

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Merjenje črnega ogljika in drugih ogljičnih aerosolov
Course title:	Measurement of Black Carbon and Other Carbonaceous Aerosols

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Senzorske tehnologije, 3. stopnja	/	1	1
Sensor Technologies, 3 rd cycle	/	1	1

Vrsta predmeta / Course type Izbirni / Elective

Univerzitetna koda predmeta / University course code: ST3-535

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
15	15			15	105	5

**Navedena porazdelitev ur velja, če je vpisanih vsaj 15 študentov. Drugače se obseg izvedbe kontaktnih ur sorazmerno zmanjša in prenese v samostojno delo. / This distribution of hours is valid if at least 15 students are enrolled. Otherwise the contact hours are linearly reduced and transferred to individual work.*

Nosilec predmeta / Lecturer: Doc. dr. Griša Močnik

Jeziki /	Predavanja / Lectures:	Slovenski ali angleški / Slovene or English
Languages:	Vaje / Tutorial:	Slovenski ali angleški / Slovene or English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Zaključen študij druge stopnje ustrezne (naravoslovne ali tehniške) smeri ali zaključen študij drugih smeri z dokazanim poznavanjem osnov področja predmeta (pisna dokazila, pogovor).

Prerequisites:

Completed second cycle studies in natural sciences or engineering or completed second cycle studies in other fields with proven knowledge of fundamentals in the field of this course (certificates, interview).

Vsebina:

Meritve črnega ogljika in drugih ogljičnih aerosolov, delovanje različnih inštrumentov, vpliv aerosolov na podnebje in zdravje ljudi.

- Nastanek in vloga primarnih in sekundarnih aerosolov.
- Razvoj inštrumentov. Osnovne in kombinirane merilne tehnike.
- Receptorske metode za določanje virov onesnaženja zraka, uporaba »aethalometerskega modela« za določitev prispevkov prometa in kurjenja biomase h koncentracijam črnega ogljika.
- Pomanjkljivosti obstoječe zakonodaje na področju onesnaženja zraka.

Content (Syllabus outline):

The measurement of Black Carbon and other carbonaceous aerosols, the instrumentation and measurements and aerosol climate and health effects.

- Primary and secondary aerosols.
- Instrument development, basic and hyphenated measurement techniques.
- Receptor source apportionment methods, use of the "Aethalometer model" to apportion black carbon measurements into contributions from traffic and biomass combustion.
- Shortcomings of existing air quality regulations.
- Planning of evaluation experiments.
- Ambient measurements; processing and

- Načrtovanje okoljskih meritev.
- Okoljske meritve, obdelava podatkov in interpretacija rezultatov.
- Sodelovanje v eksperimentalni kampanji z visokotehnološkim podjetjem.

- interpretation of the data.
- Cooperation with a small high tech enterprise within the experimental campaign.

Temeljni literatura in viri / Readings:

Knjige in poročila / Books and reports:

- IPCC, 5th Assessment Report »Climate Change 2013: The Physical Science Basis«, WMO UNEP Stockholm, 2013.
- N.A.H. Janssen et al., Health effects of black carbon, The WHO European Centre for Environment and Health, Bonn, 2012.
- UN ECE, Black carbon - Report by the Co-Chairs of the Ad Hoc Expert Group on Black Carbon, UN ECE, CLRTAP, Geneva, 2010.

Revije / Periodicals:

- Atmospheric Chemistry and Physics
- Atmospheric Measurement Techniques
- Environmental Science and Technology
- Atmospheric Environment

Cilji in kompetence:

Cilji:

- razume različne načine meritev aerosolov in pozna primerne inštrumente,
- razume posledice ogljičnih aerosolov za zdravje in podnebje,
- zna načrtovati in izvesti merilno kampanjo,
- zna uporabljati receptorske modele za določanje virov onesnaževanja zraka.

Kompetence:

Študent/študentka

- zna samostojno izvesti merilno kampanjo,
- zna obdelati podatke in rezultate uporabiti za izboljšanje stanja,
- zna zasnovati in razviti področje merjenja onesnaženosti zraka,
- zna postaviti eksperimentalno osnovo za ukrepanje in spremljanje učinkov ukrepov za izboljšanje kakovosti zraka na podlagi interdisciplinarne kritične analize stanja.

