) or 96 hours (at higher level)
- Sport, exercise and health science: 40 hours (at standard level) or 60 hours (at higher level)

Use the table below to indicate the name of the experiment you would propose for the different topics in the syllabus.

An example is given. Add as many rows as necessary.

Name of the topic	Experiment	Any ICT used? *Remember you must use all five within your programme.*	ATL Explicit teaching Where Applicable *(communication, social, self management-organization, self management-affective skills, selfmanagement-reflection, research-info and media literacy, thinking-critical thinking, thinking-transfer thinking)*
Acids and bases	Titration	Yes	
Modelling (Conceptual, Mathematical, 3D-)	2D CAD	Computer model/simulation	Self-management
Modelling, Raw material to final product	Finite Element Analysis	Graph plotting software, Database, Computer model/simulation	Research
Modelling, Raw material to final product, Innovation and design	Conceptual Modelling	Spreadsheet, Computer model/simulation	Research
Modelling, Raw material to final product	Modelling 101	Computer model/simulation	Self-management

Modelling, Raw material to final product	3D CAD	Computer model/simulation	Self-management
Resource management and sustainable prodcution, Modelling, Sustainability, Commercial production	Simulations (Some AHL)	Database, Computer model/simulation	Social
Modelling, Raw material to final product	Slicing and 3D-Printing	Data logging, Graph plotting software, Computer model/simulation	Social
Modelling, Raw material to final product	GCODE	Data logging, Computer model/simulation	Thinking
Modelling	Rendering	Computer model/simulation	-
Human factors and ergonomics	Measurement and Anthropometrics	Database	Communication
IA	Programming [Optional/Individual]	Computer model/simulation	Communication
IA	Electronics [Optional/Individual]	-	
Modelling	Physical Modelling	-	
Innovation and markets, commercial production	Photo Editing (HL)	-	
Raw material to final product	Materials Properties Demonstrations	-	
IA	Powertool use, safety and processes. [Optional/Individual]		

3. IB internal assessment requirement to be completed during the course

Briefly explain how and when you will work on it. Include the date when you will first introduce the internal assessment requirement to your students, the different stages and when the internal assessment requirement will be due.

Date IA is introduced : DP1, Term 1, December
Date IA draft for comments due: DP2, Term 1, September
Date **final** IA is due: DP2, Term 1, December

Date EA requirements introduced : DP1, Term 2, January
Date students will be prepared to complete EAs : DP2, Term 2, February

Brief explanation how you work with IA and EA:
IA:

Group 4 Project – See Group 4 Project header in Course Outline above

Design Project – This was discussed in CAT2 Workshop in Prague: Two separate Design Projects are started, running roughly four months each (albeit some overruns and overlap may be expected), in which students are expected to work on both theoretical- and practical aspects of the project. The first project is started in Year 1, Term 2, and there is recommendation – not requirement – that some summer work is done by the student to facilitate completion.

Submission of a single first draft is expected at the end of project month 3. IFF this draft is submitted according to deadline, teacher comments are submitted on the completed work.

EA:

External assessment concepts are discussed as early as DP1, Term 1, with emphasis on IB Command Terms. A test exam or task on this may be given if time allows.
EA question examples are shown and discussed on an ongoing basis. EA-related course content is pointed out.

"Mock-mocks" are set in DP1, Term 2, as well as DP2, Term 1.

Official school DP2 mock exams are subject to availability and scheduling, but have historically been held in March.

4. Laboratory facilities

Describe the laboratory and indicate whether it is presently equipped to facilitate the practical work that you have indicated in the chart above. If it is not, indicate the timeline to achieve this objective and describe the safety measures that are applicable.

Facilites for laborations in High School Chemistry and Physics is available. Classrooms for practical wood-, and metalwork are available.

5. Other resources

Indicate what other resources the school has to support the implementation of the subject and what plans there are to improve them, if needed.

