

**UČNI NAČRT PREDMETA / COURSE SYLLABUS**

<b>Predmet:</b>	POŽARNI PRAKTIKUM
<b>Course Title:</b>	FIRE'S PRACTICUM

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
MAG Tehniška varnost, 2. stopnja	/	1.,2.	2., 3., 4.
USP Technical Safety, 2 <sup>nd</sup> Cycle	/	1 <sup>st</sup> , 2 <sup>nd</sup>	2 <sup>nd</sup> , 3 <sup>rd</sup> , 4 <sup>th</sup>

**Vrsta predmeta / Course Type:** izbirni / Elective

**Univerzitetna koda predmeta / University Course Code:** TV2B4

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
/	/	75 LV	/	/	75	5

**Nosilec predmeta / Lecturer:** izr. prof. dr. Simon Schnabl / Dr. Simon Schnabl Associate Professor  
izr. prof. dr. Janez Cerkovnik / Dr. Janez Cerkovnik, Associate Professor

**Jeziki / Languages:** Predavanja / Lectures: slovenski / Slovenian  
Vaje / Tutorial: slovenski / Slovenian

**Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:** Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

**Prerequisites:** The course has to be assigned to the student.

**Vsebina:**

1. Varnost v požarnem laboratoriju
  - pregled opreme
  - varnostna navodila
2. Vrste požarnih preskusov
  - preskusi v majhnem merilu
    - i. potrebna oprema ter metode za izvajanje preskusov
    - ii. standardi
    - iii. pregled stanja v svetu
  - preskusi v naravnem merilu
    - i. potrebna oprema ter metode za izvajanje preskusov
    - ii. standardi

**Content (Syllabus outline):**

1. Safety in fire testing laboratory
  - equipment
  - safety instructions
2. Types of fire tests
  - small-scale tests
    - i. testing equipment and methods
    - ii. standards
    - iii. global picture
  - full-scale tests
    - i. testing equipment and methods
    - ii. standards
    - iii. global picture
3. Small-scale fire tests—calorimeter

iii. pregled stanja v svetu

3. Požarni preskusi v majhnem merilu – Kalotimeter

i. plastični materiali

ii. les

iii. kompozitni materiali

- čas, potreben za vžig materiala ob pilotnem plamenu ali iskri

- analiziranje toplotnega toka

- princip porabe kisika

- izvajanje meritev ob vertikalnem vzorcu

- obdelava podatkov

- statistično vrednotenje podatkov

- zanesljivost meritev

4. Požarni preskusi v naravnem merilu

- analiziranje podatkov

- primerjava izsledkov preskusa z preskusom v majhnem merilu

5. Preučevanje obnašanja materialov pri požaru z metodami termične analize

- določevanje učinkovitosti požarno-zaščitnih

intumescentnih premazov

- termična stabilnost nekaterih toplotno-izolacijskih materialov (kamena volna, steklena volna, stiropor)

- kvalitativno določevanje plinskih zvrsti, ki nastanejo pri požaru stiropora in poliuretana

i. plastic materials

ii. wood

iii. composites

- time to ignition with pilot flame or spark

- heat flux analysis

- principle of oxygen consumption

- implementing measurements with vertical sample

- data processing

- statistical analysis of data

- reliability of measurements

4. Real-scale fire tests

- data analysis

- comparison of test results with small-scale tests

5. Studying materials behaviour on fire using methods of thermal analysis

- efficiency determination of fire-protective intumescent coatings,

- thermal stability of some thermal-insulating materials (glass wool stone wool, polystyrene)

- qualitative determination of gases species, formed during combustion of polystyrene and polyurethane

#### Temeljna literatura in viri / Readings:

- ASTM E 1354-99; Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter, ASTM, West Conshohocken, PA, 1999

- ISO 5660-1:1993; Fire tests – Reaction to fire – Part 1: Rate of heat release from building products (Cone calorimeter method); ISO; Geneva, Switzerland, 1993

- Hilado C.J., Flammability Handbook for Plastics – Fourth Edition, Technomic Publishing Company, Lancaster PA, 1990

