2025/2026

Univerza v Mariboru
Medicinska fakulteta

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Ime predmeta:	**Klinična biokemija**
Course title:	**Clinical Biochemistry**

Študijski program in stopnja **Study programme and cycle**	**Študijska smer** **Study option**	**Letnik** **Year of study**	**Semester** **Semester**
Splošna medicina, enovit magistrski študijski program		Tretji	5.
General medicine, Uniform master's degree study program		Third	5th

Vrsta predmeta (obvezni ali izbirni) / **Course type (compulsory or elective)**	obvezni compulsory
Univerzitetna koda predmeta / University course code:	

Predavanja **Lectures**	**Seminar** **Seminar**	**Vaje** **Tutorial**			**Klinične vaje** **Clinical training**	**Druge oblike študija** **Other forms of study**	**Samost. delo** **Individual work**	**ECTS**
		AV	**LV**	**RV**				
15	15				30		30	3

Nosilec predmeta / Course coordinator:	**doc. dr. Evgenija Homšak**

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites for enrolling in the course or for performing study obligations:**

Vsebina (kratek pregled učnega načrta):	**Content (syllabus outline):**
PREDAVANJA in SEMINARJI: Uvod v klinično biokemijo, organizacija klinične biokemije in laboratorijev, zagotavljanje kakovosti, evaluacija metod v klinični biokemiji in referenčne vrednosti, testiranje ob pacientu (POCT), biološki vzorci – vrste analiznega materiala, seč in urinske preiskave, beljakovine v krvni plazmi, neproteinske dušikove spojine v krvnem serumu, lipidi in lipoproteini, motnje v presnovi ogljikovih hidratov, sladkorna bolezen: diagnostika in kontrola terapije, acidobazno ravnovesje in plinska analiza krvi, voda in elektroliti, laboratorijska endokrinologija, klinična encimologija, tumorski označevalci. VAJE: Hematološke preiskave, urinske preiskave, določanje acidobaznega ravnovesja in elektrolitov, analitika beljakovin v serumu, določanje neproteinskih dušikovih spojin, bilirubina in drugih pomembnih	LECTURES and SEMINARS:Introduction into Clinical Biochemistry, organisation of clinical biochemistry and laboratories, quality assurance, evaluation of methods in clinical biochemistry and reference values, point of care testing (POCT), biological material – variety of analytical samples, urine and urinanalysis, plasma proteins, nonprotein nitrogenous compounds in serum, lipids and lipoproteins, disturbances in carbohydrate metabolism, Diabetes mellitus: diagnostics and laboratory monitoring of treatment, acid – base balance and blood gas analysis, water and electrolytes, laboratory endocrinology, clinical enzymology, tumour markers. Laboratory work:Laboratory Hematology, urine examination, acid – base balance and electrolytes analysis, analytical techniques for protein determination, nonprotein nitrogenous compounds, bilirubin and other

metabolitov v serumu, imunološke preiskave, določanje koncentracij zdravilnih učinkovin v biološkem materialu, ogled klinično-biokemičnih laboratorijev.	important metabolites in serum, immunodiagnostic procedures, therapeutic drug monitoring, visit to clinical-biochemical laboratories.

Temeljni literatura in viri / Reading materials:

Temeljna literatura:

- Nessar Ahmed, Clinical Biochemistry. Oxford University Press 2011.
- CA Burtis,, Bruns DE. Fundamentals of Tietz Textbook of Clinical Chemistry and Molecular Diagnostics,
- 7th ed.Elsevier Saunders, 2015.
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Dodatna literatura:

- L Thomas. Labor und Diagnose, 6.auflage, TH – Books Verlagsgesellschaft Gmbh, Frankfurt/Main. 2005.
- LA Kaplan, AJ Pesce, Clinical Chemistry Theory, Analysis, Correlations 5th ed. Mosby Elsevier, 2010.
- LM Devlin, Textbook of biochemistry with clinical correlations. 7th edition. Wiley, 2010.
- William J Marshall, Stephen K Bangert, Clinical Chemistry, 6th edition,. Mosby Elsevier 2008.
- Michael L. Bishop, Edward P. Fody, Larry E. Schoeff, Clinical Chemistry: Tecniques, principles, correlations, 6th edition, Wolters Kluwer, Lippincott Williams Wilkins 2010.
- Robert L. Sunheimer, Linda Graves, Clinical Laboratory Chemistry, Pearson 2011.
- Osredkar Joško, Marc Janja, Laboratorijska medicina 1, Učbenik za študente medicine, farmacije in lab. biomedicine. UL, FF, Lj 2012.
- Martin A Crook, Clinical Biochemistry and Metabolic Medicine, 8th edition. CRC Press, 2012.

Cilji in kompetence:	**Objectives and competences:**
Predmet študenta teoretično in praktično seznani s področjem klinične biokemije. Na predavanjih in seminarjih posluša in aktivno pripravlja in predstavlja različne teme o pomembnosti klinično-biokemičnih preiskav v sodobni diagnostiki, seznani se tudi z analitiko teh preiskav. Na vajah vrši sam, ali v skupini, nekatere analizne postopke pregleda bioloških vzorcev.	The subject introduces the student theoretically and practically to the area of Clinical Biochemistry. The student listens to lectures and coursework and actively prepares and presents various themes on the importance of clinical-biochemical examinations in modern diagnostics as well as analytical procedures. In laboratory practice the student performs some analytical procedures for examinations of biological samples, either alone or in group.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in pridobljene kompetence Študent mora zahtevano znanje in pridobljene osnovne kompetence iz področja predmeta potrditi s kolokvijem iz vaj, opravljenim seminarjem in izpitom. Prenesljive/ključne spretnosti in drugi atributi: Pridobljeno znanje in kompetence študent koristi in uporabi za namen diagnostike in spremljanja bolezni v interni medicini, pediatriji, ginekologiji in onkologiji.	Knowledge and acquired competences Student must confirm the demented knowledge and acquired basic competences in the field of the subject with examination of laboratory practice, completed seminar and final examination. Transferable/Key Skills and other attributes: The student benefits and uses the acquired knowledge and competences for the purpose of diagnosis and disease monitoringin internal medicine, pediatrics, gynecology and oncology.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja in seminarji Laboratorijske vaje	Lectures and seminars Laboratory practice

Načini ocenjevanja:	Delež (v %) / Share (in %)	**Assessment methods:**
ŠTUDIJSKE OBVEZNOSTI ŠTUDENTOV Predavanja in seminarji so del pedagoških obveznosti študenta. Pri predavanjih je potrebna 50 % prisotnost, pri seminarjih 80 % prisotnost in pri vajah 100 % prisotnost. Prisotnost se sprotno preverja. Študent mora zahtevano znanje in pridobljene kompetence iz področja predmeta potrditi s kolokvijem iz vaj, uspešno opravljenim seminarjem in izpitom. Študent mora za vsako opravljeno vajo oddati poročilo na predpisanem obrazcu. Po opravljenem sklopu vseh predvidenih vaj in oddanih poročil sledi preverjanje znanja - kolokvij, ki zajema tematiko celotnih vaj. POGOJI ZA PRISTOP K POSAMEZNEMU PREVERJANJU ZNANJA Uspešno opravljen kolokvij iz vaj in uspešno opravljen seminar sta pogoja za pristop k opravljanju izpita iz Klinične biokemije. Zahtevana prisotnost je tudi dodaten pogoj za pristop k izpitu. OBLIKE IN NAČIN PREVERJANJA IN OCENJEVANJA ZNANJA Preverjanje znanja na izpitu se izvrši pisno, če v izpitnem roku pristopijo k izpitu več kot 4 študenti ali ustno v primeru manj kot 5 študentov. KRITERIJI ZA OCENJEVANJE IN DELEŽI Končna ocena predmeta je odraz znanja: a) ocena izpita 70 % b) ocena zaključnega kolokvija 30 % DRUGE INFORMACIJE Dodatne informacije pri izpolnjevanju študijskih obveznosti so dosegljive pri asistentih in pri predstojniku katedre oz. nosilcu predmeta.	**70** **30**	ACADEMIC OBLIGATIONS OF STUDENTS Lectures and coursework are a part of pedagogical obligations of a student. At lectures 50% attendance is required, at coursework 80% attendance is required and at laboratory practice 100% attendance is required. Attendance is checked regularly. The student must confirm the required knowledge and competences in the field of the subject by a partial exam in laboratory practice, successfully completed coursework and exam. The student must, for every completed laboratory practice, hand in a report on the prescribed form. After the completed set of all foreseen laboratory practice and reports that were handed in what follows is knowledge checking – a partial exam which encompasses the entire laboratory practice theme. REQUIREMENTS FOR ACCESS TO INDIVIDUAL KNOWLEDGE CHECKING Successfully completed partial exam in laboratory practice and successfully completed coursework are requirements for access to exam taking in Clinical biochemistry. The required attendance is also an additional requirement for taking the exam. FORMS AND MODE OF CHECKING AND ASSESSING KNOWLEDGE The examination of knowledge in the exam is performed in writing if more than four students take the exam during the exam period or orally in the case of less than five students.CRITERIA FOR ASSESSMENT AND SHARES The final grade of the subject is a reflection of knowledge: a) exam mark 70% b) final partial exam mark 30% OTHER PIECES OF INFORMATION Additional pieces of information regarding the fulfilment of academic obligations are available with assistants and heads of the departments or subject holders.

