

# Experiments and Models – Linear Response: Structure and Dynamics of Condensed Matter

Title	Experiments and Models – Linear Response: Structure and Dynamics of Condensed Matter
Semester	E2024
Master programme in	Physics and Scientific Modelling
Type of activity	Course
Teaching language	English
Study regulation	Read about the Master Programme and find the Study Regulations at <a href="http://ruc.dk">ruc.dk</a> Læs mere om uddannelsen og find din studieordning på <a href="http://ruc.dk">ruc.dk</a>

## REGISTRATION AND STUDY ADMINISTRATIVE

Sign up for study activities at [stads selvbetjening](#) within the announced registration period, as you can see on the [Studyadministration homepage](#).

When signing up for study activities, please be aware of potential conflicts between study activities or exam dates.

### Registration

The planning of activities at Roskilde University is based on the recommended study programs which do not overlap. However, if you choose optional courses and/or study plans that goes beyond the recommended study programs, an overlap of lectures or exam dates may occur depending on which courses you choose.

Number of participants

ECTS 10

Responsible for the activity

Kristine Niss ([kniss@ruc.dk](mailto:kniss@ruc.dk))

Head of study Studieleder for Fysik ([fys-sl@ruc.dk](mailto:fys-sl@ruc.dk))

Teachers

Study administration INM Registration & Exams ([inm-exams@ruc.dk](mailto:inm-exams@ruc.dk))

Exam code(s) U60191

## ACADEMIC CONTENT

**Overall objective** The course in Experiments and Models is intended to train the student's skills to conduct experiments, treat data and construct models for physical systems. The students will acquire exemplary knowledge on the interplay between theory, models and experiments and learn to bring them into play in a concrete context.

**Detailed description of content** The thematic focus in this course is on experimental methods and models of dynamics and structure of materials, particularly liquids and soft matter.

**Course material and Reading list** Fundamentals of Condensed Matter and Crystalline Physics - by David L. Sidebottom, Cambridge University Press

The course material will be a mixture of notes, lab-instructions and textbook material. The pensum will be specified on the moodle-page of the course.

The expected work effort of the students is approximately 270 hours. The hours are distributed between different activities. The times indicated here are estimates.

- Overall plan and expected work effort**
- 48 hours class (lectures and small experiments)
  - 12 hours for a selected experiment
  - 62 hours preparation for class (reading and problem solving)
  - 40 hours working with portfolio part A (small experiments)
  - 56 hours working with portfolio part B (selected experiment)
  - 50 hours preparation for exam
  - 1 hour exam

**Format**

The course includes formative evaluation based on dialogue between the students and the teacher(s).

Evaluation and feedback Students are expected to provide constructive critique, feedback and viewpoints during the course if it is needed for the course to have better quality. Every other year at the end of the course, there will also be an evaluation through a questionnaire in SurveyXact. The Study Board will handle all evaluations along with any comments from the course responsible teacher.

Furthermore, students can, in accordance with RUCs 'feel free to state your views' strategy through their representatives at the study board, send evaluations, comments or insights from the course to the study board during or after the course.

Programme The first part of the course focuses on dynamical properties of materials. A key part of the course is Electric circuit analogies used as a tool to visualize and model simple linear differential equations describing fundamental properties of materials. This part of the course includes two experiments which are performed by all students (in small groups) and

The second part of the course deals with structure of materials and basic scattering theory.

In the third part of the course students perform a larger experiment in small groups. The experiment will be within the field of structure and dynamics of amorphous and soft matter.

Details of the plan will be on the course Moodle-page.

## ASSESSMENT

After completing the course the students will be able to

- Overall learning outcomes
- demonstrate skills in using certain technical apparatus for physics experiments e.g., electronic measuring equipment and data collection on computers
  - analyse and present the data obtained
  - demonstrate knowledge, understanding and insight into selected elements of electrodynamics, continuum mechanics,

thermodynamics and condensed matter physics in a concrete experimental context

- demonstrate understanding and reflection on the overview of the experimental methods used and their status in physics
- apply complex functions and linear differential equations in order to model experimental results.
- define basic scattering theory and use it to describe theory and dynamics of liquids
- discuss the importance of the experimental results achieved and relate them to relevant theories and models.