Teacher has an array of tools and educational mateiral, including but not limited to:

- Assorted Arduino-devices
- Assorted Raspberry Pi 3B, 3B+, 4 2GB and 4 4GB options
- Assorted LEGO, including Mindstorms and Pneumatics
- Sphero Mini
- Prusa MK1 FDM-type 3D-printer
- Prusa MK3S FDM-type 3D-printer with mutli-material addon
- MSLA-type 3D-printers
- Computational cluster of 32 TFLOPS-peak perforamnce (16 + 6 + 6 SMT-enabled, virtualization-enabled cores. 128 GB non-ECC + 48 GB non-ECC + 32 GB ECC RAM. GTX 1080 and RTX 2080 Ti graphics co-processors.)
- Virtual reality equipment (Oculus Rift DK2, HTC Vive with wireless 60 GHz-link, Smartphone, Leap Motion) Pro-grade microphones
- Pro-grade DSLR and optics
- 2x Mavic Mini quadcopters
- Custom 2kg AUW quadcopter
- Assorted power tools
- Assorted electronics, actuators, active- and passive components
- Airbrush and compressor

- Personal digital library of 1000+ eBooks on Design- and Science-related topics.
- Personal software suite ranging from photogrammetry, game design, AI accessible as far as licenses allow.

School has access to laboratory facilities as above, as well as the following hardware:

- 3x Prusa MK3S FDM-type 3D-printer
- Anycubic resin-printer
- CreatBot D600 FDM-type 3D-printer
- Defunct BitsFromBytes 3D Touch FDM-type 3D-printer

FPGA development systems in planning phase.

6. Links to TOK

You are expected to explore links between the topics of your subject and TOK. As an example of how you would do this, choose one topic from your course outline that would allow your students to make links with TOK. Describe how you would plan the lesson.

Topic	Link with TOK (including description of lesson plan)
Topic 4	**Areas of knowledge** Naturalistic and scientific methodology, and WoK is reintroduced and discussed from the perspective of Design, connections between design concepts / cycles are made to scientific methods. Technology is introduced as a concept, tool and as a phenomenon.

7. International mindedness

Every IB course should contribute to the development of international-mindedness in students. As an example of how you would do this, choose one topic from your outline that would allow your students to analyse it from different cultural perspectives. Briefly explain the reason for your choice and what resources you will use to achieve this goal.

Topic	Contribution to the development of international mindedness (including resources you will use)
Topic 2	International collaboration of iterative research and development is analyzed, towards a perspective of environmental, material and social sustainability.

8. Development of the IB learner profile

Through the course it is also expected that students will develop the attributes of the IB learner profile. As an example of how you would do this, choose one topic from your course outline and explain how the contents and related skills would pursue the development of any attribute(s) of the IB learner profile that you will identify.

Topic	Contribution to the development of the attribute(s) of the IB learner profile
IA	Risk takers: Students are actively encouraged to partake in and select (vetted) activities which they have an interest in or wish to learn, risk is accrued both collectively as a class, and on the individual level of the student, due to their individual choices.

This portion of the course outline highlights our IB practices. Each section gives a taste or example of how we meet the IB standards and practices in our program.

Inquiry (Approaches to Teaching 1)

You will be given opportunities to follow your interests, actively explore, or make your own choices in certain circumstances:

Yes, heavily! Students are always encouraged to "go out and look" for applications that are relevant to them, and to request them discusses/explained/demonstrated in class.
DesTech allows significantly greater flexibility in this regard, and students are always encouraged to work on their own projects, IA, summative and formatives.

If you are very interested in this subject, you might wish to have certain CAS experiences that are quite connected to this subject. Some examples are:

Creativity: DesTech-related CAS-in creativity is actively encouraged throughout the course, from utilizing and applying Computer-Aided Drawing for your own interests, and getting those ideas 3D-printed, to webdesign, programming, graphic design and game design.
Activity: Students have previously been engaged in sports and activities, and have been encouraged to find ideas, problems, and solutions.
Service: User-Centered Design, plays a significant role in the course, co-design is also encouraged. Students can offer to design solutions to problems as part of service, not only IA.

Conceptual focus (Approaches to Teaching 2)

Research shows that when learning focuses on conceptual understanding, the learning is richer and more sustained. Here are some examples of places in the course where we work rather explicitly to develop conceptual understanding:

Intellectual Property-rights:
This is more of a discussion that is difficult to gather evidence for, but we have discussions during several classes about how intellectual property relates to real-world situations, using previous examples about patents (Håkan Lans, SKF, Swedish Match), VHS/Audio cassette- and Internet Piracy, and Trademarks. Students are strongly encouraged to investigate how and why their own ideas could be protected.