- D. Hopkins Jr.; J.G. Quintiere; Material Fire Properties and Predictions for Thermoplastics; Fire Safety Journal 26 p.241-268, Elsevier Science Limited, 1996

- Mulholland W.G., Croarkin C., Specific Extinction Coefficient of Flame Generated Smoke, Fire and Materials, 24,227-230, John Wiley and Sons, Ltd. 2000

- Rhodes, B.T., Burning Rate and Flame Heat Flux for PMMA in the Cone Calorimeter, Thesis, U.S. Department of Commerce, 1994

- The SFPE Handbook of Fire Protection Engineering, 2nd edition, SFPE, 1995

- Taylor, J.R., An Introduction to Error Analysis – The Study of Uncertainties in Physical Measurements, University Science Books, Sausalito, CA (1982) Chapter 3

- Patrick A. Enright and Charles M. Fleischmann, Uncertainty of Heat Release Rate Calculation of the ISO 5660-1 Cone Calorimeter Standard Test Method, 1999

**Cilji in kompetence:**

Predmet je namenjen poglobljanju znanj o dinamiki požara ter teoriji gorenja. V sklopu predmeta je zajeto delo v laboratoriju, izvedba analiz posameznih materialov ter njihovega obnašanja med gorenjem. Študenti spoznajo praktične metode izvajanja meritev na področju požarnega inženiringa ter se srečajo predvsem z stožčastim kalorimetrom.

**Objectives and Competences:**

The course is intended for deepening knowledge about fire dynamics and combustion theory. Students work in laboratories, carry out analyses of different materials and study their behaviour during burning and learn different practical measurement methods related to fire engineering, and learn how to use cone calorimeter.

**Predvideni študijski rezultati:**Znanje in razumevanje

Študentje naj bi razširil osnovna teoretska in praktična znanja. Prav tako bodo sposobni kritično presoditi zmogljivosti nekaterih standardnih metod, jih ovrednotiti in interpretirati.

Uporaba

Požarni praktikum je usmerjen v reševanje praktičnih problemov, ki so nujni tako pri snovanju novih učinkovin, kot tudi pri njihovi uporabi. Pri predmetu naj bi študentje pridobili znanja, ki jim omogočajo izvedbo temeljnih požarnih preizkusov. Poleg fizikalno-kemijskih osnov, ki so osnova razumevanje teorije gorenja pri požarnem preizkusu bodo študenti pridobili tudi praktična znanja, ki so potrebna pri zasnovi in izvedbi meritev ter interpretaciji podatkov in dobljenih rezultatov. Pomemben vidik predmeta je predstaviti študentu kritičen pogled na podajanje rezultatov in zmogljivosti različnih preizkusnih postopkov.

Refleksija

Teoretska in praktična znanja bo lahko študent uporabil pri reševanju praktičnih in teoretskih problemov (študij in praksa). Spoznanja o zmogljivostih in omejitvah posameznih metod v praksi pomenijo osnovo za mnoge obdelati ter primerno interpretirati.

Prenosljive spretnosti

Pri predmetu bo študent pridobil laboratorijske spretnosti, znal bo uporabljati podatke, izvajati nekatere fizikalne meritve, eksperimentalne podatke bo znal ustrezno

**Intended Learning Outcomes:**Knowledge and Comprehension

Students should upgrade basic theoretical and practical knowledge. They will also be able to critically estimate the performance of some standard methods, evaluate and interpret them.

Application

Fire practicum is focused on solving practical problems, important in design of new materials as well as in their use. In this course students should acquire skills that enable them to perform basic fire tests. In addition to the physico-chemical properties, which are base for understanding fire theory during fire-test performance, students will also gain practical skills. The letter is needed for setting-up and performing measurement, for data evaluation and interpretation of the results. An important aspect is to present a critical view on the interpretation of results and performance of different testing procedures.

Analysis

Theoretical and practical skills can be used to solve practical and theoretical problems (study and practice). Awareness about capabilities and limits of individual methods in practice is the basis for many important decisions.

