»NAPREDNA OKOLJSKA ŠPORTNA FIZIOLOGIJA«

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Napredna okoljska športna fiziologija
Course title:	Advanced environmental exercise physiology
Članica nosilka/UL Member:	UL FŠ

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
3. stopnja	Kineziologija	1.	2.	Izbirni
3rd Cycle	Kineziology	1.	2.	Izbirni

Univerzitetna koda predmeta/University course code:	0643528
Koda učne enote na članici/UL Member course code:	

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	15				125	5

Nosilec predmeta/Lecturer:	prof. dr. Tadej Debevec
Vrsta predmeta/Course type:	Izbirni/ Elective

Jeziki/Languages:	Predavanja / Lectures:	Slovensko/Angleško; Slovene/English
	Vaje / Tutorial:	Slovensko/Angleško; Slovene/English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Za pristop k predmetu ni posebnih pogojev.	No special requirements.

Vsebina:	**Content (Syllabus outline):**
Osnovi koncepti *Ključni fiziološki mehanizmi* *Terminologija* *Pogled v zgodovino* *Interdisciplinarnost* **Metode raziskovanja v okoljski fiziologiji** *Preučevanje višinske adaptatcije* *Preučevanje adaptacije na vročino/mraz* *Preučevanje ostalih okoljskih dejavnikov* *Strategije raziskovanja na področjih kjer je težje pridobivanje ustreznega števila preiskovancev* **Višinska fiziologija**	**Basics concepts** *Key physiological mechanisms* *Terminology* *Historical overview* *Interdisciplinary approach* **Research methods in environmental physiology** *Methods for investigating altitude adaptation* *Methods for investigating heat/cold adaptation* *Methods for other environmental factors* *Research methods on topic with few participants* **Altitude physiology** *Physiological effects of high altitude*

Fiziološki vplivi povečane nadmorske višine *Višinska patofiziologija* *Klinične populacije na povečani nadmorski višini* **Višinska vadba na povečani višini** *Modeli višinskega treninga* *Implementacija v trenažni proces* *Strategije ob tekmovanjih na višini* **Vpliv okoljske temperature na športno sposobnost** *Ključni termoregulacijski procesi v mrazu in vročini* *Interakcije temperaturnih sprememb z ostalimi okoljskimi dejavniki* *Metode ogrevanja/ohlajanja v mrazu/vročini v ekstremnih okoljih* **Pomen hidracije** *Fiziologija ustrezne hidriranosti v različnih okoljih / okoljskih vplivih.* **Vadba v onesnaženih okoljih** *Onesnaženost zraka in športna sposobnost/zdravje* *Ocenjevanje kakovosti zraka* *Metode zmanjševanja vpliva onesnaženosti* **Vadba v hiperbaričnem in vodnem okolju** *Vplivi povečanega tlaka na športno sposobnost in telesno homeostazo* *Vpliv temperature vode ob potapljanju* **Breztežnost / neaktivnost** *Fiziološki vplivi breztežnosti / neaktivnosti* *Sredstva za zmanjševanje vplivov breztežnosti* *Vzporednice s sedentarnim načinom življenja* **Biološki ritmi in športna sposobnost** *Vpliv fizioloških ritmov na športno sposobnost* *Motnje ritmov kot posledica ekstremnih okolij* *Pomen počitka in spanja*	*Altitude pathophysiology* *Clinical populations at moderate / high altitudes* **Altitude training and competition** *Altitude training models* *Implementation in training programmes* *Strategies for altitude competition* **Effects of ambient temperature on sports performance** *Key thermoregulatory factors in the cold / the heat* *Interactions between ambient temperature changes and other environmental factors* *Contemporary warming/cooling methods in extreme environments* **Importance of hydration** *Physiology of proper hydration under various environmental stressors* **Exercise in polluted environments** *Air pollution and sports performance/health* *Air quality assessment* *Methods to reduce the pollutant effects* **Hyperbaric physiology** *Effects of hyperbaria on exercise capacity and physiological homeostasis* *Effects of water temperature during immersion* **Gravitational physiology** *Physiological effects of microgravity* *Exercise and other countermeasures* *Similarities between microgravity and sedentarism* **Biological rhythms and sports performance** *Circadian rhythms and performance* *Rhythms disturbances in extreme environments* *Importance of sleep and recovery*

Temeljna literatura in viri/Readings:

