

NEPORUŠNO TESTIRANJE MATERIALOV IN KONSTRUKCIJ

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	NEPORUŠNO TESTIRANJE MATERIALOV IN KONSTRUKCIJ
Course title:	NON DESTRUCTIVE TESTING OF MATERIALS AND CONSTRUCTIONS
Članica nosilka/UL Member:	UL FS

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Strojništvo, tretja stopnja, doktorski	Proizvodno inženirske znanosti, kibernetika in mehatronika (smer)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code: 0033460

Koda učne enote na članici/UL Member course code: 7305

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
90					160	10

Nosilec predmeta/Lecturer: Tomaž Kek

Izvajalci predavanj: Tomaž Kek

Izvajalci seminarjev:

Izvajalci vaj:

Izvajalci kliničnih vaj:

Izvajalci drugih oblik:

Izvajalci praktičnega usposabljanja:

Vrsta predmeta/Course type:

Izbirni predmet /Elective course

Jeziki/Languages:

Predavanja/Lectures:

Angleščina, Slovenščina

Vaje/Tutorial:

Angleščina, Slovenščina

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

Prerequisites:

Veljajo splošni pogoji za doktorski študij.

General prerequisites for the third level studies.

Vsebina:

Content (Syllabus outline):

Vizualno testiranje: fizikalne osnove, opazovanje brez ali z optičnimi pripomočki, kriteriji za uspešno vizualno ocenjevanje.

Boreskopija: fizikalne osnove, optični sistemi za osvetljevanje, optični sistemi za prenos slike, ocenjevanje stanja površine, kriteriji za uspešno oceno površin.

Optična mikroskopija: fizikalne osnove, priprava odtiskov ali replik, opazovanje replik pod mikroskopom, ocenjevanje stanja površine in mikrostrukture.

Penetrantske metode: fizikalne osnove, preiskuševalne metode, pripomočki pri opazovanju površin, ocenjevanje stanja površine, dokumentiranje stanja površin, procedure za testiranje.

Preiskave površinskih napak z magnetnimi metodami: fizikalne osnove, načini magnetenja in načini razmagnetanja preizkuševalcev, vrste magnetnih sredstev, sistemi za kontrolo in prikaz rezultatov, ocenjevanja stanja površin, izdelava procedur.

Preiskave lastnosti materialov in napak v materialu z vrtničnimi tokovi: fizikalne osnove, postopki preizkušanja, razvoj kriterijev za ocenjevanje različnih

Visual testing: basic physical concepts, observations without and with optical instruments, criteria for visual assessment.

Borescopy: basic physical concepts, illumination systems, optical systems for distant image processing, surface and flaw evaluation, criteria for surface assesment.

Optical microscopy: basic physical concepts, preparing of replicas and impresses, microscopy of replicas, assessment of surface and microstructure.

Liquid penetrant inspection: basic physical concepts, methods, instruments for surface observation, surface evaluation and ways of recording of surface states, types of liquid penetrant inspections.

Magnetic methods in surface testing: basic physical concepts, magnetizing and demagnetizing of the sample, magnetic particle types, control and data display systems, surface evaluation, establishment of procedures.

Eddy current inspection: basic physical concepts, inspection methods, establishment of criteria for testing of

<p>lastnosti materialov, ocenjevanje stanja površine in površinskih slojev, testiranje korozijskih poškodb, testiranja glede na snovne lastnosti in kemično sestavo itd.. Izdelava procedur za testiranje z vrtinčnimi tokovi.</p> <p>Preiskava materialov z ultrazvokom: fizikalne osnove, pridobivanje ultrazvoka, postopki preizkušanja, naprave za preizkušanje, ultrazvočne glave, posebni postopki preizkušanja materialov in stanja materialov, izdelava procedur.</p> <p>Akustična emisija: fizikalne osnove; postopki preizkušanja, metode za vrednotenje signalov in klasifikacija signalov.</p>	<p>different materials, assessment of surface and surface layers, testing of corrosion damage, testing with regard on material properties, chemical content etc., establishment of procedures.</p> <p>Ultrasonic inspection: basic physical concepts, ultrasound generation, ultrasonic inspection methods, ultrasonic devices, ultrasonic transducers, special ultrasonic methods for material evaluation, establishment of procedures.</p> <p>Acoustic emission: basic physical concepts, methods of testing, methods of signal evaluation and signal classification.</p>
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Temeljna literatura in viri/Readings:

[1]	Conf. Proceedings of the 8th Int. Conf. of the Slovenian Society for Non-destructive Testing. Portorož, Slovenia, 2005.
[2]	ASM handbook. Vol. 17, Nondestructive evaluation and quality control / prepared under the direction of the ASM International Handbook Committee.- 5th printing, 1997.- Metal Park: ASM International, cop. 1989.
[3]	Krautkraemer, J., Krautkraemer. H.: Ultrasonic testing of materials.- 3rd ed.- Berlin: Springer-Verlag, 1983.
[4]	Proceedings of the World Conferences on Non-destructive Testing.
[5]	Journals on Non-Destructive Testing, e.g.: Nondestructive Testing and Evaluation, Materials Testing, Research in Nondestructive Evaluation.