The "big idea" I want them to learn: That **understanding** the legal framework we live and work within is important for designers.

Modelling:
Our "Topic 3" on modelling is also a particularly good example, students utilize CAD-programs for generation of their prototypes in IA, and are introduced to HOW Finite Element Analysis, Optimization, Raytracing/Rendering and exporting different viewports and sketches are directly useful both throughout the course, and how models can be used and/or marketed.

The "big idea" I want them to learn: Modelling is a "core"-concept in design and science. A digital model can be extremely versatile.

Local and/or Global links (Approaches to Teaching 3)

Global relevance is at the heart of the DP curriculum, within nearly every subject guide, the content is already baked in. But here are some of the local links we will make in our subject:

IKEA offers a great deal of amenities and nearby resources related to Design, from discussions and interviews with designers and engineers to on-site visits and interviews with staff, many of whom are parents.

Collaboration (Approaches to Teaching 4)

Sometimes what you will be learning will be linked to another subject area and sometimes we as teachers like to collaborate to articulate those links for you, we find it can make learning more meaningful. How we do this may vary from year to year, but here is an example of places in the curriculum where you might find that we will work in an interdisciplinary fashion:

Interdisciplinary connections are a vital part of the IBDP experience, parallels are constantly drawn between the curricula of DesTech and Biology, such as anatomy and physiology in Topic 1: Ergonomy, Psychology and Business in pricing considerations, and a great many parallels with Math and Physics in Topic 4: Materials Science.

We will also collaborate, you and I as the teacher on certain parts of the course. Some examples are:

Student-choice and student-lead constitute the majority of the course, from voting about the teaching style, to the freedom-under-responsibility afforded during the IA-phase.
During repetition, the majority of the time is devoted to re-learning forgotten components and topics of the course, along with develop new methods, mnemonics, and collabs to understand the course content.

And there will be times you collaborate with your classmates, such as:

You will actively engage and study together with your classmates, you will do peer-assessment, and collaborative learning exercises.

Removal of barriers to learning: (Approaches to Teaching 5)

We all have our strengths and areas to develop. If you are experiencing some form of barrier to your learning, here's what I expect you will do:

We are constantly on the lookout for your areas to develop, and try to improve those through your strengths. But please let me know as soon as you think there might be an issue, and we will work out a plan together. Should you fall behind, additional resources and opportunities will be made available where applicable. Any barriers are there to be overcome, and for you to grow as a person.

If I or another teacher detects that there might be a barrier to your learning, we will follow our Inclusion Policy.

Varied assessment (Approaches to Assessment 2)

These are the kinds of assessments used in this course *(prior to official IB assessments and including mocks)* :

Formative assessments:

Formative assessments are manifold and varied; Socratic learning and classroom discussions feature prominently and form the heart of the subject. These discussions are guided towards the interests and wishes of the students and have historically been greatly appreciated. More mundane Formative assessments are also available, including quizzes, Kahoots, and talks one-on-one.

Summative assessments allow for you to **consolidate your learning,** some examples of summative assessments in this course are:

Summative assessments are as varied as we can reasonably make them, traditional exams and papers are considered “classic”, but we also try to do more dynamic tasks, such as presentations, exhibitions, and practical examinations.

Here is some information about how your work will be marked or assessed:

I strive to assess pretty much everything anonymously, similar to the process at many universities, meaning that I do not know who is the author of a piece of work before the grade is reached.
We also standardize both in-house and externally with other schools.

Feedback (Approaches to Assessment 1)

You can expect to receive feedback from me on formative and summative assessments in this way:

Written feedback on most submitted tasks. Constructive and kind oral feedback constantly in class.
Detailed annotated IA-feedback is always given on a first draft, minor oral feedback on later revisions.

You will also have an opportunity to give feedback to me in this subject, here is how:

***(this may be something we co-create so wait on this one for a minute)*

To get to know our Assessment Policy in better detail, you can find it here.