Individual oral exam based on a portfolio.

The character limit of the portfolio is 1,200-120,000 characters, including spaces. Examples of written products are exercise responses, talking points for presentations, written feedback, reflections, written assignments. The preparation of the products may be subject to time limits.

Form of examination

The character limits include the cover, table of contents, bibliography, figures and other illustrations, but exclude any appendices.

Time allowed for exam including time used for assessment: 30 minutes. The assessment is an assessment of the oral examination. The written product(s) is not part of the assessment.

Permitted support and preparation materials for the oral exam: All.

Assessment: 7-point grading scale.

Moderation: Internal co-assessor

Form of Re-examination

Samme som ordinær eksamen / same form as ordinary exam

Type of examination in special cases

The exam starts with a short presentation by the student on a selected experiment and is followed by questions and discussions which may cover all parts of the curriculum.

The student will be evaluated on their ability to

Examination  
and  
assessment  
criteria

- present and discuss the experiments and theory of the course in a relevant manner
- analyse and present the data obtained
- demonstrate knowledge, understanding and insight into selected elements of electrodynamics, continuum mechanics, thermodynamics and condensed matter physics in a concrete experimental context
- demonstrate knowledge of the theory relevant for interpreting the experiments (e.g. complex response functions and scattering theory)
- demonstrate understanding and reflection on the overview of the experimental methods used and their status in physics
- discuss the importance of the experimental results achieved and relate them to relevant theories and models.

Exam code(s) Exam code(s) : U60191

## Course days:

**Hold: 1**

### Experiments and Models (PSM)

time	09-09-2024 13:15 til 09-09-2024 15:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	27.2-046 - fysik b (1)
Teacher	Kristine Niss ( kniss@ruc.dk )

### **Experiments and Models (PSM)**

time 10-09-2024 10:15 til  
10-09-2024 12:00  
forberedelsesnorm ikke valgt  
forberedelsesnorm D-VIP ikke valgt  
location 27.2-046 - fysik b (1)  
Teacher Kristine Niss ( kniss@ruc.dk )

### **Experiments and Models (PSM)**

time 13-09-2024 10:15 til  
13-09-2024 12:00  
forberedelsesnorm ikke valgt  
forberedelsesnorm D-VIP ikke valgt  
location 27.2-046 - fysik b (1)  
Teacher Kristine Niss ( kniss@ruc.dk )

### **Experiments and Models (PSM)**

time 16-09-2024 13:15 til  
16-09-2024 15:00  
forberedelsesnorm ikke valgt  
forberedelsesnorm D-VIP ikke valgt  
location 27.2-046 - fysik b (1)  
Teacher Kristine Niss ( kniss@ruc.dk )

### **Experiments and Models (PSM)**

time 17-09-2024 10:15 til  
17-09-2024 12:00  
forberedelsesnorm ikke valgt  
forberedelsesnorm D-VIP ikke valgt  
location 27.2-046 - fysik b (1)  
Teacher Kristine Niss ( kniss@ruc.dk )

### **Experiments and Models (PSM)**

time 20-09-2024 10:15 til  
20-09-2024 12:00  
forberedelsesnorm ikke valgt

forberedelsesnorm D-VIP ikke valgt  
location 27.2-046 - fysik b (1)  
Teacher Kristine Niss ( kniss@ruc.dk )

### **Experiments and Models (PSM)**

time 23-09-2024 13:15 til  
23-09-2024 15:00  
forberedelsesnorm ikke valgt  
forberedelsesnorm D-VIP ikke valgt  
location 27.2-046 - fysik b (1)  
Teacher Kristine Niss ( kniss@ruc.dk )

### **Experiments and Models (PSM)**

time 24-09-2024 10:15 til  
24-09-2024 12:00  
forberedelsesnorm ikke valgt  
forberedelsesnorm D-VIP ikke valgt  
location 27.2-046 - fysik b (1)  
Teacher Kristine Niss ( kniss@ruc.dk )

