

	UČNI NAČRT PREDMETA/COURSE SYLLABUS
Predmet	Biokemija, biofizika in radiologija
Course title	Biophysics, Biochemistry and Radiology

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Zdravstvena nega / 1. stopnja	Zdravstvena nega	1. letnik	1.
Nursing Care / 1 st Cycle	Nursing Care	1 st year	1 st

Vrsta predmeta/Course type obvezni/obligatory

Univerzitetna koda predmeta/University course code

Predavanja	Seminar	Sem. vaje	Lab. vaje	Teren.	Samost.	ECTS
Lectures	Seminar	Tutorial	Laboratory work	vaje	delo	
				Field work	Individ. work	
45			10		35	3

Nosilec predmeta/Lecturer: RŠ - doc. dr. Nevenka Kregar Velikonja,
IŠ – dr. Danijela Furlan, viš. pred.

Jeziki/ Predavanja/Lectures: slovenski/Slovenian

Languages: Vaje/Tutorial: slovenski/Slovenian

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

Vpis v prvi letnik študijskega programa.	A prerequisite for inclusion is enrolment in the first year of study.
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Vsebina: **Content (Syllabus outline):**

<p>Biokemija: (15P, 10 LV)</p> <ul style="list-style-type: none"> • Osnove celične zgradbe. • Osnove molekularne zgradbe organizma: ionska sestava in uvod v biomolekule, zgradba beljakovin, lipidov, ogljikovih hidratov in nukleinskih kislin. • Transport plinov in vzdrževanje pH. • Encimi in koencimi, encimske reakcije. • Lastnosti nukleinskih kislin, biosinteza beljakovin, izražanje genov; uvod v genetske bolezni, molekularne osnove raka. • Biokemične osnove celične zgradbe (holesterol in funkcije, beljakovine) 	<p>Biochemistry: (15 lectures, 10 laboratory work sessions)</p> <ul style="list-style-type: none"> • Basics of the cell structure. • Basics of the molecular structure of a living organism: ionic structure and introduction to the biomolecules, structure and function of proteins, carbohydrates, lipids, nucleic acids. • Transfer of gasses and balancing the pH. • Enzymes and coenzymes, enzyme reactions. • Characteristics of nucleic acids, biosynthesis of protein, basics of
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citoskeleta, transport po celici, prehod skozi biološke membrane itn).

- Biokemija prebave in presnove: prebavni encimi in hormoni, transport makro- in mikronutrientov, presnova beljakovin, presnova ogljikovih hidratov, presnova maščob, sinteza energetsko bogatih molekul (ATP), presnova nukleinskih kislin, presnova vitaminov in mineralov.
- Biokemične osnove vzdrževanja notranjega okolja: prenašanje sporočil znotraj celic (kalcij, ciklični AMP), prenašanje sporočil med celicami (osnove hormonskega uravnavanja celičnih procesov), beljakovine v plazmi (albumin, imunoglobulini, faktorji strjevanja krvi).
- Osnove laboratorijskih preiskav, lastnosti in posebnosti bioloških diagnostičnih vzorcev, vplivi na sestavo bioloških vzorcev.

Laboratorijske vaje:

- Kri, biokemija transportnih molekul v krvi, krvne skupine.
- Osnove dedovanja, genetske bolezni in njihova molekularna diagnostika.
- Biokemične osnove laboratorijskih preiskav; osnovne hematološke in biokemične preiskave.
- Seznanitev z analitičnim delom v laboratoriju.

Biofizika: (15 P)

- Biomehanika / opis biomehanskih količin, gibanje, nihanje, sile, dinamika, elastičnost, delo in energija, moč, statično ravnovesje, navor, težišče, tekočine, hidrostatični tlak, vzgon, gibanje tekočin, viskoznost, toplota, toplotno raztezanje snovi, energijski zakon, prevajanje toplote.
- Valovni pojavi, zvok in svetloba / opis valovanja, interferenca, uklon, spekter valovanja, ultrazvok v medicini, uho, Dopplerjev pojav, svetloba, geometrijska optika, odboj, zrcala, lom, leče, oko, kratkovidnost, dolgovidnost, očala, mikroskop.

heredity, introduction to genetic diseases, molecular basics of cancer.