- Advanced Environmental Exercise Physiology 2nd Edition; Cheung S.S. & Ainslie P. Human Kinetics, 2022.
- Ward, Milledge and West's High Altitude Medicine and Physiology; Luks A.M., Ainslie P.N., Lawley J.S., Roach R.C. & Simonson T.S. Routledge, 2021
- Human Physiology in Extreme Environments; Gunga H-C. Academic Press, 2020
- Maximising Performance in Hot Environments: A problem-based learning approach; Tyler C. Routledge, 2019
- Hypoxia Conditioning in Health, Exercise and Sport Principles, Mechanisms and Applications; Girard O., Burtscher J., Burtscher M., Millet G. Routledge, 2025

Cilji in kompetence:	**Objectives and competences:**
Glavni cilj predmeta je študentom predstaviti strategije in metode ki jih uporabljamo na področju okoljske športne fiziologije. Predmet v tem pogledu nadgrajuje dodiplomske in podiplomske predmete s	Key objective of this course it to provide prospective students with the opportunity to learn the most common methodological and research approaches that are employed within environmental exercise

področja fiziologije športa, anatomije in medicine športa z namenom izboljšanja razumevanja adaptacije človeškega telesa na vadbo oziroma napor v različnih okoljih. Človeška oz. športna zmogljivost je namreč v veliki meri determinirana prav z različnimi okoljskimi dejavniki. Ob tem je pomembno te dejavnike prepoznati ter razumeti njihov vpliv in potencialno uporabo v športu. Poleg navedenega je namen predmeta tudi usposobiti študente za uporabo različnih okoljskih vabenih metod (višinski trening, vročinska adaptacija), ki preko različnih fizioloških mehanizmov lahko izboljšajo športno sposobnost in imajo tudi terapevtsko/klinično uporabnost. Ključni cilji in pridobljene kompetence so navedene v nadaljevanju.

Cilji

- Natančno razumeti fiziološke mehanizme preko katerih različni okoljski dejavniki vplivajo na človeško telo, športno sposobnost in športni rezultat.
- Razumeti vpliv bioloških ritmov na fiziološke procese in športno sposobnost.
- Razumeti integrativne in povezane fiziološke odzive človeka na kombinirane okoljske dejavnike.
- Razumeti pomen ustrezne prehranjenosti in hidracije pri aktivnosti v ekstremnih okoljih.
- Razumeti in znati uporabljati različne metode športne vadbe, ki zmanjšajo negativni vpliv različnih okoljskih dejavnikov.
- Znati implementirati metode okoljske vadbe (višinski trening itd.) v trenažni proces za izboljšanje športnega rezultata.
- Razumeti možnosti in omejitve uporabe okoljskih dejavnikov v terapevtske namene.
- Pridobivati in kritično ovrednotiti strokovno literaturo na področju okoljske športne fiziologije.
- Izluščiti zanimiv raziskovalni problem na področju okoljske fiziologije ter zastaviti in izvesti ustrezen znanstveno-raziskovalnih ali aplikativni projekt.
- Pisno in ustno poročati o rezultatih raziskovalnega dela.

Splošne kompetence

- Razumevanje integrativnega prepletanja in soodvisnosti fizioloških sistemov v različnih okoljih.
- Sposobnost iskanja novih in povezanih dejstev ter znanj.
- Sposobnost kritičnega preverjanja ter pridobivanja informacij.
- Zmožnost samostojnega strokovno/raziskovalnega dela na enostavnejših fizioloških problemih.

physiology. This will be achieved by upgrading their understanding of sports physiology, anatomy and sports medicine and thus enable them to efficiently handle the athlete management in various "extreme" environments. This is crucial since environmental factors are known to importantly modulate exercise capacity. In addition, the course aims to equip the students with the knowledge necessary to utilize different environmental training methods for performance enhancement (i.e. altitude training, heat acclimation protocols) on the one hand and therapeutic purposes in clinical populations on the other. Key objectives and competences are outlined below:

Objectives

- To fully understand the key physiological mechanism related to environmental factors that influence human body, exercise capacity and subsequent performance.
- To recognise the importance of biological/circadian rhythms on physiological modulations.
- To understand the integrative physiological responses related to combined environmental stressors.
- To recognise the importance of proper nutrition and hydration in extreme environments.
- To understand and know how to utilize different exercise training approaches to reduce the potential negative effects of extreme environments.
- To be able to implement environmental training methods (e.g. altitude training) in the athletes' preparation with the aim of further performance improvement.
- To understand the potential benefits and limitations of various environmental stressors in therapeutic settings.
- To be able to obtain and critically assess scientific literature in the environmental exercise physiology field.
- To be able to elucidate interesting research problems related to environmental physiology and subsequently perform an appropriate research project to address these problems.
- To be able to report the obtained results in the form of public presentations and written scientific papers.

General competences

- Understanding the integrative nature of physiological responses in different environments.
- Ability to utilize experimental and theoretical strategies in exercise physiology.