Objectives and competences:

Goals:

- understanding aerosol measurement techniques and instrumentation,
- understanding health and climate effects of carbonaceous aerosols,
- learning to plan and conduct a measurement campaign,
- learning to use receptor modeling for source apportionment of air pollution.

Competencies:

- ability to independently carry out a measurement campaign,
- ability to process the data and to use the results for abatement of air quality,
- ability to open up and develop the field of air pollution,
- ability to set up an experimental foundation for air quality abatement measures and verification of their efficiency; all based on critical analysis and interdisciplinary approach.

Predvideni študijski rezultati:

- Poznavanje lastnosti črnega ogljika in ogljičnih aerosolov,

Intended learning outcomes:

- Understanding Black Carbon and carbonaceous aerosol properties,

- razumevanje vpliva teh aerosolov na zdravje in podnebje,
- poznavanje metod in inštrumentov za merjenje lastnosti aerosolov,
- uporaba inštrumentov in interpretacija meritev,
- znanje načrtovanja merilnih kampanj,
- uporaba receptorskih modelov za določanje virov onesnaženja zraka,
- uporaba receptorskih modelov za načrtovanje in spremljanje ukrepov za izboljšanje stanja.

- understanding of aerosol health and climate effects,
- knowledge about instruments and methods for measurement of aerosol properties,
- use of the instrumentation and interpretation of results,
- ability to plan and carry out measurement campaigns,
- use of receptor models for source apportionment,
- use of receptor models for planning and verification of abatement measures.

Metode poučevanja in učenja:

Interaktivna predavanja.
Terenske meritve
Vaje: obdelava podatkov.
Priprava poročila z rezultati merilne kampanje.

Learning and teaching methods:

Interactive lectures.
Ambient measurements.
Practicum: data evaluation.
Preparation of the measurement campaign report.

Delež (v %) /

Načini ocenjevanja:

Weight (in %)

Assessment:

Seminarska naloga in zagovor poročila merilne kampanje.	50 %	Seminar and defense of the report of the measurement campaign.
Ustni izpit.	50 %	Oral exam.

Reference nosilca / Lecturer's references:

- PLATT, Stephen M., JEŽEK, Irena, DRINOVEC, Luka, MOČNIK, Griša et al.. Secondary organic aerosol formation from gasoline vehicle emissions in a new mobile environmental reaction chamber. *Atmos. chem. phys.*, 2013, vol. 13, str. 9141–9158, www.atmos-chem-phys.net/13/9141/2013/, doi:10.5194/acp-13-9141-2013.
- INVERNIZZI, Giovanni, RUPRECHT, Ario, MAZZA, Roberto, DE MARCO, Cinzia, MOČNIK, Griša, SIOUTAS, Constantinos, WESTERDAHL, Dane. Measurement of black carbon concentration as an indicator of air quality benefits of traffic restriction policies within the ecopass zone in Milan, Italy. *Atmos. environ.* (1994). [Print ed.], 2011, vol. 45, issue 21, str. 3522-3527, doi: 10.1016/j.atmosenv.2011.04.008.
- NING, Zhi, CHAN, K. L., WONG, K. C., WESTERDAHL, Dane, MOČNIK, Griša, ZHOU, J. H., CHEUNG, C. S. Black carbon mass size distributions of diesel exhaust and urban aerosols measured using differential mobility analyzer in tandem with Aethalometer. *Atmos. environ.* (1994). [Print ed.], 2013, vol. 80, str. 31-40. www.sciencedirect.com/science/article/pii/S135223101300558X#, doi: 10.1016/j.atmosenv.2013.07.037.
- Principal investigator, Development and validation of an operational tool for the discrimination between fossil versus modern fuel combustion aerosols: implication for air quality and climate abatement strategies, ARRS / Commissariat à l'énergie atomique et aux énergies alternatives, Paris, France, 1000-10-340006, 2010-2012.
- Principal investigator, Fast and loading compensated Aethalometer– an instrument for real time measurement of light absorbing carbonaceous aerosol, MVZT/Eurostars (Eureka) E!4825, 2009 – 2012.