Reference nosilca / Course coordinator's references:

1. **HOMŠAK, Evgenija**. Implementing a new cardiac biomarker : keys for successes. *Indian journal of clinical biochemistry*. Nov. 2019, vol. 34, suppl. 1, str. s34. ISSN 0974-0422. https://link.springer.com/article/10.1007/s12291-019-00859-4. [COBISS.SI-ID 6867775]

2. **HOMŠAK, Evgenija**. Laboratorijska diagnostika pred in med nosečnostjo. *Laboratorijska medicina : znanstveno-strokovno glasilo Slovenskega združenja za klinično kemijo in laboratorijsko medicino*. [Tiskana izd.]. mar. 2019, [št.] 1, str. 62-64. ISSN 2670-4463. [COBISS.SI-ID 6630207]
3. SIMUNDIC, Ana-Maria, FILIPI, Petra, VRTARIC, Alen, MILER, Marijana, NIKOLAC GABAJ, Nora, KOCSIS, Andrea, AVRAM, Sanja, GLIGOROVIC BARHANOVIC, Najdana, BULO, Anyla, CADAMURO, Janne, **HOMŠAK, Evgenija**, et al. Patient's knowledge and awareness about the effect of the over-the-counter (OTC) drugs and dietary supplements on laboratory test results : a survey in 18 European countries. *Clinical chemistry and laboratory medicine*. [Online ed.]. 2019, vol. 57, iss. 2, str. 183-194. ISSN 1437-4331. https://www.degruyter.com/downloadpdf/j/cclm.2019.57.issue-2/cclm-2018-0579/cclm-2018-0579.pdf, DOI: 10.1515/cclm-2018-0579. [COBISS.SI-ID 6598463]
4. **HOMŠAK, Evgenija**, MOŽINA, Barbara. Biokemične lastnosti ginekoloških rakov in tumorski označevalci. V: TAKAČ, Iztok (ur.), ARKO, Darja. *Ginekološka onkologija*. 1. izd. Maribor: Univerzitetna založba Univerze, 2020. Str. 57-69. ISBN 978-961-286-330-2. [COBISS.SI-ID 512970552]
5. **HOMŠAK, Evgenija**, GRUSON, Damien. Soluble ST2 : a complex and diverse role in several diseases. *Clinica Chimica Acta*. [Online ed.]. 2020, vol. 507, str. 75-87, ilustr. ISSN 1873-3492. https://www.sciencedirect.com/science/article/pii/S0009898120301662?via%3Dihub, https://doi.org/10.1016/j.cca.2020.04.011, DOI: 10.1016/j.cca.2020.04.011. [COBISS.SI-ID 6989631]
6. **HOMŠAK, Evgenija**. Vpliv biološke variabilnosti na laboratorijsko diagnostiko avtoimunskih bolezni. *Laboratorijska medicina : znanstveno-strokovno glasilo Slovenskega združenja za klinično kemijo in laboratorijsko medicino*. [Tiskana izd.]. maj 2020, [št.] 2, str. 44-49, ilustr. ISSN 2670-4463. https://www.szkklm.si/assets/images/upload/LM_2_2020.pdf. [COBISS.SI-ID 19826179]
7. WIERINGA, Gijsbert, QUERALTO, Jose, **HOMŠAK, Evgenija**, JASSAM, Nuthar, CAVALIER, Etienne, SVINAROV, Dobrin, LENIČEK KRLEŽA, Jasna, CHRISTOU, Spyroula, PIKNER, Richard, RENNEBOD LARSEN, Trine, KRHIN, Blaž, et al. A proposed common training framework for specialists in laboratory medicine under EU directive 2013/55/EC : (the recognition of professional qualifications). *Clinical chemistry and laboratory medicine*. [Online ed.]. 2021, vol. 59, issue 3, str. 505-512. ISSN 1437-4331. https://doi.org/10.1515/cclm-2020-1504, https://www.degruyter.com/view/journals/cclm/ahead-of-print/article-10.1515-cclm-2020-1504/article-10.1515-cclm-2020-1504.xml, DOI: 10.1515/cclm-2020-1504. [COBISS.SI-ID 43928579]