- Biochemical basis of cell structure (cholesterol and functions, cytoskeleton protein, transfers within cells, entering the cell membrane, etc.)
- Biochemistry of metabolism and digestion: digestive enzymes and hormones, transfer of macro- and micronutrients, metabolism of protein, carbohydrates, fats; synthesis of energy-source ATP molecules, metabolism of nucleic acids, vitamins and minerals.
- Biochemistry of maintaining the internal environment: transporting signals within cells (calcium, cyclic AMP), transferring signals between cells (hormonal balancing of the cell processes), protein in plasma (albumin, immunoglobulins, factors of the blood coagulation).
- Basic laboratory examinations, characteristics and exceptions in biological diagnostic samples, influences on the biological sample structures.

Laboratory work:

- Blood, biochemistry of the transport molecules in blood, blood types.
- Molecular genetic diagnostics; genetic disorders and their molecular diagnostics.
- Basic biochemical laboratory diagnostics, basic haematological and biochemical diagnostics.
- Familiarization with analytical laboratory work;

Biophysics: (15 lectures)

- Biomechanics / describing biomechanical quantities, mechanics, oscillation, forces, dynamics, elasticity, work and energy, power, static balance, torque, gravity, fluid, hydrostatic pressure, buoyancy, the movement of fluids, viscosity, heat, thermal stretching of substances, energy law, heat transfer.
- Wave phenomena, sound and light / describing wave interference, diffraction, the spectrum of the wave, ultrasound in medicine, the ear, the

<ul style="list-style-type: none"> • Električna in magnetna / sile med statičnimi naboji, električno polje, potencial, električni dipol, kapaciteta, delovanje defibrilatorja, EKG, električni tok, upor, Ohmov zakon, magnetno polje, indukcija, tuljava, elektromagnetno valovanje. • Atomska zgradba snovi in molekularni pojavi / zgradba atoma in atomskega jedra, kvantna slika snovi, Rentgenska svetloba, slikanje z magnetno resonanco, stabilnost izotopov in pojav radioaktivnosti, jedrski razpadi, molekule, molekularna zgradba plinov in tekočin, površinska napetost, kapilarni pojavi, zračna embolija. <p>Radiologija: (15 P)</p> <ul style="list-style-type: none"> • Diagnostične metode v radiologiji - rentgenske, nuklearno medicinske, magnetnoresonančne ter ultrazvočne metode. • Prikaz značilnih slikovnih primerov iz klinične radiologije. • Uporabnost radioloških slikovnih metod in njihova izbira v diagnostiki. • Vrsta zaščite pred škodljivim delovanjem sevanja. 	<p>Doppler effect, light, geometric optics, reflection, mirrors, refraction, lenses, eye, myopia (short-sightedness), hyperopia (long-sightedness), glasses, microscope.</p> <ul style="list-style-type: none"> • Electricity and magnetism. Forces between the static charges, electric field, electric potential, dipole, capacity, operation of the defibrillator, ECG, electrical current, resistance, Ohm's law, the magnetic field, the induction coil, electromagnetic waves. • The atomic structure of different matters and molecular phenomena / structure of the atom and atomic nucleus, quantum image of materials, X-ray image, roentgen light, magnetic resonance imaging, the stability of isotopes and the phenomenon of radioactivity, nuclear decays, a molecule, molecular structure of gases and liquids, surface tension, capillary phenomena, air embolism. <p>Radiology: (15 lectures)</p> <ul style="list-style-type: none"> • Diagnostic methods in radiology - x-ray, nuclear-medical, magnetoresonant and ultrasonic methods. • Displaying the characteristic image of clinical radiology. • Usefulness of radiological imaging methods and their choice in the diagnostics. • Protection against the adverse effects of radiation.
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Temeljna literatura in viri/Readings:

Biokemija/Biochemistry

Temeljna literatura/Basic literature

- Boyer, R. (2005). *Temelji biokemije*. Ljubljana: Študentska založba.
- Milislav, I. (2010). *Izbrane teme iz biokemije za zdravstvene fakultete*. Ljubljana: Zdravstvena fakulteta

Priporočljiva literatura/Recommended literature

- Alberts, B.(2010). *Essential cell biology*. New York, London : Garland Science.

- Lehninger, A.L. (2008). *Principles of biochemistry*. New York: W.H. Freeman and Company.
- Sertić, J. (2008). *Klinička kemija i molekularna dijagnostika*. Zagreb, Medicinska naklada.

