UNIVERZITET U SARAJEVU

FAKULTET ZA SAOBRAĆAJ I KOMUNIKACIJE

STUDIJSKI PROGRAM

KOMPJUTERSKE I INFORMACIJSKE TEHNOLOGIJE

II CIKLUS STUDIJA

NA UNIVERZITETU U SARAJEVU – FAKULTETU ZA SAOBRAĆAJ I KOMUNIKACIJE

Nastavni plan

Popis obaveznih i predviđenih izbornih predmeta sa šiframa, brojem ECTS bodova i brojem kontakt sati nastave potrebnih za njihovu izvedbu (vježbe, predavanja, praksa, seminar, terenski rad, laboratorijske vježbe isl.);

NASTAVNI PLAN ZA ODSJEK: KOMUNIKACIJE, USMJERENJE: KOMPJUTERSKE I INFORMACIJSKE TEHNOLOGIJE

R.b	Šifra predmeta	Naziv predmeta	Status	I sem.				II sem.				III sem.				IV sem.
				P	V	L	ECTS	P	V	L	ECTS	P	V	L	ECTS	Izrada rada (ECTS)
1.	01ATCOS020101	Menadžment u saobraćaju i komunikacijama	obavezni	3	2	1	6									
2.	02CITOS020101	Geoinformacijski sistemi	obavezni	3	2	1	6									
3.	03CITOS020101	Teorija optimalnih rješenja	obavezni	3	2	1	6									
4.	04CITOS020101	Sigurnost i zaštita informacijskih i komunikacijskih sistema	obavezni	3	2	1	6									
5.	05CITOS020101	Napredne metode softverskog inženjerstva	obavezni	3	2	1	6									
6.	06CITOS020102	Sistemsko inženjerstvo i menadžment	obavezni					3	2	1	6					
7.	07CITOS020102	Web programiranje	obavezni					3	2	1	6					
8.	08CITOS020102	Distribuirani računarski sistemi	obavezni					3	2	1	6					
9.			izborni					3	2	1	6					
10.			izborni					3	2	1	6					
11.	11CITOS020203	Testiranje softvera i upravljanje kvalitetom	obavezni									3	2	1	6	
12.	12CITOS020203	Napredne baze podataka	obavezni									3	2	1	6	
13.			izborni stručni									3	2	1	6	

14.			izborni stručni			3	2	1	6	
15.			izborni stručni			3	2	1	6	
16.	16CITOS020204	Završni master rad	obavezni							30
Broj potrebnih kredita				**30**	**30**	**30**				**30**

Izborni predmeti: usmjerenje: kompjuterske i informacijske tehnologije

Šifra predmeta	**Naziv predmeta**	**Broj sati**			**ECTS**	**Semestar**
		P	**V**	**L/PR**		
09-10-1CITES020102	Lokacijski i navigacijski sistemi	3	2	1	6	**II**
09-10-2CITES020102	Informacijski sistemi mrežnih operatera	3	2	1	6	**II**
09-10-3CITES020102	Multimedijske komunikacije i usluge	3	2	1	6	**II**
09-10-4CITES020102	Informacione tehnologije i špeditersko poslovanje					**II**
13-14-15-1CITES020203	Napredne Internet tehnologije	3	2	1	6	**III**
13-14-15-2CITES020203	Upravljanje projektima i investicijama u saobraćaju i komunikacijama	3	2	1	6	**III**
13-14-15-3CITES020203	Upravljanje odnosima s korisnicima	3	2	1	6	**III**
13-14-15-4CITES020203	Komunikacijske tehnologije i okoliš	3	2	1	6	**III**
13-14-15-5CITES020203	Saobraćajna politika	3	2	1	6	**III**

Opis silabusa na studijskom programu Kompjuterske i informacijske tehnologije na b/h/s jeziku

Šifra predmeta: 01ATCOS020101	**Naziv predmeta:** **MENADŽMENT U SAOBRAĆAJU I KOMUNIKACIJAMA**		
Ciklus: II	**Godina: I**	**Semestar: I**	**Broj ECTS kredita: 6**
Status: Obavezni predmet		**Ukupan broj sati: 90** Razrada distribucije sati po tipu: Predavanja: 45	

	Vježbe: 45 Seminar: Terenski rad:- Laboratorijske vježbe: - Praksa:-
Učesnici u nastavi	**Nastavnici i saradnici izabrani na oblast kojoj predmet pripada/predmet**
Preduslov za upis:	NE
Cilj (ciljevi) predmeta:	Cilj predmeta je upoznavanje sa djelovanjem saobraćajnog sistema u tržišnim uvjetima i međunarodnim standardima, kako bi se obezbjedilo efektivno i efikasno poslovanje. Osposobljavanje studenata u sticanju određenih znanja o standardima i standardizaciji, kao i međuvezama različitih dijelova proizvodnje i ekonomskih procesa na koje utiče tehnička standardizacija.
Tematske jedinice: *(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)*	1. Osnove menadžmenta. Pojam, proces menadžmenta i međuzavisnost sa organizacijom. Pojam menadžmenta i procesa menadžmenta. Karakteristike savremenog menadžera. Funkcije menadžera. 2. Opće i specifične karakteristike menadžmenta u prometnom sustavu. Problematika organizacije i menadžmenta u prometnom sustavu. Definicije i sadržaj menadžmenta. Menadžment i poduzetništvo u transportnim i telekomunikacijskim preduzećima. 3. Opće i specifične karakteristike menadžmenta u prometnom sustavu. Menadžerski poslovi u upravama, zavodima i agencijama. Razvitak logističkog menadžmenta. Odnosi prometne politike i menadžmenta. Razvoj prometnog sustava i prostorno-gospodarsko strukturiranje. 4. Menadžerski koncepti poboljšanja i/ili inoviranje poslovnih procesa. Procesno-orjentirani menadžment. Inoviranje i/ili reinženjering poslovih procesa. 5. Planiranje kao funkcija i aktivnost menadžmenta. Planiranje u prometnom preduzeću. Politike i strategije prometnog preduzeća. Procesni pristup strategijskom planiranju. 6. Planiranje kao funkcija i aktivnost menadžmenta.

	Strategijska analiza konkurentske strukture prometne grane. Metode scenarija u izboru efektivne strategije preduzeća. 7. Organizacijska struktura i procesi organizacije. Pojam i šira shvatanja organizacije. Organizacijska struktura. 8. Organizacijska struktura i procesi organizacije. Uređivanje odnosa u organizaciji. 9. Organizacijska struktura i procesi organizacije. Procesna i na znanju utemeljena organizacija. Primjeri organizacijske strukture nekih transportnih i telekomunikacijskih poduzeća. 10. Vođenje poslova i motiviranje. Vođenje poslova i vodstvo. 11. Vođenje poslova i motiviranje. Utjecaji na ponašanje ljudi i motivacija. 12. Upravljanje ljudskim resursima. Upravljanje ljudskim resursima kao funkcija menadžmenta 13. Upravljanje ljudskim resursima. Aktivnosti u procesu upravljanja ljudskim resursima. Osobni razvitak menadžera. 14. Menadžerska kontrola i upravljanje kvalitetom. Osnove savremene standardizacije. Metode preuzimanja i označavanja standarda, stepeni usklađenosti i terminologija u vezi sa preuzimanjem standarda.Infrastruktura kvaliteta. 15. Menadžerska kontrola i upravljanje kvalitetom. Standardi sistema upravljanja (MSS - Management Systems Standards). Integrisani sistemi upravljanja (IMS - Integrated Management Systems).
Ishodi učenja:	Znanje: Stečena znanja koristit će se za prepozanavanje glavnih tehnoloških procesa, kao i modela upravljanja specifičnih za saobraćajne sisteme. Vještine: Sposobnost primjene teorijskih i praktičnih znanja iz oblasti menadžmenta u prometu. Kompetencije: Sistemski pristup u razumjevanju standardizacije, ovladavanje savremenom poslovnom terminologijom, kao i predočeni praktični primjeri iz područja saobraćaja i komunikacija, pomoći će studentima u njihovom uključivanju u tehničke i druge aktivnosti po završetku studija i zapošljavanju.

Ciljevi održivog razvoja (SDGs)	SDG4 – Kvalitetno obrazovanje SDG8 – Dostojanstven rad i ekonomski rast SDG9 – Industrija, inovacije i infrastruktura SDG11 – Održivi gradovi i zajednice SDG12 – Održiva potrošnja i prozvodnja SDG16 – Mir, pravda i snažne institucije
Metode izvođenja nastave:	Metoda usmenog izlaganja, metoda razgovora, metoda demonstracije, metoda rada u skupini.
Metode provjere znanja sa strukturom ocjene:	Ocjena kreativnosti na nastavi i vježbama uz izradu samostalnih radova, ocjena parcijalnog testa u toku nastave kao i ocjena završnog ispita. Kriterijum praćenja rada i ocjenjivanja studenta u toku nastave i to prema sljedećem načinu: – Domaća zadaća/seminarski rad/praktični rad/ 15 bodova (%), položeno ako se osvoji najmanje 55 %. – I Parcijalni ispit/test/provjera znanja/35 bodova (%), položen je ako se osvoji najmanje 55 %. – Završni ispit (II Parcijalni) 50 bodova (%), položeno ako se osvoji najmanje 55 %. – Završni ispit (Integralni) 85 bodova (%), položeno ako se osvoji najmanje 55 %. Završni ispit se organizuje kao pismeni/usmeni. Student na završnom ispitu može da polaže gradivo koje nije polagao i/ili uspješno okončao tokom trajanja semestra. Potreban uslov za uspješno okončan ispit je postignut rezultat od najmanje 55% bodova od maksimalnog broja bodova na parcijalnom i završnom dijelu ispita, a dovoljan uslov je da suma ostvarenih bodova (kroz: domaću zadaću, prisustvo, parcijalni i završni ispit) bude 55. Zadaća se organizuje kroz pisanje domaće zadaće i projekata. Zadaća nema mogućnost popravljanja. Za studente koji nisu uspješno okončali parcijalni ispit, završni ispit se sastoji iz cjelokupnog pređenog gradiva u toku nastave. Popravni ispit se organizuje kao i završni ispit. Konačan uspjeh studenta nakon svih predviđenih oblika provjere znanja, vrednuje se i ocjenjuje sistemom ocjenjivanja kako slijedi: a) 10 (A) - izuzetan uspjeh bez grešaka ili sa neznatnim greškama, nosi 95-100

	bodova; b) 9 (B) - iznad prosjeka, sa ponekom greškom, nosi 85-94 bodova; c) 8 (C) - prosječan, sa primjetnim greškama, nosi 75-84 bodova; d) 7 (D) - općenito dobar, ali sa značajnijim nedostacima, nosi 65-74 bodova; e) 6 (E) - zadovoljava minimalne uslove, nosi 55-64 bodova; f) 5 (F, FX) - ne zadovoljava minimalne uslove, manje od 55 bodova. Ukupno vrednovanje svih obaveza studenta u toku semestra, odnosno ocjena na ispitu zasnovana je na ukupnom broju bodova (%) koje je student stekao ispunjavanjem predispitnih obaveza i polaganjem parcijalnog i završnog ispita, a prema kvalitetu stečenih znanja i vještina, i sadrži maksimalno 100 bodova, te se utvrđuje prema sljedećoj skali: Obaveze studenta Bodovi (%) Prisutnost na predavanjima i vježbama... - Zadaća/Seminarski/Praksa/.....15 bodova (%) I Parcijalni ispit/Test/Provjera znanja/.....35 bodova (%) Završni ispit (II Parcijalni) .....50 bodova (%) Završni ispit (Integralni) .....85 bodova (%)
Literatura (obavezna):	1. Vujadin B. Vešović, „MENADŽMENT U SAOBRAĆAJU“, Univerzitet u Beogradu, Saobraćajni fakultet, 1997. 2. Šefkija Čekić, Ivan Bošnjak, „MENADŽMENT U TRANSPORTU I KOMUNIKACIJAMA“, Fakultet za saobraćaj i komunikacije UNSA, Fakultet prometnih znanosti UNIZG, Sarajevo, Zagreb, 2000.
Literatura (dodatna):	1. Alija Behmen, Sabira Salihović: MATERIJALI I ROBE U TRANSPORTU - Knjiga I, klasifikacija, standardizacija, identifikacija, Fakultet za saobraćaj i komunikacije Sarajevo i DES-Sarajevo, Sarajevo, 2007. 2. Alija Behmen, Sabira Salihović: MATERIJALI I ROBE U TRANSPORTU - Knjiga II, kvalitet: osnove, principi, kontrola, Fakultet za saobraćaj i komunikacije Sarajevo i DES-Sarajevo, Sarajevo, 2008. 3. Međunarodni/regionalni/nacionalni standardi

Šifra predmeta: 02CITOS020101	**Naziv predmeta: Geoinformacijski sistemi**		
Ciklus: II	**Godina: I**	**Semestar: I**	**Broj ECTS kredita:** 6

