

INTRODUCTION TO ENGINE LABORATORY RESEARCH ENERFT1001, 1 ECTS

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Vaasan yliopisto
UNIVERSITY OF VÅASA

Course content



- ▶ Virtual tours to marine engine laboratory and fuel laboratory
- ▶ Introduction of different engine components and monitoring devices
- ▶ Presentation of laboratory equipment and measuring instruments
- ▶ Exercises and mathematical problems concerning basic research methods in laboratories

Virtual tours



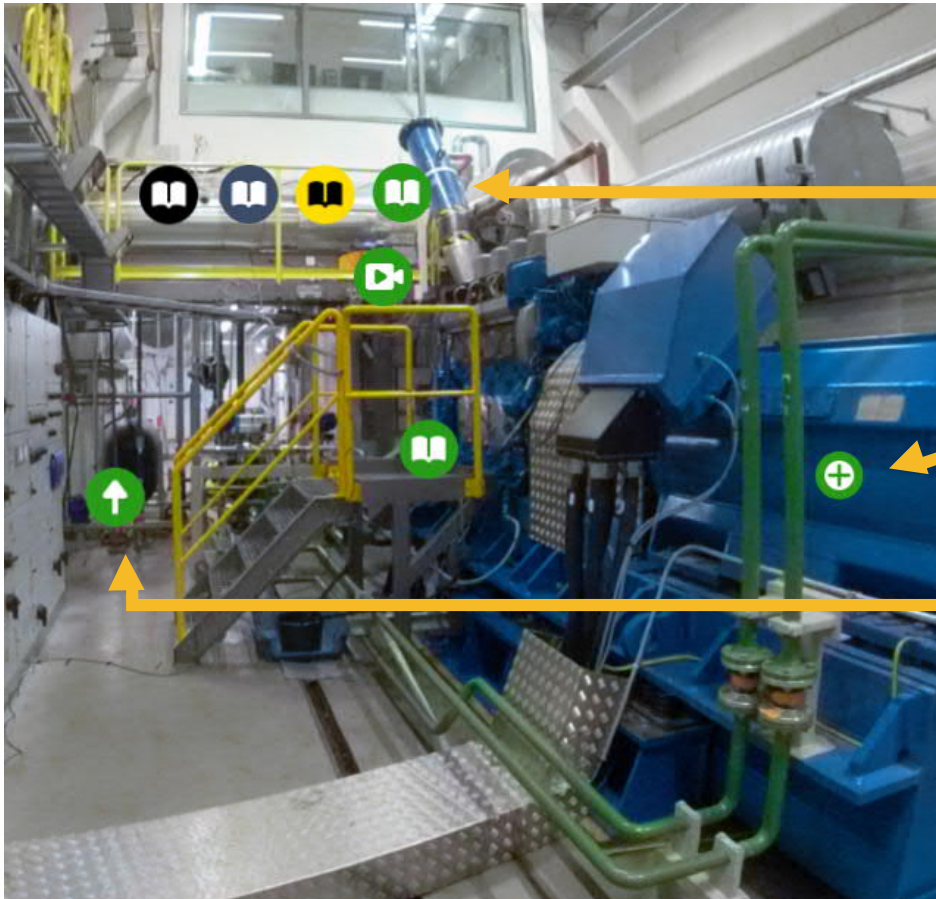
- ▶ Virtual tours to University of Vaasa's engine and fuel laboratories are implemented in Thinglink 360-environment
- ▶ Find the tours by following the web-link at the course front page
- ▶ Basic information how to use the Thinglink 360-environment is given in the next slides

How to visit the laboratories by using Thinglink 360? 1/2



- ▶ The starting page should look like this
- ▶ Virtual tours starts here
- ▶ You can find the link to the university's web-pages from here

How to visit the laboratories by using Thinglink 360? 2/2



- ▶ Symbols of book, camera or plus, includes more information - click them!
- ▶ Following the arrows you can move around the laboratories

Written assignment (report) 1/2



- ▶ Students write a report of the exercises including calculations
- ▶ All the required learning material is provided in the virtual tours and in this document
- ▶ The report is returned as a one pdf-document including answers to all exercises
- ▶ In the report, use the given University of Vaasa's template
 - ▶ You can find it from the course front page

Written assignment (report) 2/2



- ▶ The course is passed, if
 - ▶ The report includes answers to all exercises AND
 - ▶ The overall sum of exercise points is 50% or over
- ▶ The course is failed, if
 - ▶ The report is returned without answers to all exercises OR
 - ▶ The overall sum of exercise points is under 50%
- ▶ The maximum overall points of the exercises is 25.

The exercises



Exercise 1 – total 7 points

FUEL LABORATORY



- ▶ Question 1: Why is it important to know the metal contents of fuel?
- ▶ Question 2: Which are the properties that tell about the biofuel ageing?
- ▶ Question 3: What is the requirement for diesel fuel flash point set in European diesel standard?

