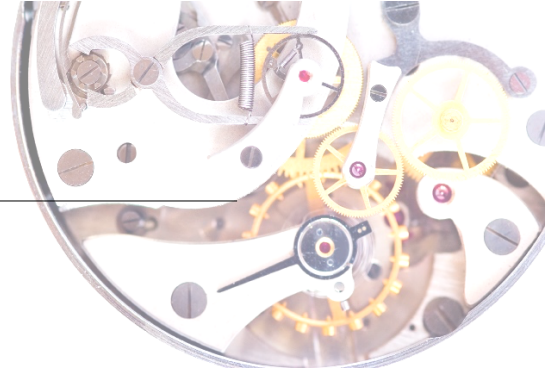# ENGINEERING DESIGN / CAD

1. Final task assignment

Contestant should create a sketch with the dimensions obtained by measuring the physical model of the detail, using measuring tools (caliper ruler, angle meter, radius meter); create missing parts, based on the drawings for the final assembly, make changes to the existing design, on its basis create the final assembly, photorealistic image, and animation.

Important note:

For each achievement task, contestants will be free to use one or several CAD software(s) preinstalled on the computer provided among: Solidworks®, Inventor Professionnal® or Fusion 360® (latest versions).

The task consists in the completion of 3 modules:

Module 1: Part modeling & Assembly

Using a detail drawing of a part, contestants will produce the relative virtual model. Using both a mechanism's description, the part modelized the step before and models of the assembly's components provided, contestants will produce a functional assembly.

Module 2: Detail drawing

Using the model of a part localized in an assembly, contestants will produce a detail drawing of this part.

Module 3: Reverse engineering by physical model

Using the physical model of a mechanical part, contestants will take measures and draw rough sketches in order to produce the closest virtual model according to the physical one.

2. Allocated time: 6 hours 00 minutes

The contest duration is 6 hours.

3. Requirements

	MODULE N°1 TYRE INFLATOR

Part modeling & mechanical assembly:

- Parts modeling
- Assembly modeling
- Assembly drawing
- Rendering

Completion time : 4 hours

- *All personal documentation should be approved by jury.*
- *No movement in skill area allowed without jury approval.*
- *Only named printing will be given to their owners.*

Presentation

Product presentation:

- The tyre inflator proposed here is a mobile compressor among a range produced by MICHELIN company.
- It is mainly used to check and adjust pressure in cars' tyres.
- Compact and light, it's easy to carry and to use and plugs directly into the cigar lighter.
- Once used, its space-saving allows to store it in the car glove box.

Technical description:

- Overall dimensions (h × l × w) : 14 × 14 × 6.5 cm
- Gross/net weight: 0,555 kg/0,450 kg
- Plug-in connection: cigar lighter 12V
- Pressure range: 0,05 bar up to 3,5 bar
- Airflow rate: 7 l/min
- Noise: 30 dB (A) measured at 4m
- USB port: phone charge / MP3
- Pressure digital backlit display
- Power button
- Unit displayed button
- Accessories provided: nylon hose 10 cm,brass tip for valve connection and adapters, power cable
- Compression unit : oil-free coaxial
- Aluminum single cylinder
- Storage for accessories
- Brand: MICHELIN
- Main color: Noir
- Certification: CE

Short user manual:

1) To use the tyre inflator, first take both cable and hose out of their housings.
2) Then plug the cigar lighter into the car 12V outlet.
3) Plug the brass tip (with eventual adapter) onto or into the valve of the product you want to check or adjust pressure.
4) Press then the power button to start the inflator: the it starts to inflate the product.
5) At least, check the pressure displayed on the digital display (use button right to the display to change unit: PSI, BAR, KPa) and once the desired pressure is reached, press the power button to stop the inflator.

Detail drawings ⇨ Parts modeling

Using detail drawings provided, **PRODUCE** relative virtual models of each part.