Skill-transference Ability

In this course, students will gain laboratory skills will be able to use data, perform some physical measurements, will be able to manipulate with experimental data and interpret them in a right

obdelati ter primerno interpretirati.

way

**Metode poučevanja in učenja:**

Laboratorijske vaje

**Learning and Teaching Methods:**

Laboratory practice.

**Načini ocenjevanja:**

Izpit pisni in ustni. Ocene: 6-10 pozitivno  
Vaje: Opravljen kolokvij Pri vajah predstavlja delež ocene tudi uspešno laboratorijsko delo.

Delež (v %) /

Weight (in %) **Assessment:**

Written and oral exam. Positive grades from 6 - 10  
Practice: completed colloquium. Part of the final grade is also laboratory work.

**Reference nosilca / Lecturer's references:**

**Izr. prof. dr. Simon Schnabl**

- **SCHNABL, Simon**, TURK, Goran, PLANINC, Igor. Buckling of timber columns exposed to fire. *Fire safety journal*, ISSN 0379-7112. [Print ed.], 2011, letn. 46, št. 7, str. 431-439, ilustr., doi: [10.1016/j.firesaf.2011.07.003](https://doi.org/10.1016/j.firesaf.2011.07.003). [COBISS.SI-ID [5504097](#)]

- **SCHNABL, Simon**, PLANINC, Igor, TURK, Goran, SRPČIČ, Stane. Fire analysis of timber composite beams with interlayer slip. *Fire safety journal*, ISSN 0379-7112. [Print ed.], 2009, letn. 44, št. 5, str. 770-778, ilustr., doi: [10.1016/j.firesaf.2009.03.007](https://doi.org/10.1016/j.firesaf.2009.03.007). [COBISS.SI-ID [4598369](#)]

- TORATTI, Tomi, **SCHNABL, Simon**, TURK, Goran. Reliability analysis of a glulam beam. *Structural safety*, ISSN 0167-4730. [Print ed.], 2007, letn. 29, št. 4, str. 279-293, ilustr., doi: [10.1016/j.strusafe.2006.07.011](https://doi.org/10.1016/j.strusafe.2006.07.011). [COBISS.SI-ID [3588961](#)]

- **SCHNABL, Simon**, TURK, Goran, PLANINC, Igor. Fire resistance of timber columns. V: CECCOTTI, Ario (ur.), KUILEN, Jan-Willem van de (ur.). *WCTE 2010 : conference proceedings*. Riva del Garda [Italy]: s.n., 2010, str. 1-7, ilustr. [COBISS.SI-ID [5069409](#)]

- **SCHNABL, Simon**, TURK, Goran, PLANINC, Igor. Uklon lesenih stebrov pri požaru = Buckling of timber columns subjected to fire. V: ŠIROK, Brane (ur.), EBERLINC, Matjaž (ur.). *Zbornik del, Kuhljevi dnevi*, 23. september 2010, Ljubljana. Ljubljana: SDM - Slovensko društvo za mehaniko, 2010, str. 207-214, graf. prikazi. [COBISS.SI-ID [5132385](#)]

- **SCHNABL, Simon**, SAJE, Miran, TURK, Goran, PLANINC, Igor. Fire analysis of wooden composite beams with interlayer slip. V: ATTARD, Thomas (ur.). *Applied Mechanics in the Americas. Vol. 12 : Proceedings of the Tenth Pan American Congress of Applied Mechanics : PACAM X, Grand Oasis Resort, Cancun, Mexico, 7.-11. January 2008*. Fresno: California State University, 2008, str. 41-44, ilustr. [COBISS.SI-ID [3866977](#)]

- PLANINC, Igor, HOZJAN, Tomaž, TURK, Goran, **SCHNABL, Simon**. Fire analysis of timber composite beams with interlayer slip : paper no. 045. V: GAD, Emad (ur.), WONG, Bill (ur.). *Australasian Structural Engineering Conference : ASEC 2008 : 26-27 June 2008, Melbourne, Australia : conference proceedings*. Collingwood [VIC]: The meeting planners, 2008, str. 1-6, ilustr. [COBISS.SI-ID [4122977](#)]