8. WIERINGA, Gijsbert, JASSAM, Nuthar, **HOMŠAK, Evgenija**, RAKO, Ivana, RACEK, Jaroslav. The Academy of the European Federation of Clinical Chemistry and Laboratory Medicine and the European Register of Specialists in Laboratory Medicine : guide to the Academy and the Register : version 4 - 2020. *Clinical chemistry and laboratory medicine*. [Online ed.]. 2021, vol. 59, issue 3, str. 499-503. ISSN 1437-4331. https://doi.org/10.1515/cclm-2020-1507, https://www.degruyter.com/view/journals/cclm/ahead-of-print/article-10.1515-cclm-2020-1507/article-10.1515-cclm-2020-1507.xml, DOI: 10.1515/cclm-2020-1507. [COBISS.SI-ID 43902467]
9. GRUSON, Damien, KUMAR DABLA, Pradeep, STANKOVIC, Sanja, **HOMŠAK, Evgenija**, GOUGET, Bernard, BERNARDINI, Sergio, MACQ, Benoit. Artificial intelligence and thyroid disease management: considerations for thyroid function tests. *Biochemia medica*. [Online ed.]. 2022, vol. 32, issue 2, str. 1-7, ilustr. ISSN 1846-7482. https://doi.org/10.11613/BM.2022.020601, https://www.biochemia-medica.com/en/journal/32/2/10.11613/BM.2022.020601, DOI: 10.11613/BM.2022.020601. [COBISS.SI-ID 111920899]
10. JAGRIČ, Tomaž, GORENJAK, Maksimiljan, **HOMŠAK, Evgenija**, KREBS, Bojan. Citokinski odgovor pri bolnikih, zdravljenih z metodo odprtega trebuha zaradi hude sepse, povzročene z dogajanjem v trebušni votlini = Interleukin response in patients treated with abbreviated laparotomy for severe intraabdominal sepsis. *Acta medico-biotechnica : AMB*. [Tiskana izd.]. 2022, vol. 15, [no.] 2, str. 17-25. ISSN 1855-5640. https://journals.um.si/index.php/amb/article/view/2561, Digitalna knjižnica Univerze v Mariboru – DKUM, Digitalna knjižnica Slovenije - dLib.si, DOI: 10.18690/actabiomed.238. [COBISS.SI-ID 139450883]
11. KUMAR DABLA, Pradeep, UPRETI, Kamal, SINGH, Divakar, SINGH, Anju, SHARMA, Jitender, DABAS, Aashima, GRUSON, Damien, GOUGET, Bernard, BERNARDINI, Sergio, **HOMŠAK, Evgenija**, STANKOVIC, Sanja. Target association rule mining to explore novel paediatric illness patterns in emergency settings. *Scandinavian journal of clinical and laboratory investigation*. 2022, vol. 82, issue 7/8, str. 595-600, ilustr. ISSN 1502-7686. https://www.tandfonline.com/doi/full/10.1080/00365513.2022.2148121, https://doi.org/10.1080/00365513.2022.2148121, DOI: 10.1080/00365513.2022.2148121. [COBISS.SI-ID 135490563]
12. JAGRIČ, Tomaž, HLADNIK, Gaja, KOLARIĆ, Rok, DUGONIK, Marjeta, **HOMŠAK, Evgenija**. Does leptin cause proximal gastric cancer in the obese? The role of serum leptin in the etiology of proximal gastric cancer. *Hormone molecular biology and clinical investigation*. 2023, [v tisku][str. 1-8], ilustr. ISSN 1868-1891. https://www.degruyter.com/document/doi/10.1515/hmbci-2022-