Status: obavezni predmet	**Ukupan broj sati: 90** Predavanja: 45 Vježbe: 30 Seminari i projektni zadaci: 15
Učesnici u nastavi	Nastavnici i saradnici izabrani na oblast kojoj predmet pripada/predmet
Preduslov za upis:	NE
Cilj (ciljevi) predmeta:	Upoznavanje studenata sa osnovnim konceptima GIS sistema, načinom rada ovih sistema, planiranjem, implementacijom i mogućim primjenama.
Tematske jedinice:	– Pojam geoinformacijskih sistema (GIS) – Komponente GIS-a – Proces prikupljanja i manipulacije GIS podacima – Struktura i modeli prostornih podataka – Upravljanje bazom podataka – Koordinatni sistemi, projekcije, georeferenciranje – Baze geografskih podataka – Standardizacija u GIS-u – Izlazni podaci i kartografija – Tehnike grafičkog prikaza – Principi slojevitog prikaza prostornih podataka – Oblasti primjene i osnovne GIS funkcije – Web i mobilni GIS – Primjena GIS-a u planiranju telekomunikacijske infrastrukture – Primjena GIS-a u planiranju saobraćajne infrastrukture
Ishodi učenja:	**Znanje:** Studenti će biti upoznati sa osnovnim konceptima razvoja i standardizacijom u oblasti GIS-a, principima web i mobilnih GIS sistema kao i konkretnoj primjeni sa posebnim fokusom na oblast saobraćaja i komunikacija. Studenti će se upoznati sa procesom razvoja GIS sistema, od trenutka javljanja ideje i potrebe za GIS-om, prikupljanja podataka i formiranja GIS baze podataka, georeferenciranja, grafičkog prikaza i korištenja GIS sistema. **Vještine:** Studenti će savladati određene softverske alate potrebne za projektovanje i razvoj GIS sistema. **Kompetencije:** Nakon položenog ispita student će biti u mogućnosti planirati, projektovati i razvijati GIS sisteme i izvršiti odabir odgovarajućih tehnologija za razvoj specifičnih rješenja.
Ciljevi održivog razvoja (SDG)	SDG9 – Industrija, inovacije i infrastruktura SDG11 – Održivi gradovi i zajednice
Metode izvođenja nastave:	Nastava se realizira kroz izvođenje predavanja, vježbi i praktičnog dijela nastave koji uključuje laboratorijske vježbe. Predavanja se realizuju kroz

	usmeno izlaganje sa prezentacijom i prikazom primjera iz prakse. Vježbe i laboratorijske vježbe održavaju se uz upotrebu softverskih alata za rješavanje konkretnih problemskih i praktičnih zadataka. Studenti će biti obavezni izraditi i prezentirati seminarske radove i/ili projektne zadatake. U toku nastave se koriste različite metode koje uključuju: usmeno izlaganje, razgovori diskusije, demonstracije, individualni i grupni rad, itd.
Metode provjere znanja sa strukturom ocjene:	Ukupan broj bodova koji student može ostvariti u toku nastave je 50 i na završnom ispitu 50. Bodovi u toku nastave su raspoređeni na zadaće i aktivnost i/ili seminar i/ili projektni zadatak i na parcijalni ispit. Završni/popravni ispit uključuje gradivo koje student nije položio na parcijalnom ispitu što znači da obuhvata drugi dio gradiva koji se vrednuje sa 50 bodova za studente koji su položili parcijalni ispit. Studenti koji nisu položili gradivo sa parcijalnog ispita polažu gradivo sa parcijalnog i završnog ispita. Završni / popravni ispit se organizuje kao pismeni i/ili usmeni ispit uz polaganje praktičnog dijela. Ukupno vrednovanje svih obaveza studenta u toku semestra, odnosno ocjena na ispitu, zasnovana je na ukupnom broju bodova koje je student stekao ispunjavanjem predispitnih obaveza, polaganjem parcijalnog i završnog ispita. Prema kvalitetu stečenih znanja i vještina student može osvojiti maksimalno 100 bodova, a prema sljedećoj skali: Struktura bodovanja Bodovi (%) Seminar / Aktivnost na nastavi / Projektni zadatak:..... 20 bodova (%) I test / I provjera znanja (I parcijalni ispit):..... 30 bodova (%) Završni ili popravni ispit (II parcijalni ispit):..... 50 bodova (%) Potreban uslov za polaganje ispita je 55 bodova u sumi uz ostvarenih najmanje 55% bodova na provjerama znanja (parcijalni ispit i završni/popravni ispit). Konačan uspjeh studenta, nakon svih predviđenih oblika provjere znanja, vrednuje se i ocjenjuje sistemom kako slijedi: a) 10 - izuzetan uspjeh bez grešaka ili sa neznatnim greškama (95-100 bodova); b) 9 - iznad prosjeka, sa ponekom greškom (85-94 bodova); c) 8 - prosječan, sa primjetnim greškama (75-84 bodova); d) 7 - općenito dobar, ali sa značajnijim nedostacima (65-74 bodova); e) 6 - zadovoljava minimalne uslove (55-64 bodova); f) 5 - ne zadovoljava minimalne uslove (manje od 55 bodova).
Literatura:	Obavezna: – Nastavni materijal dostupan na Intranet portalu Fakulteta za saobraćaj i komunikacije. Dopunska: – Kang Tsung Chang, „*Introduction to Geographic Information Systems*“, McGraw-Hill Education, 2019. – Paul Bolstad, „*GIS Fundamentals A First Text on Geographic Information Systems,*“ Eider Press, 2016.

	– Ian Heywood, Sarah Cornelius, „*An introduction to geographical information systems*“, Pearson Education Limited, 2006. – Kurt Menke, Richard Smith Jr., Luigi Pirelli, John Van Hoesen, „*Mastering QGIS*“,“ Packt Publishing Ltd., 2016. – Gábor Farkas, „Practical GIS,“ Packt Publishing Ltd., 2017. – Anita Graser, „*Learning QGIS*,“ Packt Publishing Ltd., 2016. – Ralph M. Stair, George W. Reynolds, „*Fundamentals of Information Systems*,“ Cengage Learning, 2016. – Alan Dennis, Barbara Haley Wixom, Roberta M. Roth, „*Systems analysis and design*,“ Wiley, 2015. – Patricia Wallace, „*Introduction to Information Systems*,“ Pearson Education, 2015. – Arthur M. Langer, „*Analysis and Design of Information Systems, Springer-Verlag*,“ 2008. – John Wang, „*Innovations in Supply Chain Management for Information Systems*,“ Business Science Reference, 2010. – Christos Kalloniatis: “*Modern Information Systems*,“ InTech Croatia, 2012.

Šifra predmeta: 03CITOS020101	**Naziv predmeta: TEORIJA OPTIMALNIH RJEŠENJA**		
Ciklus: II	**Godina: I**	**Semestar: I**	**Broj ECTS kredita:** 6
Status: Obavezni predmet		**Ukupan broj kontakt sati: 90** Opciono razraditi distribuciju sati po tipu: Predavanja 45 Vježbe 45 Laboratorijske vježbe 45	
Učesnici u nastavi	**Nastavnici i saradnici izabrani na oblast kojoj predmet pripada/predmet**		
Preduslov za upis:	Ne		
Cilj (ciljevi) predmeta:	Dati studentima znanja koja se odnose na koncepte i metode rješavanja problema optimizacije, sa posebnim naglaskom na rješavanje problema koji su prisutni u transportno komunikacijskim tehnologijama		
Tematske jedinice: *(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti*	• Uvod u operaciona istraživanja. Modeli i metode operacionih istraživanja. Matematički modeli u zadacima operacionih istraživanja. • Linearno programiranje. Definicija problema LP. Karakteristike modela LP. Dualnost. Rješavanje problema LP putem simpleks metode.		

organizacionih jedinica)	• Transportni problem. Formulacija i matematički model transportnog problema. Metoda određivanja bazno dopustivog rješenja. • Transportni problem. Dijagonalna metoda. Metod minimalnih cijena u redovima. Metod minilanih cijena u kolonama. Određivanje optimalnog rješenja transportnog zadatka. • Nelinearno programiranje. Uvod u nelinearno programiranje. Primjena optimizacione metode nelinearnog programiranja. • Teorija grafova. Osnovni pojmovi u teoriji grafova. • Teorija grafova. Primjena teorije grafova u prometu • Mrežno planiranje. Uvod u mrežno planiranje. Analiza strukture i osnovni elementi mrežnog planiranja. Metoda kritičnog puta CPM. • Mrežno planiranje. PERT METOD. Pojam PERT mreže. Upoređivanje proračuna parametara po metodi CPM i PERT • Dinamičko programiranje. Karakteristike modela dinamičkog programiranja. Postupak rješavanja minimalnog toka u mreži. Postupak rješavnja problema maksimalnog toka u mreži. • Dinamičko programiranje. Problem optimalnog investiranja. Problem optimalnog planiranja proizvodnje. • Algoritmi. Pojam i osobine algoritama. Osnovne algoritamske strukture. • Rješavanje problema usmjeravanja vozila • Matrične igre • Metode numeričke optimizacije sa primjenom u programu MATLAB
Ishodi učenja:	Znanje: Student nakon odslušanog i položenog kursa treba da raspolaže osnovnim teorijskim znanjima neophodnim za primjenu različitih metoda optimizacije. Vještine: Sa znanjima stečenim na ovom predmetu student će biti u mogućnosti da sagleda ulogu i značaj optimizacije za proces donošenja odluka i koristi koje se njenom primjenom mogu ostvariti. Kompetencije: Studenti se osposobljavaju za modeliranje optimizacijskih problema korištenjem odgovarajućih metodologija u cilju rješavanja raznih realnih problema iz saobraćaja i komunikacija uz pomoć računara.
Cilj održivog razvoja (SDG):	SDG4 – Kvalitetno obrazovanje, SDG8 – Dostojanstven rad i ekonomski rast, SDG9 – Industrija, inovacije i infrstruktura
Metode izvođenja nastave:	Sadržaj kursa se izvodi kroz tri aktivnosti: Predavanja u sali za sve studente koje provodi nastavnik i tokom kojih se predstavljaju teorijski aspekti uz rješavanje numeričkih problema i

	praktičnih primjera. Predavanje se odvija uz korištenje video i audio zapisa. Vježbe: Na tutorijalima se razrađuju teme izučavane na predavanjima (rješavanje konkretnih problema i diskusija) Laboratorijske vježbe: Implementacija i demonstriranje algoritama obrađenih na predavanjima. Rješavanje klasa problema obrađenih na predavanjima. Za realizaciju će se koristiti Matlab/Simulink.
Metode provjere znanja sa strukturom ocjene:	Obaveze studenta Bodovi (%) Prisutnost na predavanjima i vježbam.....Evidencija bez bodova Zadaće u toku nastave.....15 bodova (%) I Parcijalni ispit/Test/Provjera znanja/*.....20 bodova + 15 bodova teorija (%) II Parcijalni /Test/Provjera znanja/*.....20 bodova + 15 bodova teorija (%) Usmeni ispit.....20 bodova (%) *Za pozitivnu provjeru parcijalnih ispita neophodno je osvojiti minimalno 10 na zadatke odnosno 7,5 za teoriju. Konačan uspjeh studenta nakon svih predviđenih oblika provjere znanja, vrednuje se i ocjenjuje sistemom ocjenjivanja kako slijedi: a) 10 (A) - izuzetan uspjeh bez grešaka ili sa neznatnim greškama, nosi 95-100 bodova; b) 9 (B) - iznad prosjeka, sa ponekom greškom, nosi 85-94 bodova; c) 8 (C) - prosječan, sa primjetnim greškama, nosi 75-84 bodova; d) 7 (D) - općenito dobar, ali sa značajnijim nedostacima, nosi 65-74 bodova; e) 6 (E) - zadovoljava minimalne uslove, nosi 55-64 bodova; f) 5 (F, FX) - ne zadovoljava minimalne uslove, 0 – 55 bodova.
Literatura:	Obavezna: 1. Husein Pašagić, Matematičko modeliranje i teorija grafova, FPZ, Zagreb, 1998. 2. D. Lipovac, D. Letić, Metode operacionih istraživanja, Univerzitet u Novom Sadu, Zrenjanin, 1999. 3. Corne, D., Dorigo, M., Glover, F.: New Ideas in Optimization, Mc Graw Hill, 1999 Crainic, T.G., Laporte, G.: Fleet Managment and Logistics, Kluwer, 1998 Dopunska:

	1. Damir Vučina, Metode inženjerske numeričke optimizacije, FESB, Split, 2005. 2. Dr. Aleksandar Zečević, Operaciona istraživanja, Viša poslovna škola Beograd, 2000.

Šifra predmeta: 04CITOS020101	**Naziv predmeta: Sigurnost i zaštita informacijskih i komunikacijskih sistema**		
Ciklus: II	**Godina: I**	**Semestar: I**	**Broj ECTS kredita: 6**
Status: obavezan predmet		**Ukupan broj sati: 90**	
Učesnici u nastavi	Nastavnici i saradnici izabrani na oblast kojoj predmet pripada/predmet		
Preduslov za upis:	NE		
Cilj (ciljevi) predmeta:	Cilj nastavnog predmeta Sigurnost i zaštita informacijskih i komunikacijskih sistema je sticanje znanja i ovladavanje vještinama koje doprinose razvoju sigurnosti i zaštite savremenih informacijskih i komunikacijskih sistema neophodnih za rad u savremenom digitalnom okruženju. Studenti se trebaju upoznati sa osnovnim principima sigurnosti informacija i informacijskih i komunikacijskih sistema, standardima, vrstama prijetnji i zaštita, modelovanjem prijetnji, penetracijskim testiranjem, upravljanju rizicima, kompjuterksim kriminalom, društvenim inženjeringom, itd.		
Tematske jedinice:	- Uvod u sigurnost i zaštitu informacijskih i komunikacijskih sistema - Izazovi u sigurnosti i zaštiti kod savremenih informacijskih i komunikacijskih sistema - Osnovi sigurnosti informacija - Osnovi sigurnosti informacijskih i komunikacijskih sistema - Standardi informacijske sigurnosti - Vrste napada i prijetnji - Vrste zaštite - Fizička sigurnost - Upravljanje rizikom - Modelovanje prijetnji - Kompjuterski kriminal - Timovi za odgovor na računarske incidente - Penetracijsko testiranje i etičko hakiranje		