- **SCHNABL, Simon**, HOZJAN, Tomaž, TURK, Goran, PLANINC, Igor. Finite analysis of composite beams with interlayer slip : paper no. 046. V: GAD, Emad (ur.), WONG, Bill (ur.). *Australasian Structural Engineering Conference : ASEC 2008 : 26-27 June 2008, Melbourne, Australia : conference proceedings*. Collingwood [VIC]: The meeting planners, 2008, str. 1-9, ilustr. [COBISS.SI-ID [4123489](#)]
- **SCHNABL, Simon**, PLANINC, Igor, TURK, Goran. Thermomechanical fire analysis of timber composite beams with interlayer slip. V: *WCTE 2008 : conference proceedings*. Miyazaki, Japan: s.n., 2008, str. 1-8, graf. prikazi. [COBISS.SI-ID [4205665](#)], [[Scopus](#) do 21. 5. 2013: št. citatov (TC): 0, čistih citatov (CI): 0, čistih citatov na avtorja (CIAu): 0]
- **SCHNABL, Simon**, SAJE, Miran, PLANINC, Igor, TURK, Goran. Fire analysis of wooden composite beams with interlayer slip : paper 157. V: TOPPING, Barry H. V. (ur.). *Proceedings of the Eleventh International Conference on Civil, Structural and Environmental Engineering Computing, St. Julians - Malta 18.-21. September 2007*. Stirling [Scotland]: Civil-Comp Press, 2007, 15 str., ilustr. [COBISS.SI-ID [3706209](#)]
- **SCHNABL, Simon**, PLANINC, Igor, SAJE, Miran, TURK, Goran. Leseni kompozitni nosilci pri požaru = Timber composite beams exposed to fire. V: KORELC, Jože (ur.), ZUPAN, Dejan (ur.). *Zbornik del, Kuhljevi dnevi 2007, Snovik, 20.-21. september 2007*. Ljubljana: Slovensko društvo za mehaniko, 2007, str. 215-223, graf. prikazi. [COBISS.SI-ID [3708513](#)]
- izr. prof. dr. Janez Cerkovnik**
- KROFLIČ, Ana, ŠARAC, Bojan, **CERKOVNIK, Janez**, BEŠTER-ROGAČ, Marija. Hydrophobicity of counterions as a driving force in the self-assembly process : dodecyltrimethylammonium chloride and parabens. *Colloids and surfaces. A, Physicochemical and Engineering Aspects*, ISSN 0927-7757. [Print ed.], 2014, vol. 460, no. 1, str. 108-117, ilustr. [http://ac.els-cdn.com/S0927775714001307/1-s2.0-S0927775714001307-main.pdf?\\_tid=f7c6d39e-9487-11e3-afba-00000aacb35d&acdnat=1392279925\\_3dfd41bcdb545e0b24bcdcd53eb2335e](http://ac.els-cdn.com/S0927775714001307/1-s2.0-S0927775714001307-main.pdf?_tid=f7c6d39e-9487-11e3-afba-00000aacb35d&acdnat=1392279925_3dfd41bcdb545e0b24bcdcd53eb2335e), doi: 10.1016/j.colsurfa.2014.02.002. [COBISS.SI-ID 1679407]
- ŠARAC, Bojan, **CERKOVNIK, Janez**, ANCIAN, Bernard, MÉRIGUET, Guillaume, ROGER, G., DURAND-VIDAL, S., BEŠTER-ROGAČ, Marija. Thermodynamic and NMR study of aggregation of dodecyltrimethylammonium chloride in aqueous sodium salicylate solution. *Colloid and polymer science*, ISSN 0303-402X, 2011, vol. 289, no. 14, str. 1597-1607, doi: 10.1007/s00396-011-2480-2. [COBISS.SI-ID 35268613]
- TUTTLE, Tell, **CERKOVNIK, Janez**, KOLLER, Jože, PLESNIČAR, Božo. The search for protonated dihydrogen trioxide (HOOH) : insights from theory and experiment. *The journal of physical chemistry. A, Molecules, spectroscopy, kinetics, environment, & general theory*, ISSN 1089-5639, 2010, vol. 114, no. 30, str. 8003-8008, doi: 10.1021/jp103882e. [COBISS.SI-ID 34295813]