

Course Code: **GSn_008 (SwedNess), TBD (KTH)**
English Course Title: **Engineering Materials Science using Neutrons and Synchrotron X-rays**
Svenskt Kursnamn: **Neutron och synkrotronkaraktisering för materialteknik**
Credits: **5 hp**

Educational Level: Third Cycle
Subject Area: Neutron Scattering
Grade Scale: Pass/Fail

Learning Outcomes

After completing the course, the student should have

- Understanding of working principles of the presented neutron and synchrotron techniques
- Knowledge of the general data acquisition procedures, preliminary data analysis and main error sources
- Understanding of the uniqueness and limitation of these neutron and synchrotron techniques in comparison with other complementary techniques
- General knowledge of how these techniques can be applied to engineering materials and problems

Course Main Content

The course deals with the following applications of scattering techniques in the field of engineering materials science: Phase and texture analysis by neutron and synchrotron x-ray diffraction, Residual stress determination by neutron and synchrotron x-ray diffraction, Neutron and synchrotron x-ray small angle scattering and imaging for engineering materials.

The related neutron and synchrotron techniques will be presented with focus on the working principle, instrumentation, data acquisition and analysis, and application examples related to engineering materials and problems.

The course consists of lectures, practical measurements at PETRA III P21.2, practical data analysis exercises, and assignments.

Preliminary schedule

Date	Content	Place	8:15-10:00	10:15-12:00	13:15-15:00	15:15-17:00
May 20	Diffraction: phase and texture	KTH and online		Lecture 1	Lecture 2	Lecture 3
May 21	Diffraction: residual stress		Lecture 4	Lecture 5	Lecture 5	Assignment
May 22	Diffraction: residual stress; and SAS		Lecture 6	Lecture 7	Lecture 8	Lecture 9
May 23	Imaging		Lecture 10	Lecture 11		
June 3	Practical Diffraction	DESY	Diffraction measurements for phases and texture		Diffraction measurements for residual stress	
June 4	Practical SAS/imaging		SAS measurements		Imaging measurements	
June 5	Practical data analysis		Diffraction data analysis		SAS/imaging data analysis	

Teaching Language: English

Eligibility/Prerequisites

Primary: PhD students in activities related to SwedNess, CeXS, NEXT
Secondary: Other PhD students at Swedish/Nordic institutions

Prior knowledge in powder diffraction is useful.

Literature

- Course book: Neutrons and Synchrotron Radiation in Engineering Materials Science from Fundamentals to Applications, by Peter Staron, Andreas Schreyer, Helmut Clemens, and Svea Mayer. 2nd Ed. WILEY-VCH, Verlag GmbH & Co. KGaA, 2017
- Suggested books for further reading:
 - o Residual Stress Measurement by Diffraction and Interpretation by I.C. Noyan and J. B. Cohen, Springer – Verlag
 - o Introduction to texture analysis
- Selected articles

Lecturers

Peter Hedström, KTH
Magnus Hörnqvist Colliander, CTH
Invited lecturers

Examination

Hand-in assignments
Lab reports

Grading Scale: Pass/Fail

Requirements for final grade

Approved assignments and lab reports

Credits

5 credits for participation in all parts and completion of all the course work.

Contact and examiner

Peter Hedström

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