	- Društveni inženjering
Ishodi učenja:	Znanje: Studenti će steći teorijska i praktična znanja o sigurnosti i zaštiti informacijskih i komunikacijskih sistema, te njihovoj primjeni u različitim poljima saobraćaja i komunikacija. Vještine: Očekuje se da studenti ovladaju vještinama i alatima koji se koriste u oblasti sigurnosti i zaštite informacijskih i komunikacijskih sistema. Kompetencije: Studenti će biti osposobljeni da učestvuju u aktivnostima u vezi sigurnosti i zaštite informacijskih i komunikacijskih sistema u kontekstu saobraćaja i komunikacija.
Cilj održivog razvoja	SDG 4 – Kvalitetno obrazovanje SDG 9– Industrija, inovacije i infrastruktura
Metode izvođenja nastave:	Nastava se realizira kroz izvođenje predavanja, vježbi i praktičnog dijela nastave koja uključuje izradu seminarskih radova. Predavanja se realizuju kroz usmeno izlaganje sa prezentacijom i prikazom primjera iz prakse, te iniciranje diskusije. Studenti će biti obavezni izraditi i prezentirati seminarske radove i/ili projektne zadatake. U realizaciji nastave se koriste različite metode koje uključuju: usmeno izlaganje i diskusije, demonstracije primjera, metoda grafičkih i video prikaza i potenciranje rada u grupama primjenom odgovarajućih metodoloških pristupa.
Metode provjere znanja sa strukturom ocjene:	Kriterijum vrednovanja rada i ocjenjivanja studenta u toku nastave, vrši se na sljedeći način: Aktivnost (seminarski rad / projektni zadatak): od 0 do 15 bodova; I test / I provjera znanja / I parcijalni ispit: od 0 do 35 bodova. Ukupan broj bodova koji studenta može ostvariti u toku nastave može iznosi maksimalno 50 bodova. Završni / popravni ispit uključuje gradivo koje student nije položio na parcijalnom ispitu što znači da obuhvata drugi dio gradiva (II parcijalni) koji se vrednuje sa 50 bodova ili se sastoji od kompletnog gradiva, tj. I i II parcijalnog ispita. Ukupno vrednovanje svih obaveza studenta u toku semestra, odnosno ocjena na ispitu zasnovana je na ukupnom broju bodova (%) koje je student stekao ispunjavanjem predispitnih obaveza, polaganjem parcijalnog i završnog ispita. Prema kvalitetu stečenih znanja i vještina student može osvojiti

	maksimalno 100 bodova, a prema sljedećoj skali: Struktura bodovanja Bodovi (%) Seminarski / Projektni zadatak:..... 15 bodova (%) I test / I provjera znanja (I parcijalni ispit): 35 bodova (%) Završni ili popravni ispit (II parcijalni ispit):50 bodova (%) Potreban uslov za uspješno okončan ispit je postignut rezultat od 55 bodova pri čemu na svakom dijelu ispita treba ostvariti minimalno 55% (aktivnost, parcijalni ispit, završni ispit), tj. da bi student položio ispit mora ostvariti sljedeće uslove: - Aktivnost (seminarski rad / projektni zadatak): 9 bodova - I test / I provjera znanja / parcijalni ispit: 19 bodova - Završni ili popravni ispit (II parcijalni ispit): 27 bodova Studenti koji su položili parcijalni ispit, na završnom / popravnom ispitu polažu samo drugi dio gradiva (dio koji nije obuhvaćen parcijalnim ispitom). Studenti koji nisu položili parcijalni ispit, u okviru završnog / popravnog ispita polažu kompletno gradivo, pri čemu kriteriji za polaganje ispita ostaje identični. Završni / popravni ispit se organizuje kao pismeni i/ili usmeni. Aktivnost se može pratiti kroz izradu zadaće, seminarskih radova, projektnih zadataka ili polaganje kvizova. Konačan uspjeh studenta nakon svih predviđenih oblika provjere znanja, vrednuje se i ocjenjuje sistemom ocjenjivanja kako slijedi: a) 10 - izuzetan uspjeh bez grešaka ili sa neznatnim greškama, nosi 95-100 bodova; b) 9 - iznad prosjeka, sa ponekom greškom, nosi 85-94 bodova; c) 8 - prosječan, sa primjetnim greškama, nosi 75-84 bodova; d) 7 - općenito dobar, ali sa značajnijim nedostacima, nosi 65-74 bodova; e) 6 - zadovoljava minimalne uslove, nosi 55-64 bodova; f) 5 - ne zadovoljava minimalne uslove, manje od

	55 bodova.
Literatura:	Obavezna: - Whitman, M.E., Mattord, H.J.: Principles of Information Security, Course Technology, Cengage Learning, 2012. - Baraković, S., Baraković Husić, J.: „Osnove modelovanja prijetnji u oblasti informaciono-komunikacijskih sistema“, Dobra knjiga, 2022. Dopunska: – Stamp, M.: Information Security: Principles and Practice, Wiley, 2011. – Rao, U.H., Nayak, U.: The InfoSec Handbook: An Introduction to Information Security, Apress Open, 2014. – Mrdović, S.: Sigurnost računarskih sistema, Univerzitet u Sarajevu, 2014. – Internet.

Šifra predmeta: 05CITOS020101	**Naziv predmeta: Napredne metode softverskog inženjerstva**		
Ciklus: II	**Godina: I**	**Semestar: I**	**Broj ECTS kredita: 6**
Status: Obavezan predmet		**Ukupan broj kontakt sati: 90** Predavanja: 45 Vježbe: 30 Seminar: 15	
Učesnici u nastavi	**Nastavnici i saradnici izabrani na oblast kojoj predmet pripada/predmet**		
Preduslov za upis:	Ne		
Cilj (ciljevi) predmeta:	Usvajanje znanja iz naprednih metoda softverskog inžinjeringa kroz odabrana poglavlja, kao i usvajanje vještina potrebnih za praktičan i profesionalan pristup softverskom inžinjeringu u različitim tipovima softverskih projekata.		
Tematske jedinice:	• Uvod u softverski inžinjering • Softverski procesi, Alati i metode softverskog inžinjeringa • Inžinjering softverskih zahtjeva • Modeliranje sistema, UML • Dizajn, Objektni pristup • Implementacija • Verifikacija, Validacija • Održavanje, Evolucija softvera • Mjerenje softvera, Softverske metrike		

	• Upravljanje projektima • Ponovna upotreba, Komponentno bazirni SI • Agilne metode • Servisno orijentirani SI
Ishodi učenja:	Znanje: Pokazati napredno znanje i vještine iz softverskog inžinjeringa, kao i profesionalan pristup praktičnom softverskom inžinjeringu Vještine: Planirati i kreirati glavne aktivnosti i proizvesti rezultate tokom životnog ciklusa razvoja softvera. Učestvovati kao pojedinac ili član tima u kreiranju i isporučivanju kvalitetnih softverskih sistema. Primjeniti objektno orijentiranu metodologiju u SI. Primjeniti pristupe upravljanja projektima u SI okolini Kompetencije: Razumjeti i interpretirati ostale napredne i moderne metode i pristupe SI. Razlikovati i porediti modele razvoja softvera. Koristiti principe softverskog inžinjering.
Cilj održivog razvoja (SDG):	SDG5 - Osigurati uključivo i kvalitetno obrazovanje, te promovirati mogućnosti cjeloživotnog učenja svih ljudi svih životnih dobi Podcilj 4.3. - Do kraja 2030. osigurati jednaku dostupnost jeftinog i kvalitetnog tehničkog, stručnog i tercijarnog obrazovanja, uključujući sveučilišno, za sve žene i muškarce
Metode izvođenja nastave:	Nastava se realizira kroz izvođenje predavanja, vježbi i praktičnog dijela nastave koja uključuje izradu projektnih zadataka. Predavanja se realizuju kroz usmeno izlaganje sa prezentacijom i prikazom primjera iz prakse. Inicira diskusija o različitim pitanjima i problemima iz softverskog inžinjeringa. Studenti će biti obavezni izraditi i prezentirati seminarske radove i/ili projektne zadatake. U realizaciji nastave se koriste različite metode koje uključuju: usmeno izlaganje i diskusije, demonstracije primjera, metoda grafičkih i video prikaza i potenciranje rada u grupama primjenom odgovarajućih metodoloških pristupa.
Metode provjere znanja sa strukturom ocjene:	Kriterijum vrednovanja rada i ocjenjivanja studenta u toku nastave, vrši se na sljedeći način: Individualna aktivnost (seminarski rad / projektni zadatak): od 0 do 10 bodova; Grupna aktivnost (seminarski rad / projektni zadatak): od 0 do 20 bodova; I test / I parcijalni ispit: od 0 do

	35 bodova. Završni / popravni ispit uključuje gradivo koje student nije položio na parcijalnom ispitu što znači da obuhvata drugi dio gradiva (II parcijalni) koji se vrednuje sa 35 bodova ili se sastoji od kompletnog gradiva, tj. I i II parcijalnog ispita. Ukupno vrednovanje svih obaveza studenta u toku semestra, odnosno ocjena na ispitu zasnovana je na ukupnom broju bodova (%) koje je student stekao ispunjavanjem predispitnih obaveza, polaganjem parcijalnog i završnog ispita. Prema kvalitetu stečenih znanja i vještina student može steći maksimalno 100 bodova, a prema sljedećoj skali: Struktura bodovanja Bodovi (%) Individualni projekat/ Seminarski rad: 10 bodova (%) Grupni projekat: 20 bodova (%) I test (I parcijalni ispit): 35 bodova (%) Završni ili popravni ispit (II parc.ispit): 35 bodova (%) Potreban uslov za uspješno okončan ispit je postignut rezultat od 55 bodova pri čemu na sljedećim dijelovima treba ostvariti minimalno 50%, tj. da bi student položio ispit mora ostvariti sljedeće uslove: • I test / I provjera znanja / parcijalni ispit: 17,5 bodova • Završni ili popravni ispit (II parcijalni ispit): 17,5 bodova Studenti koji su položili parcijalni ispit, na završnom / popravnom ispitu polažu samo drugi dio gradiva (dio koji nije obuhvaćen parcijalnim ispitom). Studenti koji nisu položili parcijalni ispit, u okviru završnog / popravnog ispita polažu kompletno gradivo, pri čemu kriteriji za polaganje ispita ostaje identični. Završni / popravni ispit se organizuje kao pismeni i/ili usmeni. Aktivnost se može pratiti kroz izradu zadaće, seminarskih radova, projektnih zadataka ili polaganje kvizova. Konačan uspjeh studenta nakon svih predviđenih oblika provjere znanja, vrednuje se i ocjenjuje sistemom ocjenjivanja kako slijedi: a) 10 -

	izuzetan uspjeh bez grešaka ili sa neznatnim greškama, nosi 95-100 bodova; b) 9 - iznad prosjeka, sa ponekom greškom, nosi 85-94 bodova; c) 8 - prosječan, sa primjetnim greškama, nosi 75-84 bodova; d) 7 - općenito dobar, ali sa značajnijim nedostacima, nosi 65-74 bodova; e) 6 - zadovoljava minimalne uslove, nosi 55-64 bodova; f) 5 - ne zadovoljava minimalne uslove, manje od 55 bodova. Navedena skala se može korigovati prema Pravilima studiranja na Univerzitetu u Sarajevu (Član 45).
Literatura:	Obavezna: Nastavni materijal dostupan na nastavnom portalu Fakulteta za saobraćaj i komunikacije. Bakir Karahodža, Metode i procesi softverskog inžinjeringa, FSK Sarajevo, 2023. Dženana Đonko, Objektno orijentirana analiza i dizajn primjernom UML notacije, ETF Sarajevo, 2009. Dopunska: I.Sommerville: Software Engineering, 10-th Edition. Pearson Education Inc, Boston MA, USA, 2015. S.R.Schach: Object-Oriented and Classical Software Engineering, 8-th Edition. McGraw-Hill, New York, 2010. R.S.Pressman: Software Engineering - A Practitioner's Approach, 8-th Edition. McGraw-Hill, New York, 2009. H. Van Vliet: Software Engineering - Priniples and Practice, 3-rd Edition. John Wiley and Sons, Chichester UK, 2008. E.J. Braude, M.E. Bernstein: Software Engineering – Modern Approaches. John Wiley and Sons, New York, 2010. S.L. Pfleeger, J.M. Atlee: Software Engineering - Theory and Practice, 4-th Edition. Prentice Hall, Englewood Cliffs NJ, 2009. F. Tsui, O. Karam, B. Bernal: Essentials of Software Engineering, 3-rd Edition. Jones & Bartlett Publishers, Sudbury MA, 2013.

Šifra predmeta:	**Naziv predmeta:**

06CITOS020102	**SISTEMSKO INŽENJERSTVO I MENADŽMENT**		
Ciklus: II	**Godina: I**	**Semestar: II**	**Broj ECTS kredita: 6**
Status: Obavezni predmet		**Ukupan broj sati: 90** Razrada distribucije sati po tipu: Predavanja: 45 Vježbe: 45 Seminar: Terenski rad:- Laboratorijske vježbe: - Praksa:-	

Učesnici u nastavi	**Nastavnici i saradnici izabrani na oblast kojoj predmet pripada/predmet**
Preduslov za upis:	NE
Cilj (ciljevi) predmeta:	Cilj predmeta jeste ovladavanje prometnim procesima i sučeljima, kao i utvrđivanje zajedničkih prometnih veličina koje omogućavaju kvalitetnije povezivanje u jedinstvenu prometnu mrežu. Postizanjem adekvatne interakcije između komponenata prometnog sustava kroz njegov životni ciklus bit će dat osvrt na pojedine faze tehnoloških procesa u saobraćaju i komunikacijama.
Tematske jedinice: *(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)*	1. Uvod 2. Temeljna određenja sustavskog inženjerstva i menadžmenta. 3. Razvoj sustavskog mišljenja i metodologija. 4. Kritičko sustavsko razmišljanje i komplementarizam. 5. Sustavski dijagrami pomagala. 6. Definiranje i razvoj sustava. 7. Sustavska analiza. 8. Sustavska dinamika. 9. Programsko inženjerstvo. 10. Clios metodološki pristup. 11. Menadžment sustavskog znanja. 12. Ekologija sustavskog znanja i profesionalna etika. 13. Klir-Orchardova paradigma. 14. GSPS. Morfološka mreža rješavanja problema. 15. Razrada GSPS s primjerima.
Ishodi učenja:	Znanje: Stečena znanja koristit će se za prepozanavanje glavnih tehnoloških procesa, kao i rješavanje specifičnih problema prometnih sistema, zasnovan na sistemskom pristupu.