Exercise 2 – total 8 points

ENGINE LABORATORY



- ▶ Question 1: What is the significance of measuring nitrogen and carbon oxides in engine exhaust?
- ▶ Question 2: What kind of effects may the smallest exhaust particles have on human health?

Exercise 3 – total 4 points

ENGINE LABORATORY



- ▶ Question 1: Why hydrogen is an interesting alternative fuel for heavy-duty applications? What advances compared to biogas and diesel you can find from the material?
- ▶ Question 2: What are the main obstacles when hydrogen is considered as an alternative fuel in a compression ignited engine? Mention at least four.

Exercise 4 – total 6 points

ENGINE LABORATORY

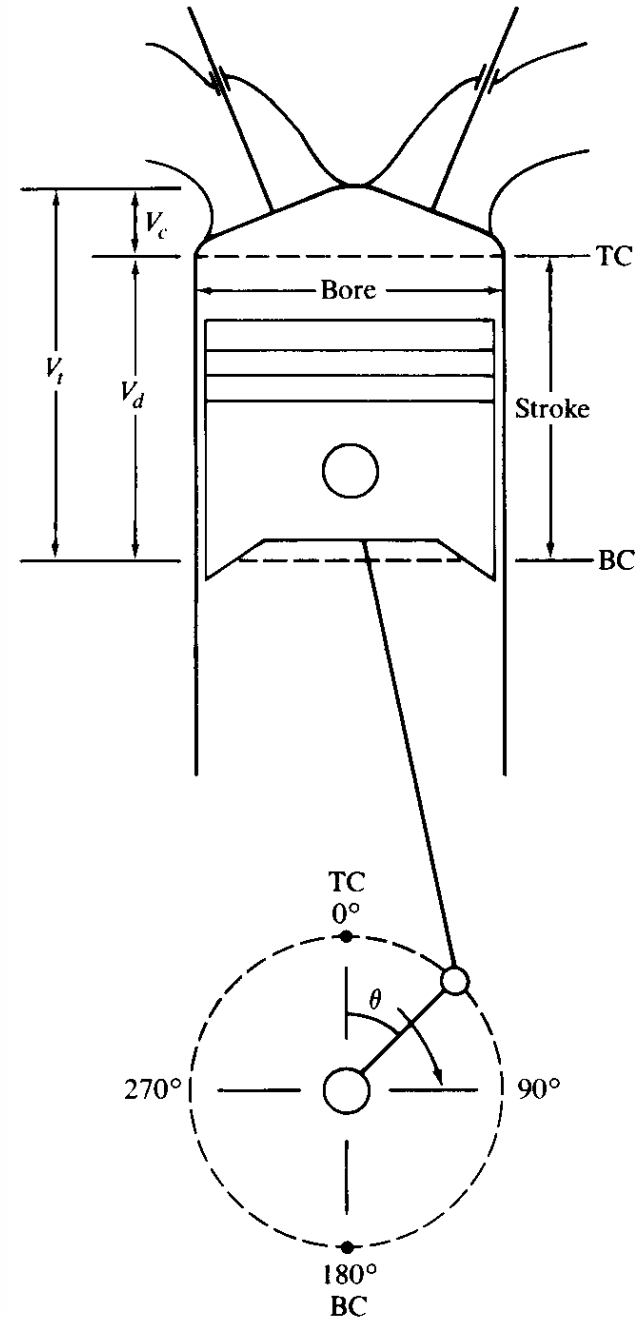


- ▶ The required engine specifications are provided at the virtual environment of the engine laboratory
- ▶ The required formulas and notations are given in the next slide
- ▶ Determine
 - ▶ The brake mean effective pressure, BMEP (p_e) of the W4L20 research engine. Give the answer in bar unit.
 - ▶ The mean piston speed (\bar{s}_p) of the W4L20 research engine. Give the answer in m/s unit.

Notations



- ▶ Cylinder bore, B
- ▶ Piston stroke, L
- ▶ Swept volume, V_d
- ▶ Compression volume, V_c
- ▶ Top dead center, TDC (or TC)
- ▶ Bottom dead center, BDC (or BC)
- ▶ Crank angle, ϑ [theta]
- ▶ Brake power, P_b
- ▶ Engine speed, N
- ▶ $n_R = 2$ (4-stroke)
- ▶ $n_R = 1$ (2-stroke)



Formulas



- ▶ Brake mean effective pressure (BMEP), p_e

$$p_e = \frac{P_b n_R}{V_d N}$$

- ▶ Swept volume, V_d

$$V_d = \frac{\pi B^2}{4} \times L$$

- ▶ Mean piston speed

$$\bar{S}_p = 2LN$$

Thank you!