### **Experiments and Models (PSM)**

time 30-09-2024 13:15 til  
30-09-2024 15:00  
forberedelsesnorm ikke valgt  
forberedelsesnorm D-VIP ikke valgt  
location 27.2-046 - fysik b (1)  
Teacher Dorthe Posselt ( dorthe@ruc.dk )

### **Experiments and Models (PSM)**

time 01-10-2024 10:15 til  
01-10-2024 12:00  
forberedelsesnorm ikke valgt  
forberedelsesnorm D-VIP ikke valgt  
location 27.2-046 - fysik b (1)  
Teacher Dorthe Posselt ( dorthe@ruc.dk )

## **Experiments and Models - Hand in Maxwell Model report on Moodle (PSM)**

time 03-10-2024 23:59 til  
03-10-2024 23:59  
forberedelsesnorm ikke valgt  
forberedelsesnorm D-VIP ikke valgt

## **Experiments and Models (PSM)**

time 04-10-2024 10:15 til  
04-10-2024 12:00  
forberedelsesnorm ikke valgt  
forberedelsesnorm D-VIP ikke valgt  
location 27.2-046 - fysik b (1)  
Teacher Dorthe Posselt ( dorthe@ruc.dk )

## **Experiments and Models (PSM)**

time 07-10-2024 13:15 til  
07-10-2024 15:00  
forberedelsesnorm ikke valgt  
forberedelsesnorm D-VIP ikke valgt  
location 27.2-046 - fysik b (1)  
Teacher Dorthe Posselt ( dorthe@ruc.dk )

## **Experiments and Models (PSM)**

time 08-10-2024 10:15 til  
08-10-2024 12:00  
forberedelsesnorm ikke valgt  
forberedelsesnorm D-VIP ikke valgt  
location 27.2-046 - fysik b (1)  
Teacher Dorthe Posselt ( dorthe@ruc.dk )

## **Experiments and Models (PSM)**

time 11-10-2024 10:15 til  
11-10-2024 12:00  
forberedelsesnorm ikke valgt  
forberedelsesnorm D-VIP ikke valgt



location 27.2-046 - fysik b (1)  
Teacher Dorthe Posselt ( dorthе@ruc.dk )

### **Experiments and Models (PSM)**

time 14-10-2024 13:15 til  
14-10-2024 15:00  
forberedelsesnorm ikke valgt  
forberedelsesnorm D-VIP ikke valgt  
location 27.2-046 - fysik b (1)  
Teacher Dorthe Posselt ( dorthе@ruc.dk )

### **Experiments and Models (PSM)**

time 15-10-2024 10:15 til  
15-10-2024 12:00  
forberedelsesnorm ikke valgt  
forberedelsesnorm D-VIP ikke valgt  
location 27.2-046 - fysik b (1)  
Teacher Dorthe Posselt ( dorthе@ruc.dk )

### **Experiments and Models (PSM)**

time 18-10-2024 10:15 til  
18-10-2024 12:00  
forberedelsesnorm ikke valgt  
forberedelsesnorm D-VIP ikke valgt  
location 27.2-046 - fysik b (1)  
Teacher Dorthe Posselt ( dorthе@ruc.dk )

### **Experiments and Models (PSM)**

time 21-10-2024 13:15 til  
21-10-2024 15:00  
forberedelsesnorm ikke valgt  
forberedelsesnorm D-VIP ikke valgt  
location 27.2-046 - fysik b (1)  
Teacher Kristine Niss ( kniss@ruc.dk )

## **Experiments and Models (PSM)**

time 22-10-2024 10:15 til  
22-10-2024 12:00  
forberedelsesnorm ikke valgt  
forberedelsesnorm D-VIP ikke valgt  
location 27.2-046 - fysik b (1)  
Teacher Kristine Niss ( kniss@ruc.dk )

## **Experiments and Models - Hand in scattering report on Moodle (PSM)**

time 24-10-2024 23:59 til  
24-10-2024 23:59  
forberedelsesnorm ikke valgt  
forberedelsesnorm D-VIP ikke valgt

## **Experiments and Models (PSM)**

time 25-10-2024 10:15 til  
25-10-2024 12:00  
forberedelsesnorm ikke valgt  
forberedelsesnorm D-VIP ikke valgt  
location 27.2-046 - fysik b (1)  
Teacher Kristine Niss ( kniss@ruc.dk )