	Vještine: Sposobnost primjene teorijskih i praktičnih znanja iz oblasti menadžmenta u prometu. Kompetencije: Sistemski pristup u razumjevanju sistemskog pritupa i njegove primjene u oblasti menadžmenta, ovladavanje savremenom poslovnom terminologijom, kao i predočeni praktični primjeri iz područja saobraćaja i komunikacija, pomoći će studentima u njihovom uključivanju u tehničke i druge aktivnosti po završetku studija i zapošljavanju.
Ciljevi održivog razvoja (SDGs)	• SDG4 – Kvalitetno obrazovanje • SDG8 – Dostojanstven rad i ekonomski rast • SDG9 – Industrija, inovacije i infrastruktura • SDG11 – Održivi gradovi i zajednice • SDG12 – Održiva potrošnja i proizvodnja • SDG16 – Mir, pravda i snažne institucije
Metode izvođenja nastave:	Metoda usmenog izlaganja, metoda razgovora, metoda demonstracije, metoda rada u skupini.
Metode provjere znanja sa strukturom ocjene:	Ocjena kreativnosti na nastavi i vježbama uz izradu samostalnih radova, ocjena parcijalnog testa u toku nastave kao i ocjena završnog ispita. Kriterijum praćenja rada i ocjenjivanja studenta u toku nastave i to prema sljedećem načinu: – Domaća zadaća/seminarski rad/praktični rad/ 15 bodova (%), položeno ako se osvoji najmanje 55 %. – I Parcijalni ispit/test/provjera znanja/35 bodova (%), položen je ako se osvoji najmanje 55 %. – Završni ispit (II Parcijalni) 50 bodova (%), položeno ako se osvoji najmanje 55 %. – Završni ispit (Integralni) 85 bodova (%), položeno ako se osvoji najmanje 55 %. Završni ispit se organizuje kao pismeni/usmeni. Student na završnom ispitu može da polaže gradivo koje nije polagao i/ili uspješno okončao tokom trajanja semestra. Potreban uslov za uspješno okončan ispit je postignut rezultat od najmanje 55% bodova od maksimalnog broja bodova na parcijalnom i završnom dijelu ispita, a dovoljan uslov je da suma ostvarenih bodova (kroz: domaću zadaću, prisustvo, parcijalni i završni ispit) bude 55. Zadaća se organizuje kroz pisanje domaće zadaće i projekata. Zadaća nema mogućnost popravljanja. Za studente koji nisu

	uspješno okončali parcijalni ispit, završni ispit se sastoji iz cjelokupnog pređenog gradiva u toku nastave. Popravni ispit se organizuje kao i završni ispit. Konačan uspjeh studenta nakon svih predviđenih oblika provjere znanja, vrednuje se i ocjenjuje sistemom ocjenjivanja kako slijedi: a) 10 (A) - izuzetan uspjeh bez grešaka ili sa neznatnim greškama, nosi 95-100 bodova; b) 9 (B) - iznad prosjeka, sa ponekom greškom, nosi 85-94 bodova; c) 8 (C) - prosječan, sa primjetnim greškama, nosi 75-84 bodova; d) 7 (D) - općenito dobar, ali sa značajnijim nedostacima, nosi 65-74 bodova; e) 6 (E) - zadovoljava minimalne uslove, nosi 55-64 bodova; f) 5 (F, FX) - ne zadovoljava minimalne uslove, manje od 55 bodova. Ukupno vrednovanje svih obaveza studenta u toku semestra, odnosno ocjena na ispitu zasnovana je na ukupnom broju bodova (%) koje je student stekao ispunjavanjem predispitnih obaveza i polaganjem parcijalnog i završnog ispita, a prema kvalitetu stečenih znanja i vještina, i sadrži maksimalno 100 bodova, te se utvrđuje prema sljedećoj skali: Obaveze studenta Bodovi (%) Prisutnost na predavanjima i vježbama... - Zadaća/Seminarski/Praksa/.....15 bodova (%) I Parcijalni ispit/Test/Provjera znanja/.....35 bodova (%) Završni ispit (II Parcijalni) .....50 bodova (%) Završni ispit (Integralni) .....85 bodova (%)
Literatura (obavezna):	3. Čaušević S, Bošnjak I, SUSTAVSKO INŽENJERSTVO U TRANSPORTU I KOMUNIKACIJAMA, Univerzitet u Sarajevu, Fakultet za saobraćaj i komunikacije, Sarajevo, 2006. 4. Čaušević S, Bošnjak I, SUSTAVSKO INŽENJERSTVO I MENADŽMENT, Univerzitet u Sarajevu, Fakultet za saobraćaj i komunikacije, Sarajevo, 2011. 5. Bilješke i prezentacije sa predavanja i vježbi.

Šifra predmeta: 07CITOS020102	**Naziv predmeta: Web programiranje**		
Ciklus: II	**Godina: I**	**Semestar: II**	**Broj ECTS kredita:** 6
Status: Obavezni		**Ukupan broj kontakt sati: 3+2+1**	

Učesnici u nastavi	**Nastavnici i saradnici izabrani na oblast kojoj predmet pripada/predmet**
Preduslov za upis:	n/a
Cilj (ciljevi) predmeta:	Obezbjediti teorijsko i praktično znanje naprednog web razvoja. Osposobiti studente za praktičan rad u razvoju naprednih web aplikacija. Upoznati studente sa implementcijom umjetne inteligencije u poslovnim rješenjima. Upoznati studente sa naprednim web programiranjem. Izgraditi kompetencije kako bi studenti mogli biti konkurentni na tržištu rada i steći dovoljne kompetencije kako bi mogli ponuditi svoje usluge privrednim subjektima u nivou medior full-stack developera.
Tematske jedinice: *(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)*	Napredne JavaScript funkcionalnosti, JavaScript razvojni okviri Promisses JS OOP Napredni eventi .NET Core Entity framework ML.NET – AI u poslovnim rjesenjima – Sistemi preporuke Ostale AI fukcionalnosti u web aplikacijama – Predikcije i klasifikacije Kontejnerski pristup isporuci aplikacija DevOps Web bazirana aplikacija
Ishodi učenja:	Znanje: Znanje naprednog full stack razvoja Vještine: Back-end i front-end razvoj Kompetencije: Medior full-stack developer
Cilj održivog razvoja (SDG):	SDG4 – Kvalitetno obrazovanje

Metode izvođenja nastave:	Predavanja – teorijske osnove Vježbe – Praktična primjena teroijskih znanja Laboratorijske vježbe – Praktičan rad na projektu
Metode provjere znanja sa strukturom ocjene:	Seminarski rad i ispit
Literatura:	Obavezna: Osnove web razvoja i dizajna, Babovic E., Music D. 2021 Dopunska: Beginning ASO,NET 4.5 in C#, MacDonald M. You Don't Know JS (Yet), Simpson K. Pro ASP.NET Core 6, Freeman A

Šifra predmeta: 08CITOS020102	**Naziv predmeta: Distribuirani računarski sistemi**		
Ciklus: II	**Godina: II**	**Semestar: I**	**Broj ECTS kredita: 6**
Status: Obavezan		**Ukupan broj kontakt sati: 90** Predavanja: 45 Vježbe: 30 Seminar: 15	
Učesnici u nastavi	**Nastavnici i saradnici izabrani na oblast kojoj predmet pripada/predmet**		
Preduslov za upis:	Nema		
Cilj (ciljevi) predmeta:	Usvajanje znanja o konceptu cloud računarstva, načinu funkcioniranja i pozitivnim stranama i problemima u korištenju ovog koncepta.		
Tematske jedinice:	• Uvod – pojam cloud računarstva, standardizacija • Arhitektura cloud računarstva • Modeli isporuke: SaaS, PaaS, IaaS • Javni, privatni, nacionalni i hibridni cloud koncepti • Infrastruktura cloud-a sa aspekta korisnika i provajdera • Pozitivni aspekti i problemi u korištenju cloud računarstva • Sigurnosni aspekti i zaštita privatnosti • Migracija sa klasičnog koncepta na cloud • Podatkovni centri • Planiranje kapaciteta		

	• Upravljanje kvalitetom usluga u cloud računarstvu • Napredne tehnologije i koncepti
Ishodi učenja:	Znanje: Studenti koji završe ovaj kolegij će steći znanja o osnovnim konceptima cloud računarstva i o tome kako su tehnike cloud računarstva implementirane u komercijalnim cloud sistemima. Vještine: Suradnju u učenju kroz rad u paru ili grupi, vještina prezentiranja, vještina istraživanja na zadanu temu. Kompetencije: Studenti koji završe ovaj kolegij steći će kompentacije koje se odnose na infrastrukturu koja je potrebna potrebna za realizaciju i korištenje cloud usluga, kako izgledaju i kako se realizuju usluge cloud računarstva sa korisničke i provajderske strane, sigurnosni mehanizmi, kao i ekonomski i tehnički aspekti korištenja cloud računarstva.
Cilj održivog razvoja (SDG):	SDG5 - Osigurati uključivo i kvalitetno obrazovanje, te promovirati mogućnosti cjeloživotnog učenja svih ljudi svih životnih dobi Podcilj 4.3. - Do kraja 2030. osigurati jednaku dostupnost jeftinog i kvalitetnog tehničkog, stručnog i tercijarnog obrazovanja, uključujući sveučilišno, za sve žene i muškarce
Metode izvođenja nastave:	Nastava se realizira kroz izvođenje predavanja, vježbi i praktičnog dijela nastave koja uključuje izradu projektnih zadataka. Predavanja se realizuju kroz usmeno izlaganje sa prezentacijom i prikazom primjera iz prakse. Inicira diskusija o različitim pitanjima i problemima iz softverskog inžinjeringa. Studenti će biti obavezni izraditi i prezentirati seminarske radove i/ili projektne zadatake. U realizaciji nastave se koriste različite metode koje uključuju: usmeno izlaganje i diskusije, demonstracije primjera, metoda grafičkih i video prikaza i potenciranje rada u grupama primjenom odgovarajućih metodoloških pristupa.
Metode provjere znanja sa strukturom ocjene:	Kriterijum vrednovanja rada i ocjenjivanja studenta u toku nastave, vrši se na sljedeći način: Individualna aktivnost (seminarski rad / projektni zadatak): od 0 do 10 bodova; Grupna aktivnost (seminarski rad / projektni zadatak): od 0 do 20 bodova; I test / I parcijalni ispit: od 0 do 35 bodova. Završni / popravni ispit uključuje gradivo koje student nije položio na parcijalnom ispitu što znači da obuhvata drugi dio gradiva (II parcijalni) koji se vrednuje sa 35 bodova ili se sastoji od kompletnog

	gradiva, tj. I i II parcijalnog ispita. Ukupno vrednovanje svih obaveza studenta u toku semestra, odnosno ocjena na ispitu zasnovana je na ukupnom broju bodova (%) koje je student stekao ispunjavanjem predispitnih obaveza, polaganjem parcijalnog i završnog ispita. Prema kvalitetu stečenih znanja i vještina student može steći maksimalno 100 bodova, a prema sljedećoj skali: Struktura bodovanja Bodovi (%) Individualni projekat/ Seminarski rad: 20 bodova (%) Grupni projekat: 10 bodova (%) I test (I parcijalni ispit): 35 bodova (%) Završni ili popravni ispit (II parc.ispit): 35 bodova (%) Potreban uslov za uspješno okončan ispit je postignut rezultat od 55 bodova pri čemu na sljedećim dijelovima treba ostvariti minimalno 50%, tj. da bi student položio ispit mora ostvariti sljedeće uslove: • I test / I provjera znanja / parcijalni ispit: 17,5 bodova • Završni ili popravni ispit (II parcijalni ispit): 17,5 bodova Studenti koji su položili parcijalni ispit, na završnom / popravnom ispitu polažu samo drugi dio gradiva (dio koji nije obuhvaćen parcijalnim ispitom). Studenti koji nisu položili parcijalni ispit, u okviru završnog / popravnog ispita polažu kompletno gradivo, pri čemu kriteriji za polaganje ispita ostaje identični. Završni / popravni ispit se organizuje kao pismeni i/ili usmeni. Aktivnost se može pratiti kroz izradu zadaće, seminarskih radova, projektnih zadataka ili polaganje kvizova. Konačan uspjeh studenta nakon svih predviđenih oblika provjere znanja, vrednuje se i ocjenjuje sistemom ocjenjivanja kako slijedi: a) 10 - izuzetan uspjeh bez grešaka ili sa neznatnim greškama, nosi 95-100 bodova; b) 9 - iznad prosjeka, sa ponekom greškom, nosi 85-94 bodova;

	c) 8 - prosječan, sa primjetnim greškama, nosi 75-84 bodova; d) 7 - općenito dobar, ali sa značajnijim nedostacima, nosi 65-74 bodova; e) 6 - zadovoljava minimalne uslove, nosi 55-64 bodova; f) 5 - ne zadovoljava minimalne uslove, manje od 55 bodova. Navedena skala se može korigovati prema Pravilima studiranja na Univerzitetu u Sarajevu (Član 45).
Literatura:	Obavezna: Nastavni materijal dostupan na nastavnom portalu Fakulteta za saobraćaj i komunikacije. Dopunska: T. ERL: Cloud Computing: Concepts, Technology & Architecture, Prentice Hall, Massachusetts, 2013. Dopunska: R. Rafaels: Cloud Computing: From Beginning to End, 2015., M. Cavis: Architecting the Cloud, Prentice-Hall, Wiley, 2014

Šifra predmeta: 09-10-1CITES020102	**Naziv predmeta: LOKACIJSKI I NAVIGACIJSKI SISTEMI**		
Ciklus: II	**Godina: I**	**Semestar: II**	**Broj ECTS kredita:** 6
Status: **Obavezni predmet za KT i PLT** **Izborni predmet za KiT**		**Ukupan broj kontakt sati: 90** Predavanja 45 Vježbe 30 Laboratorijske vježbe 15	
Učesnici u nastavi	**Nastavnici i saradnici izabrani na oblast kojoj predmet pripada/predmet**		
Preduslov za upis:	NE		
Cilj (ciljevi) predmeta:	Cilj kursa je da upozna studente sa razlozima pojavljivanja, razvojem, primjenom i značajem LCS i LBS servisa. Kurs će obuhvatiti tehnike pozicioniranja korisnika u mrežama namjenjenim za komunikaciju i u mrežama razvijenim isključivo za pozicioniranje, te tehnike pozicioniranja u indoor i outdoor sistemima.		
Tematske jedinice: *(po potrebi plan izvođenja po*	1. Nastanak i terminologija u lokacijskim i navigacijskim sistemima 2. Klasifikacija metoda pozicioniranja 3. Standardizacija LCS servisa		

sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)	4. Integrisane i samostalne metode pozicioniranja 5. Mobile based i network based metode pozicioniranja 6. Propagacija radio signala 7. Satelitske metode pozicioniranja 8. Metode pozicioniranja u ćelijskim radio sistemima 9. Indoor metode pozicioniranja (WLAN i Bluetooth) 10. Indoor metode pozicioniranja (Infrastrukturni sistemi, kamere, infracrvena tehnologija) 11. Algoritmi za određivanje lokacije korisnika 12. Pozicioniranje korisnika u LTE mrežama 13. Primjena lokacijskih i navigacijski sistema 14. Aspekti zaštite privatnosti i sigurnosti korisnika 15. Budućnosti LBS servisa. Korisnički zahtjevi i očekivanja.
Ishodi učenja:	**Znanje:** Studenti će steći teorijska i tehnička znanja o realizaciji lokacijskih i navigacijskih servisa. Upoznat će se s tehnologijama i matematičkim metodama korištenim za pozicioniranje korisnika u različitim sistemima. **Vještine:** Studenti će razviti sposobnost procjene tačnosti, troškova i izvodljivosti implementacije sistema za pozicioniranje i navigaciju. Moći će odabrati odgovarajuće metode pozicioniranja za specifična područja kroz komparativnu analizu. **Kompetencije:** Studenti će biti kompetentni za samostalno odabiranje, analiziranje i rješavanje problema vezanih za pozicioniranje korisnika u unutrašnjim i vanjskim prostorima. Također, bit će sposobni primijeniti mjere privatnosti i sigurnosti kako bi zaštitili podatke korisnika u servisima baziranim na lokaciji.
Cilj održivog razvoja (SDG):	SDG9 – Industrija, inovacije i infrastruktura SDG11 – Održivi gradovi i zajednice
Metode izvođenja nastave:	Nastava se realizira kroz izvođenje predavanja, vježbi, laboratorijskih vježbi/terenskog rada/prakse. Zastupljene su sljedeće metode: metoda usmenog izlaganja, metoda razgovora, metoda demonstracije, metoda grafičkog i softverskog prikaza, kao i metoda rada u skupini. Na predavanima se obrađuju teorijski koncepti i principi uz prikaz opisnih primjera i rješavanje određenih zadataka. Dodatni primjeri se razmatraju i rješavaju kroz vježbe i rad u odgovarajućim softverskim alatima, laboratorijske vježbe/terenski rad/praksu, što omogućava kontinuiran rad i pripremu za samostalno rješavanje problema. Na laboratorijskim vježbama/terenskom radu/praksi razvijat će se

	vještine potrebne za individualni i timski rad u cilju izvršavanja zadataka iz zadane oblasti.
Metode provjere znanja sa strukturom ocjene:	Ocjena kreativnosti na nastavi i vježbama uz izradu samostalnih radova, ocjena parcijalnog testa u toku nastave kao i ocjena završnog ispita. Kriterijum praćenja rada i ocjenjivanja studenta u toku nastave i to prema sljedećem načinu: – Domaća zadaća/seminarski rad/praktični rad/ 15 bodova (%), položeno ako se osvoji preko 50 %. – I Parcijalni ispit/test/provjera znanja/35 bodova (%), položen je ako se osvoji preko 50 %. – Završni ispit (II Parcijalni) 50 bodova (%), položeno ako se osvoji preko 50 %. Ukupan broj bodova (%) koji student prema navedenom praćenju u toku nastave može ostvariti iznosi maksimalno 50 bodova (%), što sa Završnim (II parcijalnim) čini 100 bodova (%). Za studente koji nisu položili I Parcijalni ispit ili Završni ispit se organizuje iz popravni ispit na kojem je potrebno položiti oba dijela ispita sa ostvarenih najmanje 50% bodova. Konačan uspjeh studenta nakon svih predviđenih oblika provjere znanja, vrednuje se i ocjenjuje sistemom ocjenjivanja kako slijedi: a) 10 (A) - izuzetan uspjeh bez grešaka ili sa neznatnim greškama, nosi 95-100 bodova; b) 9 (B) - iznad prosjeka, sa ponekom greškom, nosi 85-94 bodova; c) 8 (C) - prosječan, sa primjetnim greškama, nosi 75-84 bodova; d) 7 (D) - općenito dobar, ali sa značajnijim nedostacima, nosi 65-74 bodova; e) 6 (E) - zadovoljava minimalne uslove, nosi 55-64 bodova; f) 5 (F, FX) - ne zadovoljava minimalne uslove, manje od 55 bodova. Ukupno vrednovanje svih obaveza studenta u toku semestra, odnosno ocjena na ispitu zasnovana je na ukupnom broju bodova (%) koje je student stekao ispunjavanjem predispitnih obaveza i polaganjem parcijalnog i završnog ispita, a prema kvalitetu stečenih znanja i vještina, i sadrži maksimalno 100 bodova, te se utvrđuje prema sljedećoj skali:

	Obaveze studenta Bodovi (%) Prisutnost na predavanjima i vježbama. - Zadaća/Seminarski/Praksa/.....15 bodova (%) I Parcijalni ispit/Test/Provjera znanja/.....35 bodova (%) Završni ispit (II Parcijalni) .....50 bodova (%)
Literatura:	Obavezna: Nastavni materijal dostupan na web stranici Fakulteta za saobraćaj i komunikacije. Dopunska: 1. A. BENSKY: Wireless Positioning Technologies and Applications, Artech House, 2008. 2. R. MAUTZ: Indoor Positioning Technologies, Školska knjiga, Cirih, 2012. 3. J. FIGUEIRAS, S. FRATTASI: Mobile Positioning and Tracking, Wiley, 2010. 4. A. TANENBAUM, D. WETHERALL: Računarske mreže, Prevod petog izdanja, Mikro knjiga, 2012.

Šifra predmeta: 09-10-2CITES020102	**Naziv predmeta:** INFORMACIJSKI SISTEMI MREŽNIH OPERATERA		
Ciklus: II	**Godina: 1**	**Semestar: 2**	**Broj ECTS kredita:** 6
Status: Izborni		**Ukupan broj sati: 90** Predavanja: 45 Vježbe: 30 Seminari i projektni zadaci: 15	
Učesnici u nastavi	**Nastavnici i saradnici izabrani na oblast kojoj predmet pripada/predmet**		
Preduslov za upis:	NE		
Cilj (ciljevi) predmeta:	Upoznavanje sa principima, alatima i metodologijama projektovanja i razvoja informacijskih sistema sa fokusom na sisteme koji se primjenjuju kod mrežnih operatera.		
Tematske jedinice:	– Upoznavanje sa osnovnim konceptima razvoja informacijskih sistema – Vrste informacionih sistema i njihova primjena kod mrežnih operatera – Modeliranje i projektovanje informacijskih sistema – Zahtjevi za informacijskim sistemima: prikupljanje i analiza zahtjeva (Use Case; UML)		

	– CASE alati za planiranje, projektovanje, konstrukciju i dokumentovanje – Alati za podršku timskog rada i praćenja napretka projekta – Modeli razvoja informacijskih sistema: modeli bazirani na vodopadu, iterativni i inkrementalni modeli, Bemov spiralni model – Modeli razvoja informacijskih sistema bazirani na prototipovima – Agilne metode razvoja: SCRUM, XP, FDD, DSDM, Kristal, ASD – Modeliranje i reinženjering procesa: Workflow, blueprint, gantogrami i DFD dijagrami – Upravljanje IT servisima i ITIL – Koncepti servisno-orijentisane arhitekture (SOA) – ERP sistemi i njihova primjena u saobraćaju i komunikacijama
Ishodi učenja:	**Znanje:** Studenti će steći znanja i vještine potrebne za planiranje, modeliranje i projektovanje informacijskih sistema. Također, studenti će se upoznati sa nekim od najkorištenijih metodologija sa fokusom na agilne pristupe kao što je SCRUM i alatima za modeliranje i reinžinjering procesa. **Vještine:** Očekuje se da studenti ovladaju vještinama i CASE alatima koji se koriste kod projektovanja i razvoja informacijskih sistema. **Kompetencije:** Stećena znanja i vještine će omogućiti studentima da budu osposobljeni da učestvuju u razvojnim timovima koji se bave planiranjem, projektovanjem i razvojem informacijskih sistema uz primjenu odgovarajućih metodoloških pristupa i CASE alata.
Ciljevi održivog razvoja (SDG)	SDG9 – Industrija, inovacije i infrastruktura SDG11 – Održivi gradovi i zajednice
Metode izvođenja nastave:	Nastava se realizira kroz izvođenje predavanja, vježbi i praktičnog dijela nastave koja uključuje izradu projektnih zadataka. Predavanja se realizuju kroz usmeno izlaganje sa prezentacijom i prikazom primjera iz prakse. Inicira diskusija o problemima planiranja, modeliranja i analize informacijskih sistema. Studenti će biti obavezni izraditi i prezentirati seminarske radove i/ili projektne zadatake. U realizaciji nastave se koriste različite metode koje uključuju: usmeno izlaganje i diskusije, demonstracije primjera, metoda grafičkih i video prikaza i potenciranje rada u grupama primjenom odgovarajućih metodoloških pristupa.
Metode provjere znanja sa strukturom ocjene:	Vrednovanja rada i ocjenjivanje studenta u toku nastave vrši se na sljedeći način: Aktivnost (seminarski rad i aktivnosti na nastavi): od 0 do 20 bodova; Parcijalni ispit: od 0 do 30 bodova. Ukupan broj bodova

	koji studenta može ostvariti u toku nastave može iznosi maksimalno 50 bodova. Završni / popravni ispit uključuje gradivo koje student nije položio na parcijalnom ispitu, a koji se vrednuje sa 50 bodova. Ako student nije položio parcijalni ispit, na završnom ispitu posebno polaže gradivo sa parcijalnog ispita. Prema kvalitetu stečenih znanja i vještina student može osvojiti maksimalno 100 bodova, a prema sljedećoj skali: Struktura bodovanja Bodovi (%) Aktivnosti u toku nastave:..... 20 bodova (%) Parcijalni ispit:..... 30 bodova (%) Završni / popravni ispit:..... 50 bodova (%) Ukupno vrednovanje studenta i formiranje ocjene je zasnovano na ukupnom broju bodova (%) koje je student stekao ispunjavanjem ispitnih obaveza i posebnih kriterija. Potreban uslov za uspješno okončan ispit je postignut rezultat od 55 bodova pri čemu na svakom dijelu ispita treba ostvariti minimalno 55% (parcijalni ispit, završni/popravni ispit). Završni/popravni ispit se organizuje kao pismeni i/ili usmeni. Aktivnost se može vrednovati kroz izradu zadaće, seminarskih radova, polaganje kvizova i aktivnosti na nastavi. Student je obavezan prisustvovati nastavi u skladu sa Pravilima studiranja. Konačan uspjeh studenta nakon svih predviđenih oblika provjere znanja, vrednuje se i ocjenjuje sistemom ocjenjivanja kako slijedi: a) 10 - izuzetan uspjeh bez grešaka ili sa neznatnim greškama, nosi 95-100 bodova; b) 9 - iznad prosjeka, sa ponekom greškom, nosi 85-94 bodova; c) 8 - prosječan, sa primjetnim greškama, nosi 75-84 bodova; d) 7 - općenito dobar, ali sa značajnijim nedostacima, nosi 65-74 bodova; e) 6 - zadovoljava minimalne uslove, nosi 55-64 bodova; f) 5 - ne zadovoljava minimalne uslove, manje od 55 bodova.
Literatura:	Obavezna: – A. Čolaković, „*Informacijski sistemi mrežnih operatera (SKRIPTA),"* Fakultet za saobraćaj i komunikacije, Sarajevo, 2021.

	Dopunska: – Andrew Stellman, Jennifer Greene, "Learning Agile: Understanding Scrum, XP, Lean, and Kanban," O'Reilly Media, 2014. – Klaus-Dieter Gronwald, "Integrated Business Information Systems: A Holistic View of the Linked Business Process Chain ERP-SCM-CRM-BI-Big Data," Springer-Verlag Berlin Heidelberg, 2017. – Avraham Shtub, Reuven Karni, "ERP: The Dynamics of Supply Chain and Process Management," Springer US, 2010. – Ralph Kimball, Margy Ross, "The Data Warehouse Toolkit: The Complete Guide to Dimensional Modeling," Wiley, 2002. – Ralph M. Stair, George W. Reynolds, „Fundamentals of Information Systems," Cengage Learning, 2016. – Anita Pickerden, „Planning and Managing your Work Based Projects," bookboon.com, 2015. – Richard T. Watson (editor), „Information Systems," Global Text Project (Creative Commons Attribution 3.0 License), 2017, – Patricia Wallace, „Introduction to Information Systems," Pearson Education, 2015. – Alan Dennis, Barbara Haley Wixom, Roberta M. Roth, „Systems analysis and design," Wiley, 2015. – Arthur M. Langer, „Analysis and Design of Information Systems, Springer-Verlag," 2008.

Šifra predmeta: 09-10-3CITES020102	**Naziv predmeta: Multimedijske komunikacije i usluge**		
Ciklus: II (drugi)	**Godina: I (prva)**	**Semestar: II (drugi)**	**Broj ECTS kredita:** 6
Status: Izborni predmet		**Ukupan broj kontakt sati: 45 P+45 V** Predavanja – 45 sati Vježbe – 45 sati	
Učesnici u nastavi	**Nastavnici i saradnici izabrani na oblast kojoj predmet pripada/predmet**		
Preduslov za upis:	Ne		
Cilj (ciljevi) predmeta:	Cilj predmeta je omogućiti studentima razumijevanje i primjenu tehnika obrade, kodiranja i distribucije multimedijskih signala te upoznati ih sa infrastrukturom potrebnom za prijenos multimedijskih usluga.		
Tematske jedinice: *(po potrebi plan izvođenja po*	**Uvod:** • Pojam, izvori i vrste multimedije.		

sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)	• **I sedmica** **Podjela i osnove multimedije:** • Osnove multimedije, osnove kodiranja, postupci kreiranja i izvođenja multimedijskih sadržaja. • **Planirano vrijeme: II-III sedmica** **Formati i multimedijske komponente:** • Svojstva i kompresija teksta. • Svojstva i kompresija zvuka i videa. • Digitalna obrada slike. • **Planirano vrijeme: IV-VI sedmica** **Multimedijske usluge:** • Osnovne kategorije i vrste multimedijskih usluga. • Primjeri multimedijskih usluga kao što su videokonferencije, IPTV, internet bazirane multimedijske usluge, WebRTC. • **Planirano vrijeme: VII-VIII sedmica** **Interaktivni multimedijski sadržaji:** • Uvod u alate i tehnike za kreiranje interaktivnih multimedijskih sadržaja, uključujući interaktivne web stranice, animacije, i igre. • **Planirano vrijeme: IX sedmica** **Protokoli za multimediju:** • Pregled protokola relevantnih za implementaciju multimedijskih usluga. • **Planirano vrijeme: X-XI sedmica** **Načini pohrane, prijenosa, obrade i prikaza multimedijskih podataka:** • Pregled različitih metoda za pohranu, prijenos i obradu multimedijskih podataka. • **Planirano vrijeme: XII-XIII sedmica** **UX/UI dizajn za multimedijske aplikacije:** • Osnove dizajna korisničkog iskustva (UX) i korisničkog interfejsa (UI) u multimedijskim aplikacijama.