• Usposobljenost za uporabo empiričnih in teoretičnih raziskovalnih strategij v kineziologiji. **Specifične kompetence** • Poznavanje interaktivnih vplivov različnih okoljskih dejavnikov in človeka. • Zmožnost analize vplivov okolja na vadbeni proces in tekmovalno sposobnost. • Sposobnost implementacije okoljskih faktorjev v vadbeni proces z namenom izboljševanja športne sposobnosti. • Sposobnost priprave in implementacije različnih terapevtskih metod okoljske vadbe za v kliničnih populacijah. • Sposobnost sinteze smiselnih znanstvenih vprašanj in izvedbe raziskovalnega dela na področju okoljske in športne fiziologije. • Zmožnost interdisciplinarnega povezovanja znanj in raziskovalnih metod s področji vezanih na kineziologijo in okoljsko fiziologijo (kineziologija, medicina športa, fiziologija napora).	• Ability to identify and obtain important facts and new knowledge. • Ability to obtain and critically assess crucial information. • Ability for independent research work in kinesiology. **Topic-specific competences** • Understanding the interactive effects of individual or combined environmental factors • Ability to analyse the effects of environmental factors. • Ability to implement the environmental stressors in the athletes' training in order to further enhance sport performance. • Ability to recognize and implement various therapeutic environmental strategies in clinical populations. • Ability to synthesize scientific questions and perform research projects in the field of environmental exercise physiology. Ability to employ interdisciplinary experimental approaches (related to kinesiology, sports medicine and physiology) to answer contemporary kinesiology and environmental exercise physiology issues.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: • Študentje bodo poznali osnovne principe in fiziološke mehanizme, ki vplivajo na adaptacijo posameznika na različne okoljske dejavnike. • Sposobni bodo kritično oceniti potencialne negativne in pozitivne učinke različnih okoljskih dejavnikov na športnika. • Poznali bodo različne metode višinske in vročinske aklimatizacije ter bodo sposobni njihove implementacije v trenažni process. • Razumeli bodo prednosti in omejitve uporabe različnih okoljskih dejavnikov za terapevtske namene. • Sposobni bodo pridobivati in kritično ovrednotiti literaturo na področju okoljske športne fiziologije. • Sposobni bodo načrtovati in izvajati znanstveno/raziskovalne projekte na področju okoljske fiziologije.	Knowledge and understanding: • Students will understand the basic physiological principles and mechanism governing adaptation of humans to various extreme environments. • Students will be able to critically distinguish potential positive and negative effects of environmental factors on athletes. • Students will understand and know how to utilize different methods of altitude and heat acclimation. • Students will understand the potential and limitations of therapeutic environmental strategies in clinical populations. • Students will be able to critically evaluate the scientific literature covering the field of environmental exercise physiology. • Students will be able to plan and execute environmental physiology research projects.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, seminarji, seminarska naloga, vaje.	Lectures, seminars, coursework, tutorial.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Seminar z zagovorom	50%	Seminar presentation
Ustni izpit	50%	Oral exam

Ocenjevalna lestvica:	**Grading system:**
15 – 10, pri čemer velja, da je pozitivna ocena od 6-10	5–10, where a score of 6–10 is considered a passing grade

Reference nosilca/Lecturer's references:

1. Debevec, T., D. P. Longman and J. G. Bourgois (2024). "Defining adaptation within applied physiology - is there room for improvement?" Front Physiol 15: 1459026.
2. Narang, B. J., K. Drole, J. F. P. Barber, P. S. R. Goods and T. Debevec (2025). "Utility of hypoxic modalities for musculoskeletal injury rehabilitation in athletes: A narrative review of mechanisms and contemporary perspectives." J Sports Sci 43(19): 2227-2240.
3. Narang, B. J., A. Štritof and T. Debevec (2025). "The Acute Effects of Caffeine and Normobaric Hypoxia on Cardiorespiratory Exercise Responses in Healthy Adults: A Randomized Controlled Trial." Int J Sport Nutr Exerc Metab 35(5): 385-393.
4. Narang, B. J., D. Tominec, M. Stalmans, G. P. Millet, C. Poffé and T. Debevec (2025). "The effects of 2 days of intermittent exogenous ketosis at high altitude on baroreflex sensitivity and ventilation under hypoxic and hypercapnic conditions." Am J Physiol Regul Integr Comp Physiol 329(2): R350-r362.
5. Tominec, D., M. Stalmans, B. J. Narang, G. P. Millet, C. Poffé and T. Debevec (2025). "Exogenous Ketosis during Early Acclimatization at High Altitude: Ventilatory, Cardiovascular and Muscular Responses to Maximal Exercise." Med Sci Sports Exerc 57(11): 2468-2479.