0101/html, https://doi.org/10.1515/hmbci-2022-0101, DOI: 10.1515/hmbci-2022-0101. [COBISS.SI-ID 178840067]

13. ROŠKAR, Zlatko, DREISINGER, Mojca, TIČ, Primož, **HOMŠAK, Evgenija**, BEVC, Sebastjan, GOROPEVŠEK, Aleš. New flow cytometric methods for monitoring STAT5 signaling reveal responses to SARS-CoV-2 antigen-specific stimulation in FOXP3+ regulatory T cells also in patients with advanced chronic lymphocytic leukemia. *Biosensors*. 2023, vol. 13, issue 5, [article no.] 539, str. [1]-22, ilustr. ISSN 2079-6374. https://www.mdpi.com/2079-6374/13/5/539/htm, https://doi.org/10.3390/bios13050539, DOI: 10.3390/bios13050539. [COBISS.SI-ID 151737859]
14. GÓRSKA, Ewelina, TYLICKA, Marzena, HERMANOWICZ, Adam, MATUSZCZAK, Ewa, SANKIEWICZ, Anna, GORODKIEWICZ, Ewa, HERMANOWICZ, Justyna, KARPIŃSKA, Elźbieta, SOCHA, Katarzyna, KOCHANOWICZ, Jan, **HOMŠAK, Evgenija**, et al. UCHL1, besides leptin and fibronectin, also could be a sensitive marker of the relapsing–remitting type of multiple sclerosis. *Scientific reports*. 2023, [vol.] 13, [article no.] 3423, str. [1-10], ilustr. ISSN 2045-2322. https://www.nature.com/articles/s41598-023-30237-3, https://doi.org/10.1038/s41598-023-30237-3, Digitalna knjižnica Univerze v Mariboru – DKUM, DOI: 10.1038/s41598-023-30237-3. [COBISS.SI-ID 143814659]
15. QUERALTÓ, Josep, BRADY, Jennifer, CAROBENE, Anna, **HOMŠAK, Evgenija** and WIERINGA Gijsbert. The European Register of Specialists in Clinical Chemistry and Laboratory Medicine: code of conduct, version 3 – 2023. Clin Chem Lab Med 2023 Feb 1;61(6):981-988.doi: 10.1515/cclm-2023-0031.
16. BELE, Uroš, SERDINŠEK, Tamara, **HOMŠAK, Evgenija**, BUT, Igor. The impact of extracorporeal magnetic stimulation as addition to mirabegron in overactive bladder treatment in women: a single-centre randomized sham-controlled study. *Journal of clinical medicine*. 2024, vol. 13, issue 3, [article no.] 916, str. [1]-10, ilustr. ISSN 2077-0383. https://www.mdpi.com/2077-0383/13/3/916, https://doi.org/10.3390/jcm13030916, DOI: 10.3390/jcm13030916. [COBISS.SI-ID 183860227]