	• **Planirano vrijeme: XIV sedmica** **Programski alati za multimediju:** • Pregled programskih alata i projekti koji koriste te alate. • Multimedija u virtualnoj stvarnosti (VR). • **Planirano vrijeme: XV sedmica**
Ishodi učenja:	**Znanje:** Student stječe temeljna znanja o multimedijskim signalima, formatima i protokolima, kao i o tehnologijama za njihovu obradu, kompresiju i prijenos. Također, upoznaje se s osnovnim konceptima digitalnih medija, uključujući audio, video i tekstualne podatke, te njihovom integracijom u multimedijske sisteme. **Vještine:** Razvijanje praktičnih vještina u kodiranju i kompresiji različitih tipova multimedijskih signala, uključujući zvuk, sliku i video. Student se osposobljava za korištenje specifičnih softverskih alata i algoritama za obradu multimedijskih podataka te njihovu optimizaciju za različite platforme i medije. **Kompetencije:** Kompetencije za primjenu stečenih znanja u dizajnu, implementaciji i evaluaciji multimedijskih komunikacijskih sistema. Student je sposoban analizirati zahtjeve za prijenos i pohranu multimedijskih podataka te razviti rješenja koja zadovoljavaju tehničke i korisničke potrebe u kontekstu multimedijskih usluga i aplikacija.
Cilj održivog razvoja (SDG):	**SDG4 – Kvalitetno obrazovanje:** Predmet "Multimedijske komunikacije i usluge" doprinosi osiguravanju inkluzivnog i kvalitetnog obrazovanja kroz stjecanje tehničkih vještina i znanja potrebnih za razvoj i primjenu multimedijalnih tehnologija, što omogućava studentima bolje prilike za zapošljavanje. **SDG9 – Industrija, inovacije i infrastruktura:** Predmet "Multimedijske komunikacije i usluge" osposobljava studente za sudjelovanje u izgradnji moderne i inovativne infrastrukture kroz primjenu naprednih multimedijskih tehnologija, potičući tako održivu

	industrijalizaciju i tehnološke inovacije. **SDG11 – Održivi gradovi i zajednice:** Kroz predmet "Multimedijske komunikacije i usluge", studenti stječu vještine potrebne za razvoj i primjenu multimedijalnih rješenja koja mogu doprinijeti stvaranju pametnih gradova i održivih zajednica, omogućujući bolju povezanost i upravljanje urbanim resursima. **SDG12 – Održiva potrošnja i proizvodnja:** Predmet "Multimedijske komunikacije i usluge" potiče studente na usvajanje tehnologija koje omogućavaju efikasnu obradu i prijenos multimedijskih podataka, čime se doprinosi smanjenju resursne potrošnje i optimizaciji proizvodnih procesa.
Metode izvođenja nastave:	Predavanja: Fokusirana na teorijske aspekte multimedijskih komunikacija i usluga, uključujući primjere i analizu najnovijih istraživanja i tehnologija. Laboratorijske vježbe: Praktične vježbe usmjerene na razvoj vještina u obradi, kompresiji i prijenosu multimedijskih signala. Seminari: Studenti istražuju specifične teme vezane za multimedijske komunikacije i pripremaju seminarske radove koje prezentiraju pred grupom. Praktični projekti: Studenti rade na praktičnim projektima koji uključuju dizajn i implementaciju multimedijskih komunikacijskih sistema, uključujući korištenje relevantnih softverskih alata.
Metode provjere znanja sa strukturom ocjene:	Testovi: 0-10% Seminarski radovi: 0-20% Parcijalni ispit: 0-35% Završni ispit: 0-35% Konačna ocjena (Ukupno): 100%
Literatura:	Obavezna: Bilješke sa predavanja te, 1. Kontrola kvaliteta komunikacijskih usluga, Nermin Goran, Alem Čolaković, Sarajevo, 2024. 2. Multimedija i kodiranje, Jasmina Baraković Husić, Enisa Brka,

	Mesud Hadžialić, Mirko Škrbić, Sarajevo, 2014. 3. Multimedijske komunikacije: Aplikacije, middleware, mreže, Zoran S. Bojkovic, Dragorad A. Milovanovic, Branko M. Vucetic, CET, Beograd, 2008. 4. Osnove multimedijalnih sistema Dragan Milovanović, Akademska misao, Beograd, 2009. 5. Kompresija i prijenos multimedijskih podataka, Miloš Savić. Univerzitet u Novom Sadu, 2012. Dopunska: 1. Digital Multimedia: Concepts, Methodologies, Tools, and Applications, Information Resources Management Association (IRMA), IGI Global, 2020. 2. Multimedia Foundations: Core Concepts for Digital Design, Vic Costello, Susan Weinschenk, Focal Press, 2016. 3. Multimedia Processing, Communication and Computing Applications, Sudeep Tanwar, Anup Kumar, N. S. Chaudhari, Springer, 2019.

Šifra predmeta: 09-10-4CITES020102	**Naziv predmeta: Informacione tehnologije i špeditersko poslovanje**		
Ciklus: II	**Godina: I**	**Semestar: II**	**Broj ECTS kredita:** 6
Status: Obavezan predmet		**Ukupan broj kontakt sati: 90** Opciono razraditi distribuciju sati po tipu: Predavanja: 45 Vježbe:30 Seminarski i projektni zadatak: 15	
Učesnici u nastavi	**Nastavnici i saradnici izabrani na oblast kojoj predmet pripada/predmet**		
Preduslov za upis:	NE		
Cilj (ciljevi) predmeta:	Upoznavanje sa savremenim informacionim i komunikacijskim tehnologijama koje se primjenjuju u oblasti logističke špedicije, specifičnim softverskim alatima, te metodama i efektima njihove		

	primjene.
Tematske jedinice: *(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)*	1. Uvod 2. Identifikacija tehnoloških procesa logističke špedicije 3. Identifikacija ključnih interesnih skupina u logističkom špediterskom lancu 4. Teoretske postavke aktuelnih informacionih tehnoloških rješenja koje se primjenjuju u oblasti špedicije 5. Značaj i mogućnosti primjene aplikativnih softvera u upravljanju sistema logističke špedicije i implementacija najboljih praksi 6. Metodološki pristupi u projektovanju informaciono-tehnoloških rješenja u logističkoj špediciji 7. CRM (Customer Relationship Management) u logističko špediterskim kompanijama 8. Planiranje i optimiziranje špediterske usluge- maksimiziranje korisnosti i snižavanje troškova procesa narudžbi, bukiranja i otpreme robe 9. Upravljanje procesima uvoza, izvoza i globalne vanjsko-trgovinske razmjene (harmonizirane tarife, ugovori o vanjskoj trgovini, INCOTERMS) 10. Softverske aplikacije za Business-to-Bussiness SCM (Supply Chain Management) 11. Softverske aplikacije za upravljanje carinskim procedurama bazirane na EU legislativi 12. Softverske aplikacije za upravljanje poslovima skladištenja 13. Softverske aplikacije za upravljanje transportnim lancem 14. Web aplikacije i on-line usluge za vanjskotrgovinsku usklađenost, tarifske klasifikacije, uvozno-izvoznu dokumentaciju, elektronsko izvještavanje, verifikacija 15. Povezivanje segmentiranih softverskih aplikacija u holistički logističko-špediterski informacioni sistem (End-to-End Management)
Ishodi učenja:	Znanje: Studenti kroz nastavni proces predavanja, vježbe, laboratorijske

	vježbe i praktičan rad trebaju steći odgovarajuća znanja i vještine za praktičnu primjenu kroz: razvoj IT i evaluaciju efekata njihove primjene u logističkoj špediciji, te samostalnu formulaciju ciljeva istraživanja i primjenu odgovarajućih metoda i modela za njihovu realizaciju Vještine: Sistemski pristup u projektovanju IT poslovnih procesa logističke špedicije i razumijevanje algoritama kao osnove špediterskih softverskih rješenja; identifikaciju i korištenje relevantnih informacionih tehnoloških rješenja iz područja logističke špedicije, kritičku analizu, procjenu i sintezu raspoloživih znanja; razvoj i primjenu špediterskih softverskih upravljačkih modela, te prezentaciju stečenih znanja stručnoj i naučnoj javnosti.planira, upravlja i kontroliše realizaciju različitih tipova projekta u poslovnim sistemima. Kompetencije: Aplikaciju stečenih znanja u konkretnim modelima
Cilj održivog razvoja (SDG):	SDG 4: Kvalitetno obrazovanje - Osigurati uključivo i kvalitetno obrazovanje, te promovisati mogućnosti cjeloživotnog učenja za sve, SDG 8: Dostojanstven rad i ekonomski rast - Promovisati održivi, uključivi i održivi ekonomski rast, zapošljavanje i dostojanstven rad za sve, SDG 9: Industrija, inovacije i infrastruktura - Izgraditi otpornu infrastrukturu, promovirati uključivu i održivu industrializaciju i poticati inovacije, SDG 12: Odgovorna potrošnja i proizvodnja - Osigurati održive obrasce potrošnje i proizvodnje, SDG 16: Mir, pravda i snažne institucije - Promovisati mirne i uključive društva za održivi razvoj, osigurati pristup pravdi za sve i izgraditi efikasne, odgovorne i uključive institucije na svim nivoima
Metode izvođenja nastave:	Tokom izvođenja programa nastavnik izlaže pojedine tematske jedinice (ex katedra), omogućava studentima praćenje video zapisa sa edukativnim sadržajem (DVD, video prezentacije) iz predmetne oblasti i organizuje diskusije na zadanu temu (interaktivna nastava). U okviru vježbi provodi se razmatranje i rješavanje primjera i zadataka sukladno teoretskoj tematici, pomaže se studentima u samostalnom rješavanju zadataka, u izradi programa, projekata i seminarskih radova.

Metode provjere znanja sa strukturom ocjene:	Kriterijum vrednovanja rada i ocjenjivanja studenta u toku nastave, vrši se na sljedeći način: Seminarski rad / projektni zadatak: od 0 do 15 bodova, položeno ako se osvoji preko 50% I test / I provjera znanja / I parcijalni ispit: od 0 do 35 bodova, položeno ako se osvoji preko 50% Završni ispit – pismeni 20 bodova Završni ispit – usmeni 30 bodova Završni ispit (Inegralni) – pismeni - 40 bodova Završni ispit (Inegralni) – usmeni – 45 bodova Da bi student položio ispit mora položiti usmeni dio ispita. Ukupan broj bodova koji studenta može ostvariti u toku nastave može iznosi maksimalno 50 bodova. Završni ispit uključuje gradivo koje student nije položio na parcijalnom ispitu što znači da obuhvata drugi dio gradiva (II parcijalni) koji se vrednuje sa 50 bodova ili se sastoji od kompletnog gradiva, tj. I i II parcijalnog ispita. Ukupno vrednovanje svih obaveza studenta u toku semestra, odnosno ocjena na ispitu zasnovana je na ukupnom broju bodova (%) koje je student stekao ispunjavanjem predispitnih obaveza, polaganjem parcijalnog i završnog ispita. Prema kvalitetu stečenih znanja i vještina student može osvojiti maksimalno 100 bodova, a prema sljedećoj skali: Struktura bodovanja Bodovi (%) Seminarski / Projektni zadatak:..... 15 bodova (%) I test / I provjera znanja (I parcijalni ispit):.....35 bodova (%) Završni (II parcijalni ispit):.....50 bodova (%) Potreban uslov za uspješno okončan ispit je postignut rezultat od 55 bodova pri čemu na svakom dijelu ispita treba ostvariti minimalno 50% (aktivnost, parcijalni ispit, završni ispit-pismeni), tj. da bi student položio ispit mora ostvariti sljedeće uslove:

	- Aktivnost (seminarski rad / projektni zadatak): 7,5 bodova - I test / I provjera znanja / parcijalni ispit: 17,5 bodova - Završni ispit (II parcijalni ispit) – pismeni dio: 10 bodova Studenti koji su položili parcijalni ispit, na završnom ispitu polažu samo drugi dio gradiva (dio koji nije obuhvaćen parcijalnim ispitom). Studenti koji nisu položili parcijalni ispit, u okviru završnog ispita polažu kompletno gradivo, pri čemu kriteriji za polaganje ispita ostaje identični. Završni ispit se organizuje kao pismeni i/ili usmeni. Aktivnost se može pratiti kroz izradu zadaće, seminarskih radova, projektnih zadataka ili polaganje kvizova. Napomena: Studenti su obavezni prisustvovati svim oblicima nastave minimalno 80 % od ukupnog fonda sati i prisustvo na nastavi je uslov za ovjeru urednog pohađanja nastave. Student može, u opravdanim slučajevima (bolest) odsustvovati sa nastave, za što je obavezan dostaviti zdrastveno opravdanje. Seminarski rad i domaća zadaća će biti bodovane samo ako budu predane prema definisanim terminima. Naknadne predaje istih neće se bodovati. Konačan uspjeh studenta nakon svih predviđenih oblika provjere znanja, vrednuje se i ocjenjuje sistemom ocjenjivanja kako slijedi: a) 10 - izuzetan uspjeh bez grešaka ili sa neznatnim greškama, nosi 95-100 bodova; b) 9 - iznad prosjeka, sa ponekom greškom, nosi 85-94 bodova; c) 8 - prosječan, sa primjetnim greškama, nosi 75-84 bodova; d) 7 - općenito dobar, ali sa značajnijim nedostacima, nosi 65-74 bodova; e) 6 - zadovoljava minimalne uslove, nosi 55-64 bodova; f) 5 - ne zadovoljava minimalne uslove, manje od 55 bodova
Literatura:	Obavezna:

	1. R. Zelenika: Logistička špedicija, Ekonomski fakultet, Zagreb, 2000. 2. Zelenika, R.: Logistički sustavi, Ekonomski fakultet u Rijeci, 2005.; 3. Gordana M. Radivojević, Upravljanje informacijama u logistici. Beograd 2023. 4. Ivanković, Č.: Špedicija i logistika, Fakultet prometnih znanosti, Zagreb, 2005. 5. R. Zelenika: Međunarodna špedicija, Ekonomski fakultet, Zagreb, 1996. 6. Deljanin: Logistika u saobraćaju i komunikacijama, Skripta, FSK, 2013. 7. Deljanin: Logistički sistemi, Skripta, FSK, 2014. Dopunska: 1. Andrijanić I., Aržek Z., Prebežac D., Zelenika R., Transportno i špeditersko poslovanje, Zagreb, 2001. 2. Z. Aržek, G. Badovinac: Transport i osiguranje, Izdavačko-instruktivni biro, Zagreb, 1986. 3. J. Mađarić: Međunarodna špedicija, Fakultet prometnih znanosti, Zagreb, 1991. 4. Grabovac: Odgovornost poduzetnika multimodalnog prijevoza stvari, Prometni fakultet, Split, 1986. 5. Shipping and logistics management, Y H V Lun; Kee-hung Lai; T C E Cheng Publisher: New York; London : Springer, 2010. 6. International logistics supply chain outsourcing: from local to global, Alan Rushton; Steve WalkerPublisher:London : Kogan Page, 2007. 7. Transportation Management with SAP TM, Bernd Lauterbach, Stefan Sauer, Jens Kappauf, Jens Gottlieb, Dominik Metzger, Christopher Sürie, 2nd, updated and revised edition 2016. 8. Warehouse Management with SAP EWM, Balaji Kannapan, Hari Tripathy, Vinay Krishna, 2nd, updated and revised edition 2016. ČASOPISI – International Journal of Phisical Distribution, – Computers and Operation Research – International Journal of Information Management – European Journal of Operational Research – Journal of Bussines Logistics

Šifra predmeta: 11CITOS020203	**Naziv predmeta: Testiranje softvera i upravljanje kvalitetom**		
Ciklus: II	**Godina: I**	**Semestar: II**	**Broj ECTS kredita: 6**

Status: Obavezan predmet	**Ukupan broj kontakt sati: 90** Predavanja: 45 Vježbe: 30 Seminar: 15
Učesnici u nastavi	**Nastavnici i saradnici izabrani na oblast kojoj predmet pripada/predmet**
Preduslov za upis:	Ne
Cilj (ciljevi) predmeta:	Usvajanje znanja o konceptima upravljanja kvalitetom softvera i softverskih rješenja, kao i usvajanje vještina potrebnih za praktičnu analizu kvaliteta softvera i primjenu tehnika i mjera za testiranje softvera.
Tematske jedinice:	• Osnovni pojmovi i terminologija • Parametri kvaliteta programskih rješenja • Procesi upravljanja kvalitetom • Sigurnost i pouzdanost • Verifikacija i validacija • Tehnike za upravljanje kvalitetom • Analiza grešaka - defekta (error, fault, failure, mistake) • Mjerenje kvaliteta programskih rješenja • Osnove testiranja softvera • Ključni koncepti testiranja • Tehnike testiranja • Upravljanje procesom testiranja • Evaluacija testiranih rješenja • Upravljanje dokumentacijom
Ishodi učenja:	Znanje: Demonstrate advanced knowledge and skills in software quality management. Principles of software testing from the aspect of quality and the ability to analyze problems, identify and define requirements for quality software. Vještine: Primjena odgovarajućih metoda i alata u utvrđivanju uzroka problema i otklanjanje grešaka u softverskim rješenjima. Učestvovati kao pojedinac ili član tima u kreiranju i nadgledanju razvoja kvalitetnih softverskih sistem. Poznavanje tehnika za testiranje softvera, njihovu evaluaciju i upravljanje procesom testiranja. Kompetencije: Samostalno razumijevanja i interpretacija razlličitih pitanja i problema iz domena upravljanja kvalitetom softvera. Razlikovati i porediti principa testiranja softvera u različitim

	softverskim projektima.
Cilj održivog razvoja (SDG):	SDG5 - Osigurati uključivo i kvalitetno obrazovanje, te promovirati mogućnosti cjeloživotnog učenja svih ljudi svih životnih dobi Podcilj 4.3. - Do kraja 2030. osigurati jednaku dostupnost jeftinog i kvalitetnog tehničkog, stručnog i tercijarnog obrazovanja, uključujući sveučilišno, za sve žene i muškarce
Metode izvođenja nastave:	Nastava se realizira kroz izvođenje predavanja, vježbi i praktičnog dijela nastave koja uključuje izradu projektnih zadataka. Predavanja se realizuju kroz usmeno izlaganje sa prezentacijom i prikazom primjera iz prakse. Inicira diskusija o različitim pitanjima i problemima iz softverskog inžinjeringa. Studenti će biti obavezni izraditi i prezentirati seminarske radove i/ili projektne zadatake. U realizaciji nastave se koriste različite metode koje uključuju: usmeno izlaganje i diskusije, demonstracije primjera, metoda grafičkih i video prikaza i potenciranje rada u grupama primjenom odgovarajućih metodoloških pristupa.
Metode provjere znanja sa strukturom ocjene:	Kriterijum vrednovanja rada i ocjenjivanja studenta u toku nastave, vrši se na sljedeći način: Individualna aktivnost (seminarski rad / projektni zadatak): od 0 do 10 bodova; Grupna aktivnost (seminarski rad / projektni zadatak): od 0 do 20 bodova; I test / I parcijalni ispit: od 0 do 35 bodova. Završni / popravni ispit uključuje gradivo koje student nije položio na parcijalnom ispitu što znači da obuhvata drugi dio gradiva (II parcijalni) koji se vrednuje sa 35 bodova ili se sastoji od kompletnog gradiva, tj. I i II parcijalnog ispita. Ukupno vrednovanje svih obaveza studenta u toku semestra, odnosno ocjena na ispitu zasnovana je na ukupnom broju bodova (%) koje je student stekao ispunjavanjem predispitnih obaveza, polaganjem parcijalnog i završnog ispita. Prema kvalitetu stečenih znanja i vještina student može steći maksimalno 100 bodova, a prema sljedećoj skali: Struktura bodovanja Bodovi (%) Individualni projekat/ Seminarski rad: 10 bodova (%) Grupni projekat: 20 bodova (%) I test (I parcijalni ispit): 35 bodova (%)

	Završni ili popravni ispit (II parc.ispit): 35 bodova (%) Potreban uslov za uspješno okončan ispit je postignut rezultat od 55 bodova pri čemu na sljedećim dijelovima treba ostvariti minimalno 50%, tj. da bi student položio ispit mora ostvariti sljedeće uslove: • I test / I provjera znanja / parcijalni ispit: 17,5 bodova • Završni ili popravni ispit (II parcijalni ispit): 17,5 bodova Studenti koji su položili parcijalni ispit, na završnom / popravnom ispitu polažu samo drugi dio gradiva (dio koji nije obuhvaćen parcijalnim ispitom). Studenti koji nisu položili parcijalni ispit, u okviru završnog / popravnog ispita polažu kompletno gradivo, pri čemu kriteriji za polaganje ispita ostaje identični. Završni / popravni ispit se organizuje kao pismeni i/ili usmeni. Aktivnost se može pratiti kroz izradu zadaće, seminarskih radova, projektnih zadataka ili polaganje kvizova. Konačan uspjeh studenta nakon svih predviđenih oblika provjere znanja, vrednuje se i ocjenjuje sistemom ocjenjivanja kako slijedi: a) 10 - izuzetan uspjeh bez grešaka ili sa neznatnim greškama, nosi 95-100 bodova; b) 9 - iznad prosjeka, sa ponekom greškom, nosi 85-94 bodova; c) 8 - prosječan, sa primjetnim greškama, nosi 75-84 bodova; d) 7 - općenito dobar, ali sa značajnijim nedostacima, nosi 65-74 bodova; e) 6 - zadovoljava minimalne uslove, nosi 55-64 bodova; f) 5 - ne zadovoljava minimalne uslove, manje od 55 bodova. Navedena skala se može korigovati prema Pravilima studiranja na Univerzitetu u Sarajevu (Član 45).
Literatura:	Obavezna: Nastavni materijal dostupan na nastavnom portalu Fakulteta za saobraćaj i komunikacije. Bakir Karahodža, Metode i procesi softverskog inžinjeringa, FSK

	Sarajevo, 2023. Dopunska: 1. P. Ammann and J. Offutt. Introduction to Software Testing. Cambridge University Press, 2008. 2. Daniel Galin, Software Quality Assurance, Pearson Addison Wesley, Harlow, 2004. 3. G. Gordon Schulmeyer, Handbook of Software Quality Assurance, Artech House, 2007.

Šifra predmeta: 12CITOS020203	**Naziv predmeta: Napredne baze podataka**		
Ciklus: II	**Godina: II**	**Semestar: III**	**Broj ECTS kredita:** 6
Status: Obavezni		**Ukupan broj kontakt sati: 90** Predavanja 3 sedmično - ukupno 45, Vježbe 3 sedmično - ukupno 45	
Učesnici u nastavi	**Nastavnici i saradnici izabrani na oblast kojoj predmet pripada/predmet**		
Preduslov za upis:	Ne		
Cilj (ciljevi) predmeta:	Upoznavanje sa naprednim konceptima baza podataka, administracije sitema za upravljanje bazama podataka te vrstama naprednih baza podataka		
Tematske jedinice: *(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)*	1. Napredne mogućnosti SQL a. Rad sa skriptama i upravljanje greškama b. Triggeri c. Kursori d. CTE e. Nedostaci i izazovi relacionog modela f. Indeksi 2. Transakcije. Pogreške i oporavak. 3. Sigurnost u bazama podataka 1. Nalozi za prijavu 2. Korisnički računi 3. Uloge 4. Kriptografija 5. Transparentno šifriranje podatka 6. Uvijek šifirani podaci 7. Dinamičko maskiranje podataka		

	4. Administracija DBMS 5. Tehnologije visoke dostupnosti 1. Replikacije 2. Mirroring baze podataka 3. AlwaysOn rješenja 6. NoSQL baze podataka 1. Osobine NoSQL baza podataka 2. Vrste NoSQL baza podataka 1. Key/Value baze podataka 2. Dokument - baze podataka 3. Kolonski orijentisane baze 4. Graf-baze podataka 3. Prednosti i nedostaci NoSQL baza podataka 7. Skladišta podataka 1. OLAP 2. Višedimenzionalni modeli 3. Arhitektura 4. Implementacija 5. Efikasnost 8. Vremenske baze podataka 9. Geoprostorne baze podataka 10. Tokovi podataka (data streams)
Ishodi učenja:	Znanje: Poznavanje naprednih koncepata upravljanja bazama podataka. Osnovni koncepti nerelacionih baza podataka i skladišta podataka. Vještine: Napredni koncepti SQL; Administracija SQL; Kreiranje NoSQL baze podataka; Kreiranje skladišta podataka; Kompetencije: Administracija sistema za upravljanje bazama podataka, poznavanje koncepata NoSQL baza podataka i posebnih vrsta baza podataka (vremenske, geoprostorne, data streams).
Cilj održivog razvoja (SDG):	SDG 4: Kvalitetno obrazovanje - Osigurati uključivo i kvalitetno obrazovanje, te promovisati mogućnosti cjeloživotnog učenja za sve, SDG 9: Industrija, inovacije i infrastruktura - Izgraditi otpornu infrastrukturu, promovirati uključivu i održivu industrializaciju i poticati inovacije,
Metode izvođenja nastave:	Teorijska predavanja na kojima se predstavljaju koncepti predviđeni tematskim cjelinama. Vježbe uključuju rješavanje praktičnih problema gdje će se prikazati primjena koncepata naučenih na predavanjima. Vježbe podstiču studente na aktivno rješavanje postavljenih problema.

Metode provjere znanja sa strukturom ocjene:	Izrada seminarskog rada: maksimalno 15 bodova Parcijalni ispit:maksimalno 35 bodova Student koji na parcijalnom ispitu ostvari više od 55% stiče pravo polaganja zaavršnog ispita: maksimalno 50 bodova Student koji na parcijalnom ispitu ne ostvari 55% polaže integralni popravni ispit koji donosi maksimalno 85 %. Student koji na završnom ne ostvari 55% na popravnom ispitu polaže popravni završni ispit koji donosi maksimalno 50 bodova.
Literatura:	1. SQL & NoSQL Databases: Models, Languages, Consistency Options and Architectures for Big Data Management, Andreas Meier and Michael Kaufmann 2019 2. MODELIRANJE, IMPLEMENTACIJA I ADMINISTRACIJA BAZA PODATAKA, Željko Kovačević,2018 3. H.Garcia-Molina, J. D. Ullman, J. D. Widom: Database Systems: The Complete Book, Prentice-Hall, 2001 4. SKLADIŠTENJE PODATAKA Put do znanja i poslovne inteligencije, Ćurko, Katarina; Španić Kezan, Maja 2016

Šifra predmeta: 13-14-15-1CITES020203	**Naziv predmeta: Napredne internet tehnologije**		
Ciklus: II	**Godina: II**	**Semestar: III**	**Broj ECTS kredita:** 6
Status: obavezni predmet		**Ukupan broj sati: 90** Predavanja: 45 Vježbe: 30 Seminari i projektni zadaci: 15	
Učesnici u nastavi	**Nastavnici i saradnici izabrani na oblast kojoj predmet pripada/predmet**		
Preduslov za upis:	NE		
Cilj (ciljevi) predmeta:	– Sticanje znanja o IoT (*Internet of Things*) paradigmi i mogućnostima njene primjene. – Upoznavanje sa arhitekturama, tehnologijama i alatima za razvoj IoT sistema kao i izazovima, otvorenim pitanjima i potencijalima razvoja.		

Tematske jedinice:	– IoT koncept i primjena – IoT standardizacija – IoT arhitektura i infrastruktura – Tehnologije senzora i senzorske mreže – Hardverske platforme – Komunikacijske tehnologije za razvoj pametnih rješenja – SDN i NFV – Protokolska arhitektura IoT – Softverske i Cloud platforme za IoT – Sigurnosni aspketi IoT – QoS u IoT sistemima
Ishodi učenja:	**Znanje:** Studenti će moći prepoznati mogućnosti primjene IoT tehnologija za rješavanje različitih problemskih situacija sa posebnim fokusom na unaprijeđenje sigurnosti i efikasnosti saobraćajnog sistema. Također, studenti će biti u mogućnosti projektovati i razvijati IoT sisteme bazirane na interakcijama različitih tehnologija, hardverskih i cloud platformi. **Vještine:** Studenti će biti u mogućnosti primjenjivati određene alate potrebne za projektovanje i razvoj IoT sistema uključujući softverske alate, konfigurciju mreže i hardvera. **Kompetencije:** Nakon položenog ispita student će biti u mogućnosti planirati, projektovati i razvijati IoT sisteme i izvršiti odabir odgovarajućih tehnologija za razvoj specifičnih rješenja.
Ciljevi održivog razvoja (SDG)	SDG9 – Industrija, inovacije i infrastruktura SDG11 – Održivi gradovi i zajednice
Metode izvođenja nastave:	Nastava se realizira kroz izvođenje predavanja, vježbi, seminara i praktičnog dijela nastave koji uključuje laboratorijske vježbe i/ili terenski rad/praksu. Predavanja se realizuju kroz usmeno izlaganje sa prezentacijom i prikazom primjera iz prakse. Tokom realizacije nastave se inicira diskusija o problemima projektovanja i razvoja sistema baziranih na naprednim internet tehnologijama. Studenti će biti obavezni izraditi i prezentirati seminarske radove i/ili projektne zadatake. U toku nastave se koriste različite metode koje uključuju: usmeno izlaganje, diskusije, demonstracije, individualni i grupni rad, itd.
Metode provjere znanja sa strukturom ocjene:	Ukupan broj bodova koji student može ostvariti u toku nastave je 50 i na završnom ispitu 50. Bodovi u toku nastave su raspoređeni na zadaće i aktivnost i/ili seminar i/ili projektni zadatak i na parcijalni ispit.

