

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Statika in trdnost
Course title:	Statics and strength of materials
Članica nosilka/UL Member:	UL FS

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Strojništvo - projektno aplikativni program, prva stopnja, visokošolski strokovni	Ni členitve (študijski program)	1. letnik	1. semester

Univerzitetna koda predmeta/University course code: 0562660

Koda učne enote na članici/UL Member course code: 3005-V

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
45		45			35	5

Nosilec predmeta/Lecturer: Miroslav Halilović

Vrsta predmeta/Course type: Obvezni splošni predmet /Compulsory general course

Jeziki/Languages:

Predavanja/Lectures:	Slovenščina
Vaje/Tutorial:	Slovenščina

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

Prerequisites:

Ni pogojev.

No conditions.

Vsebina:

Content (Syllabus outline):

<ol style="list-style-type: none"> Osnovni pojmi mehanike <ul style="list-style-type: none"> Sila, moment, rezultanta, ravnotežje Sistemi sil s skupnim in brez skupnega prijemališča Vzporedni premik sil, redukcija sil Obremenitve in podpore <ul style="list-style-type: none"> Vrste obremenitev, vrste sil Koncept prostega telesa Podpore, reakcije, prostostne stopnje Notranje veličine Diagrami notranjih sil in momentov <ul style="list-style-type: none"> Koncept navideznega rezanja Mešani sistemi, razdelitev na podsisteme Pravila skiciranja diagramov 	<ol style="list-style-type: none"> Basic concepts of mechanics <ul style="list-style-type: none"> Force, moment, resultant, equilibrium Concurrent and non-concurrent force system Moving a force to a parallel line, force reduction Loads and supports <ul style="list-style-type: none"> Types of loads, types of forces Free-body principle Supports, reactions, DOF Internal quantities Diagrams of internal forces and moments <ul style="list-style-type: none"> Principle of intersection Mixed systems, dividing into subsystems Rules for sketching diagrams
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<ul style="list-style-type: none"> - Kontrola pravilnosti diagramov 	<ul style="list-style-type: none"> - Checking the correctness of diagrams
<p>4. Paličje</p> <ul style="list-style-type: none"> - Statična določenost - Metode reševanja paličja - Izračun notranjih sil 	<p>4. Trusses</p> <ul style="list-style-type: none"> - Static determinacy - Methods for truss analysis - Calculation of internal force
<p>5. Napetosti in deformacije</p> <ul style="list-style-type: none"> - Vrste napetosti in deformacij (normalna, strižna) - Posebna napetostna in deformacijska stanja - Primerjalna napetost - Hookov zakon 	<p>5. Stresses and strains</p> <ul style="list-style-type: none"> - Types of stresses and strains (normal, shear) - Special stress and strain states - Equivalent stress - Hooke's law
<p>6. Enosni primeri</p> <ul style="list-style-type: none"> - Raztezek pri enosnem stanju, deformacija paličja - Razlika med dimenzioniranjem pri nateznem ali tlačnem stanju 	<p>6. Uniaxial cases</p> <ul style="list-style-type: none"> - Elongation in case of uniaxial state, truss deformation - Difference between dimensioning in case of tensile or compressive state
<p>7. Upogib</p> <ul style="list-style-type: none"> - Porazdelitev napetosti v nosilcu - Vztrajnostni moment prereza - Steinerjevo pravilo - Dimenzioniranje na upogib 	<p>7. Bending</p> <ul style="list-style-type: none"> - Stress distribution in the beam - Area moment of inertia - Steiner's rule - Bending dimensioning
<p>8. Upogibnica</p> <ul style="list-style-type: none"> - Izračun povesov pri upogibu - Superpozicija - Princip reševanja primerov s pomočjo tabeliranih elementarnih rešitev 	<p>8. Deflection line</p> <ul style="list-style-type: none"> - Calculation of deflection - Superposition - Principle of solving using tabulated elementary solutions
<p>9. Torzija</p> <ul style="list-style-type: none"> - Porazdelitev napetosti v gredi - Torzijski in polarni vztrajnostni moment - Bredtove enačbe za zaprte tankostenske prereze - Dimenzioniranje na torzijo - Membranska analogija 	<p>9. Torsion</p> <ul style="list-style-type: none"> - Stress distribution in a shaft - Torsional and polar moment of inertia - Bredt's formulas for thin-walled closed cross sections - Dimensioning to the torsion - Membrane analogy
<p>10. Strig</p> <ul style="list-style-type: none"> - Strig veznih elementov, dimenzioniranje - Dimenzioniranje na bočni tlak - Statični moment - Strig v nosilcih pri upogibu 	<p>10. Shear</p> <ul style="list-style-type: none"> - Shear of fasteners, dimensioning - Dimensioning to lateral pressure - Static moment - Transverse shear in bending
<p>11. Sestavljene obremenitve</p> <ul style="list-style-type: none"> - Princip kombiniranja napetosti - Kombinacija natega in upogiba - Kombinacija upogiba in torzije - Splošne kombinacije obremenitvenih stanj - Dimenzioniranje pri sestavljenih obremenitvah 	<p>11. Combined loading</p> <ul style="list-style-type: none"> - Principle of combined stresses - Combined tension and bending - Combined bending and torsion - General combinations of loading states - Dimensioning to combined loads
<p>12. Statično nedoločeni primeri</p> <ul style="list-style-type: none"> - Princip reševanja - Problemi upogiba - Problemi torzije - Enosni problemi 	<p>12. Statically indeterminate cases</p> <ul style="list-style-type: none"> - Principle for solving - Bending problems - Torsion problems - Uniaxial problems
<p>13. Uklon</p> <ul style="list-style-type: none"> - Opis pojava - Kritična sila - Dimenzioniranje na uklon 	<p>13. Buckling</p> <ul style="list-style-type: none"> - Description of phenomenon - Critical force - Dimensioning to buckling
<p>14. Trenje</p> <ul style="list-style-type: none"> - Coulombov model trenja - Princip reševanja z razstavljanjem na prosta telesa - Trenje na hrapavem kolutu, Eulerjeva enačba 	<p>14. Friction</p> <ul style="list-style-type: none"> - Coulomb's law of friction - Principle of solving by free-body principle