Cilji in kompetence:

<p>Cilji:</p> <p>Študentu podati zadostno znanje s področja neporušnega testiranja za začetne korake samostojnega dela na tem področju.</p> <p>Kompetence:</p> <p>Študent osvoji osnovne postopke NDT ter rokovanje z instrumenti. Zna izbrati in uporabiti najprimernejši postopek pri podanem materialu, možnih napakah ter opremi in času, ki mu je na voljo.</p>	<p>Objectives and competences:</p> <p>Goals:</p> <p>The principal goal is to give student enough knowledge from the field of Non Destructive Testing.</p> <p>Competences:</p> <p>The student acquires competence in basic NDT procedures and handling of the NDT instruments. He knows how to select and use the best suitable procedure for a given combination of material, possible defects and available resources in a sense of time and equipment available.</p>
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Predvideni študijski rezultati:

Študent osvoji osnovne postopke NDT ter rokovanje z instrumenti. Zna izbrati in uporabiti najprimernejši postopek pri podanem materialu, možnih napakah ter opremi in času, ki mu je na voljo.

Intended learning outcomes:

The student acquires competence in basic NDT procedures and handling of the NDT instruments. He knows how to select and use the best suitable procedure for a given combination of material, possible defects and available resources in a sense of time and equipment available.

Metode poučevanja in učenja:

Predavanja, laboratorijske vaje, seminarsko delo, e-izobraževanje, konzultacije. Seminarsko delo v čim večji meri navezuje se na področje doktorskega raziskovanja. Študij z uporabo priporočene literature.

Learning and teaching methods:

Lectures, laboratory practice & seminar work, e-education, consulting. The seminar work is related, as much as possible, to the student's doctoral research field. Study on a recommended literature basis.

Načini ocenjevanja:**Delež/
Weight****Assessment:**

Ustni izpit, poročilo o seminarskem delu. Pogoji za opravljanje ustnega izpita je uspešno izdelano in pozitivno ocenjeno seminarsko delo. Način (pisni izpit, ustno izpraševanje, naloge, projekt): • projektni seminar (20%) • ustno izpraševanje (80%)

Oral exam, report on seminar work. The condition for admission to oral exam is successful completion of seminar work, rewarded with a passing grade. Method (written exam, oral examination, assignments, project) • project seminar (20%) • oral examination (80%)

Reference nosilca/Lecturer's references:**doc.dr. Tomaž KEK**

KEK, Tomaž, KUSIĆ, Dragan, GRUM, Janez. Wavelet packet decomposition to characterize injection molding tool damage. Applied sciences, ISSN 2076-3417, Feb. 2016, vol. 6, iss. 2, f. 1-13, ilustr. <http://www.mdpi.com/2076-3417/6/2/45>, doi: 10.3390/app6020045.

KEK, Tomaž, KUSIĆ, Dragan, FINC, Matej, GRUM, Janez. Detection of damaged tool in injection molding process with acoustic emission. Research in nondestructive evaluation, ISSN 0934-9847, 2016, vol. 27, nr. 2, str. 86-99, ilustr. <http://www.tandfonline.com/doi/pdf/10.1080/09349847.2015.1061074>, doi: 10.1080/09349847.2015.1061074.

FINC, Matej, KEK, Tomaž, GRUM, Janez. Quality control of crimped joint contacts with conductors through thermography. Insight, ISSN 1354-2575. [Print ed.], May

2015, vol. 57, no. 5, str. 257-265, ilustr., doi: [10.1784/insi.2015.57.5.257](https://doi.org/10.1784/insi.2015.57.5.257).

MOJŠKERC, Bor, KEK, Tomaž, GRUM, Janez. Pulse-echo ultrasonic testing of adhesively bonded joints in glass façades. *Strojniški vestnik*, ISSN 0039-2480, Mar. 2016, vol. 62, nr. 3, str. 147-153, ilustr., doi: 10.5545/sv-jme.2015.2988.

KUSIĆ, Dragan, SVEČKO, Rajko, KEK, Tomaž, HANČIČ, Aleš, GRUM, Janez. Influence of increased injection pressure load on the captured acoustic emission signals and dimensional accuracies of polypropylene test specimens. *Insight*, ISSN 1354-2575. [Print ed.], Dec. 2013, vol. 55, no. 12, str. 659-664, doi: [10.1784/insi.2012.55.12.659](https://doi.org/10.1784/insi.2012.55.12.659).