SAVE your files according to designations writen on parts' drawings with a name such as **« Designation_xxxxx »** in the folder **« M1_xxxxx »** (xxxxx: 5 first letters of your LAST NAME), folder that you previously create on Windows' desktop.

Parts modeling ⇨ Subassembly modeling

Using both the mechanism's description, bill of material, parts modelized the step before and models of the assembly's components provided, **PRODUCE** a subassembly model of the mechanical system.

Assembly instructions:

⇨ 3 configurations are expected according to the positions of the crank rod system (extreme positions and middle).

⇨ Some parts are deformable (hose, joints) and are represented in the free state.

⇨ Given spring will have to be modified or remodelized once inserted into the assembly.

⇨ Top cover is voluntarily not provided!

SAVE your file as **« Mechanical system_xxxxx »** in the folder **« M1_xxxxx »**.

Parts & subassembly modeling ⇨ Assembly modeling

Using both the mechanism's description, bill of material, parts and subassembly modelized steps before and models of the assembly's components provided, **PRODUCE** a functional assembly model.

Assembly instructions:

⇨ Assembly will be represented when not in use (i.e all accessories in their housings).

⇨ Any configuration mentioned above allowed.

SAVE your files as **« Tyre inflator_xxxxx »** in the folder **« M1_xxxxx »**.

Subassembly modeling ⇨ Subassembly drawing

Using your mechanical subassembly model, **EDIT** a drawing following the instructions below:

⇨ Standard ISO sheet format (A2 max).
⇨ Choice of scale.
⇨ Views allowing to see the 3 configurations mentioned above.
⇨ Views allowing to see different internal mountings of the mechanical subassembly.
⇨ Views allowing to see the 2 states of the spring according to the 2 operating phases (suction or compression of the air).
⇨ Usual title block informations.
⇨ Bill of material.
⇨ Usual detailing (hatch, axis, …).
⇨ Annotations (parts items numbers).

SAVE your file as **« Mechanical system_xxxxx »** in the folder **« M1_xxxxx »**.

Assembly modeling ⇨ Assembly drawing

Using your assembly model, **EDIT** a drawing following the instructions below:

- ⇨ Standard ISO sheet format (A2 max).
- ⇨ Choice of scale.
- ⇨ Any configuration mentioned above allowed.
- ⇨ Views allowing to see different mountings.
- ⇨ Exploded isometric view (with pre-assemblies not exploded).
- ⇨ Usual title block informations.
- ⇨ Bill of material (with pre-assemblies not exploded: see bill of material provided).
- ⇨ Usual detailing (hatch, axis, …).
- ⇨ Annotations (parts items numbers).

SAVE your file as **« Tyre inflator_xxxxx »** in the folder **« M1_xxxxx »**.

Assembly modeling ⇨ Rendering

Using both the mechanism's description and bill of material, **GET** a photorealistic image of the assembly following the instructions below:

- ⇨ Choice of the background.
- ⇨ Choice of the view (mechanical subassembly should be partially shown).
- ⇨ Logo « MICHELIN » and pressure display picture provided.
- ⇨ File format : JPEG.
- ⇨ File resolution : 1024 × 768.

SAVE your file as **« Tyre inflator_xxxxx »** in the folder **« M1_xxxxx »**.

MARKING SCHEME

N°	Items to be evaluated	Distribution		
A	**Part modeling & mechanical assembly**	*Subjective*	*Objective*	*Total*
01	Parts modeling	-	10.00	10.00
02	Assembly modeling	-	30.00	30.00
03	Assembly drawing	2.00	13.00	15.00
04	Assembly rendering	2.00	3.00	5.00
	Total A			**60.00**

MODULE N°2
TYRE INFLATOR

Detail drawing:

- ● Drawing of part with complete specifications

Completion time : 1 hour

- ● *All personal documentation should be approved by jury.*
- ● *No movement in skill area allowed without jury approval.*
- ● *Only named printing will be given to their owners.*

Part model ⇨ Detail drawings

Using both the mechanism's description, bill of material and assembly you modelized in module M1, **EDIT** a drawing of the « Power button » provided following the instructions below :

- ⇨ Standard ISO sheet format A3
- ⇨ Choice of scale
- ⇨ Choice of views
- ⇨ All manufacturing specifications
- ⇨ Usual title block informations
- ⇨ Usual detailing (hatch, axis, …)

SAVE your file as **« Power button_xxxxx »** in the folder **« M2_xxxxx »**.