Biofizika/Biophysics:

Temeljna literatura/Basic literature

- Sevšek, F. (2004). *Biomehanika*. Ljubljana: VŠZ, Univerza v Ljubljani.
- Halliday, D., Resnick, R. in Walker, J. (2013). *Fundamentals of physics*. 6. ed. New York: Wiley and sons. – izbrana poglavja

Priporočljiva literatura/Recommended literature

- Elektronsko gradivo s predavanj.

Radiologija/Radiology:

- Tabor, L. (ur.), Jevtić, V. (ur.) in Pavčnik, D. (ur.). (1990). *Rentgenologija: diagnostične slikovne metode in intervencijska radiologija*. Ljubljana: Medicinski razgledi.
- Sutton, D. (ur.). (2005). *A textbook of radiology and imaging*. Edinburgh: Churchill Livingstone.
- Jevtić, V., Šurlan, M., Matela, J. (v tisku). *Diagnostična radiologija in intervencijska radiologija. I. del*. Ljubljana, Maribor

Cilji in kompetence:

Učna enota prispeva predvsem k razvoju naslednjih splošnih in specifičnih kompetenc:

- Usvojiti znanja potrebna za razumevanje osnovnih pojavov, procesov in tehnik v zdravstvu, medicini in v človeškem telesu, ki temeljijo na principih biokemije in biofizike.
- Na različnih primerih iz zdravstva, medicine in narave spoznati aplikacijo biofizikalnega in biokemijskega znanja in dobiti celosten pregled nad bazičnimi biokemijskimi in biofizikalnimi vsebinami.
- Spoznati možnosti radioloških diagnostičnih metod, ki so vse pomembnejši dejavnik sodobne medicine.
- Možnost prispevanja (UZ v ZDA ne izvajajo zdravniki in v timih intervencijske radiologije).

Objectives and competences:

The learning unit mainly contributes to the development of the following general and specific competences:

- The acquisition of knowledge, obligatory for understanding the basic phenomena, processes and techniques in medicine, healthcare and human body, founded on the principles of biochemistry and biophysics.
- With specific cases in medicine, healthcare and nature, getting familiar with how to apply the biophysics and biochemistry knowledge to gain an integrative view over basic contents.
- Getting to know the possibilities of the radiology diagnostic methods, as the more and more important factor of the contemporary medicine.
- The possibility of contribution (the ultrasound examination in the USA is

	not performed by doctors nor in teams of intervention radiology).
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Predvideni študijski rezultati:

Intended learning outcomes:

<p>Znanje in razumevanje: Študent/-ka:</p> <ul style="list-style-type: none"> • pozna glavne biomolekule in njihovo delovanje ter pozna glavne biokemične procese, ki se odvijajo v človeškem organizmu; • študent se seznani z delom v diagnostičnem laboratoriju in s vplivi predanalitskih dejavnikov na rezultate laboratorijskih preiskav; • študent se seznani z osnovami biofizike in pridobi znanja o biofizikalnih procesih človeškega organizma; • - znanje in razumevanje osnov radioloških diagnostični metod omogoča razumevanje njihove pravilne uporabe v klinični radiologiji. 	<p>Knowledge and understanding: Students:</p> <ul style="list-style-type: none"> • know major biomolecules and their operation, and main biochemical processes that are taking place in the human body; • are informed of the work in the diagnostic laboratory and the influences of pre-analysis factors on the results of the laboratory tests; • are informed of the basics of biophysics and obtain knowledge of bio-processes in the human organism; • understand the basics of radiological diagnostic methods, which allows the understanding of their use in clinical radiology.
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Metode poučevanja in učenja:

Learning and teaching methods:

<ul style="list-style-type: none"> • <i>predavanja</i> z aktivno udeležbo študentov (razlaga, diskusija, vprašanja, primeri, reševanje problemov), • <i>laboratorijske vaje</i>. 	<ul style="list-style-type: none"> • <i>lectures</i> with active student participation (explanation, discussion, questions, examples, problem solving); • <i>laboratory work</i>.
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Načini ocenjevanja:	Delež (v %) Weight (in %)	Assessment:
Načini:		Types:
<ul style="list-style-type: none"> • izpit 	75%	<ul style="list-style-type: none"> • exam
<ul style="list-style-type: none"> - biokemija - biofizika - radiologija 	25%	<ul style="list-style-type: none"> - biochemistry - biophysics - radiology
<ul style="list-style-type: none"> • kolokvij iz vaj 	25%	<ul style="list-style-type: none"> • preliminary exam based on laboratory work

Ocenjevalna lestvica: ECTS.

Grading scheme: ECTS.