## **Experiments and Models (PSM)**

time 28-10-2024 13:15 til  
28-10-2024 15:00  
forberedelsesnorm ikke valgt  
forberedelsesnorm D-VIP ikke valgt  
location 27.2-046 - fysik b (1)  
Teacher Kristine Niss ( kniss@ruc.dk )

## **Experiments and Models (PSM)**

time 29-10-2024 10:15 til  
29-10-2024 12:00  
forberedelsesnorm ikke valgt  
forberedelsesnorm D-VIP ikke valgt  
location 27.2-046 - fysik b (1)

Teacher Kristine Niss ( kniss@ruc.dk )

### **Experiments and Models (PSM)**

time 01-11-2024 10:15 til  
01-11-2024 12:00  
forberedelsesnorm ikke valgt  
forberedelsesnorm D-VIP ikke valgt  
location 27.2-046 - fysik b (1)  
Teacher Kristine Niss ( kniss@ruc.dk )

### **Experiments and Models (PSM)**

time 04-11-2024 08:15 til  
04-11-2024 16:00  
forberedelsesnorm ikke valgt  
forberedelsesnorm D-VIP ikke valgt  
location 27.2-046 - fysik b (1)

### **Experiments and Models (PSM)**

time 05-11-2024 10:15 til  
05-11-2024 12:00  
forberedelsesnorm ikke valgt  
forberedelsesnorm D-VIP ikke valgt  
location 27.2-046 - fysik b (1)

### **Experiments and Models (PSM)**

time 08-11-2024 10:15 til  
08-11-2024 12:00  
forberedelsesnorm ikke valgt  
forberedelsesnorm D-VIP ikke valgt  
location 27.2-046 - fysik b (1)

### **Experiments and Models - Hand in all the three mandatory reports on Moodle (PSM)**

time 08-11-2024 23:59 til  
08-11-2024 23:59  
forberedelsesnorm ikke valgt

forberedelsesnorm D-VIP ikke valgt

### **Experiments and Models (PSM)**

time 11-11-2024 09:15 til  
11-11-2024 15:00  
forberedelsesnorm ikke valgt  
forberedelsesnorm D-VIP ikke valgt  
location 27.2-046 - fysik b (1)  
Teacher Dorthe Posselt ( dorthе@ruc.dk )  
Tina Hecksher ( tihe@ruc.dk )

### **Experiments and Models (PSM)**

time 18-11-2024 09:15 til  
18-11-2024 15:00  
forberedelsesnorm ikke valgt  
forberedelsesnorm D-VIP ikke valgt  
location 27.2-046 - fysik b (1)  
Teacher Dorthe Posselt ( dorthе@ruc.dk )  
Tina Hecksher ( tihe@ruc.dk )

### **Experiments and Models (PSM)**

time 26-11-2024 10:15 til  
26-11-2024 12:00  
location 27.2-046 - fysik b (1)  
Teacher Dorthe Posselt ( dorthе@ruc.dk )  
Kristine Niss ( kniss@ruc.dk )

### **Experiments and Models - Hand in report on selected experiment on Moodle (PSM)**

time 29-11-2024 23:59 til  
29-11-2024 23:59  
forberedelsesnorm ikke valgt  
forberedelsesnorm D-VIP ikke valgt

## **Experiments and Models - Hand-in of portfolio (exam) (PSM)**

time 08-01-2025 10:00 til  
08-01-2025 10:00  
forberedelsesnorm ikke valgt  
forberedelsesnorm D-VIP ikke valgt

## **Experiments and Models - Exam (PSM)**

time 17-01-2025 08:15 til  
17-01-2025 16:00  
location 27.2-046 - fysik b (1)

## **Experiments and Models - Hand-in of portfolio (reexam) (PSM)**

time 21-02-2025 10:00 til  
21-02-2025 10:00  
forberedelsesnorm ikke valgt  
forberedelsesnorm D-VIP ikke valgt

## **Experiments and Models - Reexam (PSM)**

time 27-02-2025 08:15 til  
27-02-2025 16:00