15. Statika vrvi - Vrvni sistemi - Hiperbolična verižnica - Parabolična verižnica	- Friction on a rough wheel, Euler equation 15. Statics of a hanging rope - Rope systems - Catenary - Parabolic shape
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Temeljna literatura in viri/Readings:

Halilović, Urevc, Starman: Osnove statike in trdnosti, Fakulteta za strojništvo, 2019

Cvetaš: Statika, Tehniška založba Slovenije, 2001

Hibbeler: Mechanics of Materials, Prentice Hall, 2011

Engineering Mechanics: Statics, Wiley, 2015

Cilji in kompetence:

<p>Cilji:</p> <p>Spoznati osnovne pojme področij statike in trdnosti na način, ki je uporaben pri obravnavi strojniških konstrukcij</p> <p>Spoznati osnove obravnave delovanja zunanjih obremenitev ter analitičnih principov obravnavanja mehanskega odziva</p> <p>Spoznati osnove statičnih in trdnostnih preračunov</p> <p>Kompetence:</p> <p>Obvlada temeljna strokovna znanja s področja mehanike (P3-PAP)</p> <p>Razume vpliv obremenitve na mehanski odziv sistema (P1-PAP)</p> <p>Usposobljen je za dimenzioniranje enostavnih konstrukcij v primeru osnovnih in kombiniranih obremenitvenih stanj (S1-PAP)</p>	<p>Objectives and competences:</p> <p>Goals:</p> <p>To learn the basic concept in the field of statics and strength of materials in a way that is useful in dealing with mechanical structures</p> <p>To get a insight into the basics of external loads consideration and to learn the analytical principles for mechanical response analysis</p> <p>To learn the basics of static and strength calculations</p> <p>Competences:</p> <p>Mastering the fundamental knowledge in the field of mechanics (P3-PAP)</p> <p>Understanding the influence of loading on mechanical response of the system (P1-PAP)</p> <p>The ability to sizing of simple structures in the case of basic and combined loading conditions (S1-PAP)</p>
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Predvideni študijski rezultati:

<p>Znanja:</p> <p>Poglobljeno strokovno teoretično in praktično znanje na področju statike in trdnosti, vključno z metodami za osnovne statične in trdnostne analize.</p> <p>Spretnosti:</p> <p>S1.1: Izvajanje osnovnih statičnih analiz (izračun reakcij ter notranjih veličin)</p> <p>S1.1: Izvajanje osnovnih trdnostnih analiz (analiza napetostno-deformacijskih stanj)</p>	<p>Intended learning outcomes:</p> <p>Knowledge:</p> <p>In-depth professional theoretical and practical knowledge of static and strength of materials, including methods for basic static and strength analysis.</p> <p>Skills:</p> <p>S1.1: Performing basic static analysis (computation of reactions and internal quantities)</p> <p>S1.1: Performing basic strength analysis (analysis of stress-strain states)</p>
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Metode poučevanja in učenja:

Learning and teaching methods:

P1 Avditorna predavanja	P1 Lectures
P3 Avditorne vaje, kjer se teoretično znanje s predavanj podkrepi z računskimi primeri	P3 Tutorials where theoretical knowledge from lectures is supported by computational examples
P4 Laboratorijske vaje z namenskimi pripomočki za izvajanje elementarnih mehanskih preizkusov (stojala, uteži, škripci, silomeri...)	P4 Laboratory exercises with purposefully gadgets for performing basic mechanical tests (stands, weights, pulleys, strain gauges ...)
P5 Uporaba študijskega gradiva v obliki knjige in spletne učilnice	P5 Use of study material in the form of video lessons and an online classroom
P9 Laboratorijske vaje se izvajajo po didaktični metodi <i>Jigsaw Classroom</i>	P9 Exercises are performed according to the didactic method of <i>Jigsaw Classroom</i>
P10 Uporaba anket v realnem času med predavanji	P10 Use real-time surveys
P12 Individualizirane domače naloge v spletni učilnici	P12 Individualized homework in an online classroom
P13 Individualizirani kolokviji in izpiti s samodejnim popravljanjem v realnem času	P13 Individualized colloquiums and exams with real-time auto-correction

Načini ocenjevanja:	Delež/Weight	Assessment:
Teoretične vsebine	50,00 %	Theory
Praktične vsebine	40,00 %	Practical work
Samostojno delo	10,00 %	Coursework

Reference nosilca/Lecturer's references:

Miroslav Halilović:

STARMAN, Bojan, MAČEK, Andraž, RUS, Primož, OBID, Štefan, KRALJ, Aleš, **HALILOVIČ, Miroslav**. Primary seal deformation in multipane glazing units. Applied sciences. 2020, vol. 10, iss. 4, str. 1-20, ilustr. ISSN 2076-3417. [COBISS.SI-ID 17042971] (tip. 1.01)

KOC, Pino, **HALILOVIČ, Miroslav**, ŠTOK, Boris. Impact of restrained thermal expansion on NPP Krško primary loop piping. Tehnički vjesnik : znanstveno-stručni časopis tehničkih fakulteta Sveučilišta u Osijeku, ISSN 1330-3651, 2013, god. 20, br. 5, str. 897-904. [COBISS.SI-ID 13212955] (tip. 1.01)

HALILOVIČ, Miroslav, ŠTOK, Boris. Analitično spremljanje razvoja elastoplastičnega stanja med upogibom nosilcev pravokotnega prereza = Analytical tracing of the evolution of the elasto-plastic state during the bending of beams with a rectangular cross-section. Strojniški vestnik, ISSN 0039-2480, 2007, letn. 53, št. 12, str. 806-818. [COBISS.SI-ID 10378011] (tip. 1.01)

KAVČIČ, Boris, POKORN, **Miran**, **HALILOVIČ, Miroslav**, KOC, Pino, ŠTOK, Boris, MOLE, Nikolaj. Clipping assembly of a document file : European Patent specification EP 1606122 B1, 2008-05-21. Munich: European Patent Office, 2008. 1 listina, ilustr. [COBISS.SI-ID 9102363] (tip 2.24)