MARKING SCHEME

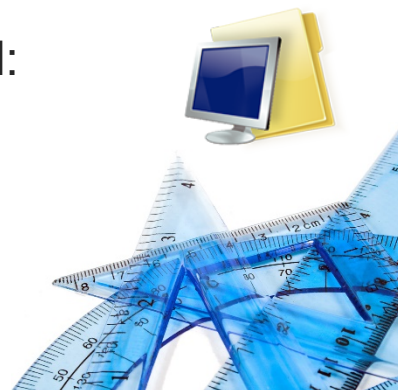| N°	Items to be evaluated	Distribution		
B	**Detail drawing**	*Subjective*	*Objective*	*Total*
05	Détail drawing	2.00	18.00	20.00
	Total B			**20.00**

MODULE N°3
SANDER ADAPTER

Reverse engineering by physical model:

- 3D model of the object
- Drawing of the object

Completion time : 1 hour

- *All personal documentation should be approved by jury.*
- *No movement in skill area allowed without jury approval.*
- *Only named printing will be given to their owners.*

Physical prototype ⇨ Part model

Using the physical prototype object given, **MAKE** a sketch of the object and **DETERMINE** all necessary dimensions with avalailable measuring tools.

Notes :

- All parts of the object should be modelized and can be disassembled (tools provided) but will have to be shown as assembled in the model.
- Don't care about manufacturing defects
- Use your own measuring tools
- Measuring precision :
  - Functionnal : 0,2 mm
  - Non-functionnal : 0,5 mm
- Sketch is not assessed

Pay attention : you can start modelize after 10 minutes but the physical prototype will be removed after 20 minutes !

Using your sketch, **PRODUCE** virtual model of the object.

SAVE your file as **« Sander adapter_xxxxx »** in the folder **« M3_xxxxx »**.

Part model ⇨ Shape drawing

Using the model of the object you made before, **EDIT** a drawing following the instructions below :

⇨ Drawing of the assembly
⇨ Standard ISO sheet format (A2 max)
⇨ Choice of scale
⇨ Choice of views
⇨ No dimension or other specification, only shapes
⇨ Annotation of the main plastic part volume
⇨ Usual title block informations
⇨ Usual detailing (hatch, axis, …)

SAVE your file as **« Sander adapter_xxxxx »** in the folder **« M3_xxxxx »**.

MARKING SCHEME

N°	Items to be evaluated	Distribution		
C	**Reverse engineering by physical model**	*Subjective*	*Objective*	*Total*
06	3D model of the object	-	15.00	15.00
07	Drawing of the object	2.00	3.00	5.00
	Total C			**20.00**

4. Procedure

Day -1 (March 23rd): Contestants will be welcomed by judges. There will be a briefing on the contest organization and safety rules. Contestants will be drawn for the appointment of the workplace, according to the number of the draw, customize their personal equipment (hardware peripherals – keyboard, mouse, 3D manipulators) and adjust the software parameters.

Day 1 (March 24th): The Module 1 task will be given to contestants. 15 minutes are allocated for studying a task with a judge, after which a 10-minute question and answer briefing will be organized. After the briefing contestants perform the task assignment.

Day 2 (March 25th):

The Module 2 task will be given to contestants. 15 minutes are allocated for studying a task with a judge, after which a 10-minute question and answer briefing will be organized. After the briefing contestants perform the task assignment.

The Module 3 task will be given to contestants. 15 minutes are allocated for studying a task with a judge, after which a 10-minute question and answer briefing will be organized. After the briefing contestants perform the task assignment.