	Završni/popravni ispit uključuje gradivo koje student nije položio na parcijalnom ispitu što znači da obuhvata drugi dio gradiva koji se vrednuje sa 50 bodova za studente koji su položili parcijalni ispit. Studenti koji nisu položili gradivo sa parcijalnog ispita polažu gradivo sa parcijalnog i završnog ispita. Završni / popravni ispit se organizuje kao pismeni i/ili usmeni ispit uz polaganje praktičnog dijela. Ukupno vrednovanje svih obaveza studenta u toku semestra, odnosno ocjena na ispitu, zasnovana je na ukupnom broju bodova koje je student stekao ispunjavanjem predispitnih obaveza, polaganjem parcijalnog i završnog ispita. Prema kvalitetu stečenih znanja i vještina student može osvojiti maksimalno 100 bodova, a prema sljedećoj skali: Struktura bodovanja Bodovi (%) Seminar / Aktivnost na nastavi / Projektni zadatak:..... 20 bodova (%) I test / I provjera znanja (I parcijalni ispit):..... 30 bodova (%) Završni ili popravni ispit (II parcijalni ispit):..... 50 bodova (%) Potreban uslov za polaganje ispita je 55 bodova u sumi uz ostvarenih najmanje 55% bodova na provjerama znanja (parcijalni ispit i završni/popravni ispit). Konačan uspjeh studenta, nakon svih predviđenih oblika provjere znanja, vrednuje se i ocjenjuje sistemom kako slijedi: a) 10 - izuzetan uspjeh bez grešaka ili sa neznatnim greškama (95-100 bodova); b) 9 - iznad prosjeka, sa ponekom greškom (85-94 bodova); c) 8 - prosječan, sa primjetnim greškama (75-84 bodova); d) 7 - općenito dobar, ali sa značajnijim nedostacima (65-74 bodova); e) 6 - zadovoljava minimalne uslove (55-64 bodova); f) 5 - ne zadovoljava minimalne uslove (manje od 55 bodova).
Literatura:	Obavezna: – A. Čolaković, „*Napredne internet tehnologije (SKRIPTA),"* Fakultet za saobraćaj i komunikacije, Sarajevo, 2020. Dopunska literatura: – Yang Yang, Xu Chen, Rui Tan, Yong Xiao, "Intelligent IoT for the Digital World: Incorporating 5G Communications and Fog/Edge Computing Technologies," Wiley, 2021. – Vangelis Angelakis, Elias Tragos, Henrich C. Pöhls, Adam Kapovits, Alessandro Bassi, "Designing, Developing, and Facilitating Smart Cities: Urban Design to IoT Solutions," Springer International Publishing, 2017. – Shree Krishna Sharma, Dushantha Nalin K. Jayakody, Symeon Chatzinotas, Alagan Anpalagan, "Communication Technologies for Networked Smart Cities," The Institution of Engineering and Technology, 2021. – John R. Vacca, "Solving Urban Infrastructure Problems Using Smart City Technologies: Handbook on Planning, Design, Development, and Regulation," Elsevier, 2020.

	– Constandinos X. Mavromoustakis, George Mastorakis, Jordi Mongay Batalla, "Internet of Things (IoT) in 5G Mobile Technologies," Springer International Publishing, 2016. – Anuradha, J., Tripathy, B. K, "Internet of things (IoT) : technologies, applications, challenges and solutions," CRC Press;Taylor & Francis, 2018. – Kayhan Zrar Ghafoor, Kevin Curran, Linghe Kong, Ali Safa Sadiq, "Security and Organization within IoT and Smart Cities," CRS Press, 2020. – Hongjian Sun, Chao Wang, Bashar I. Ahmad, "From Internet of Things to Smart Cities: Enabling Technologies," CRC Press;Chapman and Hall/CRC, 2017. – Fadi Al-Turjman (editor), Muhammad Imran (editor), "IoT Technologies in Smart-Cities: From sensors to big data, security and trust (Control, Robotics and Sensors)," The Institution of Engineering and Technology, 2020. – David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things," Cisco Press, 2017. – Al-Turjman, Fadi, "Intelligence in IoT-enabled smart cities," Taylor & Francis;CRC, 2019. – Bharat Chaudhari, Marco Zennaro, "LPWAN Technologies for IoT and M2M Applications," Elsevier, 2020.

Šifra predmeta: 13-14-15-2CITES020203	**Naziv predmeta: Upravljanje projektima i investicijama u saobraćaju i komunikacijama**		
Ciklus: II	**Godina: II**	**Semestar: III**	**Broj ECTS kredita:** 6
Status: obavezni i izborni predmet		**Ukupan broj kontakt sati: 90** Opciono razraditi distribuciju sati po tipu: Predavanja: 45 Vježbe: 30 Seminarski/projektni zadatak: 15	
Učesnici u nastavi	**Nastavnici i saradnici izabrani na oblast kojoj predmet pripada/predmet**		
Preduslov za upis:	NE		
Cilj (ciljevi) predmeta:	Osnovni ciljevi predmeta se ogledaju u sticanju znanja iz oblasti upravljanja projektima i investicijama, razumjevanju metoda i tehnika		

	koje se primjenjuju u procesima upravljanja projektima i investicijama, te osposobljavanju studenata za praktičnu primjenu znanja iz ove oblasti.
Tematske jedinice: *(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)*	1. Opšti pojmovi investicija: Pojam i definisanje investicija. Vrste investicija u saobraćaju 2. Priprema investicionih projekata: Prethodna studija opravdanosti. Studija opravdanosti 3. Ocjena studije opravdanosti: Finansijska ocjena. Nacionalna ocjena. Ocjena investicija u uslovima neizvjesnosti 4. Cost - Benefit analiza: Principi cost-benefit analize. Utvrđivanje troškova i koristi. Vrednovanje troškova i koristi. Kriterijumi koji se koriste u cost-benefit analizi. Primjene cost-benefit analize 5. Biznis plan: Pojam biznis plana. Sadržaj biznis plana 6. Unido metodologija: Priprema industrijskih projekata. Ocjena industrijskih projekata 7. Ocjena investicionih projekata od strane Svjetske banke: Globalna procedura razmatranja i ocjene investicionih projekata. Ocjena rentabilnosti projekata 8. Upravljanje projektima: Koncept upravljanja projektima. Organizacija za upravljanje projektom. 9. Standardni računarski programi za upravljanje projektima 10. Primjena koncepta upravljanja projektima u saobraćaju 11. Realizacija projekta: Planiranje realizacije projekta. Planiranje vremena. Planiranje troškova i resursa. 12. Praćenje i kontrola realizacije projekta: Praćenje i kontrola vremena realizacije projekta. Praćenje i kontrola resursa i troškova realizacije projekta. 13. Upravljanje promjenama u projektu 14. Upravljanje rizicima u projektu 15. Izvještaj: Sistem izvještavanja o realizaciji projekta. Zatvaranje projekta
Ishodi učenja:	**Znanje:** Studenti će steći znanja iz oblasti upravljanja projektima i investicijama, metoda i tehnika koje se primjenjuju u procesima upravljanja projektima i investicijama, te osposobljavanju studenata za praktičnu primjenu znanja iz ove oblasti. **Vještine:** Nakon završetka kursa studenti će biti sposobni da razumije procese upravljanja projektima i investicijama, procijeni odgovarajuće metode u procesu upravljanja projektima, procijeni odgovarajuće metode u procesu upravljanja investicijama, planira aktivnosti za oba procesa, primjeni koncept upravljanja određenim projektom u realnom sistemu i poslovnom okruženju, primjeni koncept upravljanja investicijskim aktivnostima u realnom sistemu i poslovnom okruženju, planira, upravlja i kontroliše realizaciju različitih tipova projekta u

	poslovnim sistemima. **Kompetencije:** Aplikaciju stečenih znanja u konkretnim modelima.
Cilj održivog razvoja (SDG):	SDG 8: Dostojanstven rad i ekonomski rast - Promovisati održivi, uključivi i održivi ekonomski rast, zapošljavanje i dostojanstven rad za sve; SDG 9: Industrija, inovacije i infrastruktura - Izgraditi otpornu infrastrukturu, promovirati uključivu i održivu industrializaciju i poticati inovacije; SDG 12: Odgovorna potrošnja i proizvodnja - Osigurati održive obrasce potrošnje i proizvodnje.
Metode izvođenja nastave:	Tokom izvođenja programa nastavnik izlaže pojedine tematske jedinice (ex katedra), omogućava studentima praćenje video zapisa sa edukativnim sadržajem (DVD, video prezentacije) iz predmetne oblasti i organizuje diskusije na zadanu temu (interaktivna nastava). U okviru vježbi provodi se razmatranje i rješavanje primjera i zadataka sukladno teoretskoj tematici, pomaže se studentima u samostalnom rješavanju zadataka, u izradi programa, projekata i seminarskih radova.
Metode provjere znanja sa strukturom ocjene:	Kriterijum vrednovanja rada i ocjenjivanja studenta u toku nastave, vrši se na sljedeći način: Seminarski rad / projektni zadatak): od 0 do 15 bodova; I test / I provjera znanja / I parcijalni ispit: od 0 do 35 bodova. Ukupan broj bodova koji studenta može ostvariti u toku nastave može iznosi maksimalno 50 bodova. Završni / popravni ispit uključuje gradivo koje student nije položio na parcijalnom ispitu što znači da obuhvata drugi dio gradiva (II parcijalni) koji se vrednuje sa 50 bodova ili se sastoji od kompletnog gradiva, tj. I i II parcijalnog ispita. Ukupno vrednovanje svih obaveza studenta u toku semestra, odnosno ocjena na ispitu zasnovana je na ukupnom broju bodova (%) koje je student stekao ispunjavanjem predispitnih obaveza, polaganjem parcijalnog i završnog

	ispita. Prema kvalitetu stečenih znanja i vještina student može osvojiti maksimalno 100 bodova, a prema sljedećoj skali: Struktura bodovanja..... bodovi (%) Seminarski / Projektni zadatak:.....15 bodova (%) I test / I provjera znanja (Iparcijalni ispit): 35 bodova (%) Završni ispit (II parcijalni ispit):.....50 bodova (%) Potreban uslov za uspješno okončan ispit je postignut rezultat od 55 bodova pri čemu na svakom dijelu ispita treba ostvariti minimalno 55% (aktivnost, parcijalni ispit, završni ispit), tj. da bi student položio ispit mora ostvariti sljedeće uslove: - Aktivnost (seminarski rad / projektni zadatak): 8 bodova - I test / I provjera znanja / parcijalni ispit: 19 bodova - Završni ispit (II parcijalni ispit): 27 bodova Studenti koji su položili parcijalni ispit, na završnom ispitu polažu samo drugi dio gradiva (dio koji nije obuhvaćen parcijalnim ispitom). Studenti koji nisu položili parcijalni ispit, u okviru završnog ispita polažu kompletno gradivo, pri čemu kriteriji za polaganje ispita ostaje identični. Završni ispit se organizuje kao pismeni i/ili usmeni. Aktivnost se može pratiti kroz izradu zadaće, seminarskih radova, projektnih zadataka ili polaganje kvizova. Napomena: Studenti su obavezni prisustvovati svim oblicima nastave minimalno 80 % od ukupnog fonda sati i prisustvo na nastavi je uslov za ovjeru urednog pohađanja nastave. Student može, u opravdanim slučajevima (bolest) odsustvovati sa nastave, za što je obavezan dostaviti zdrastveno opravdanje. Seminarski rad i domaća zadaća će biti bodovane samo ako budu predane prema definisanim terminima. Naknadne predaje istih neće se

	bodovati. Konačan uspjeh studenta nakon svih predviđenih oblika provjere znanja, vrednuje se i ocjenjuje sistemom ocjenjivanja kako slijedi: a) 10 - izuzetan uspjeh bez grešaka ili sa neznatnim greškama, nosi 95-100 bodova; b) 9 - iznad prosjeka, sa ponekom greškom, nosi 85-94 bodova; c) 8 - prosječan, sa primjetnim greškama, nosi 75-84 bodova; d) 7 - općenito dobar, ali sa značajnijim nedostacima, nosi 65-74 bodova; e) 6 - zadovoljava minimalne uslove, nosi 55-64 bodova; f) 5 - ne zadovoljava minimalne uslove, manje od 55 bodova.
Literatura:	Obavezna: 1. Bilješke i slajdovi s predavanja (moći će se preuzeti na WEB site-u Fakulteta). 2. Vujadin Vešović, „Upravljanje projektima“, 9. Izdanje, Beograd, 2010. 3. Vladimir B. Depolo, „Upravljanje projektima u saobraćajnom inžinjerstvu“, Beograd, 2010. Dopunska: 1. Petar Jovanović, “Upravljanje investicijama”, 8. izdanje, Beograd, 2013.

Šifra predmeta: 13-14-15-3CITES020203	**Naziv predmeta: UPRAVLJANJE ODNOSIMA S KORISNICIMA**		
Ciklus: II	**Godina: II**	**Semestar: III**	**Broj ECTS kredita:** 6
Status: Izborni predmet KT, KIT, PT		**Ukupan broj kontakt sati: 90** Opciono razraditi distribuciju sati po tipu: Predavanja 30 Vježbe 30 Laboratorijske vježbe/ Terenski rad/Praksa: 30	
Učesnici u nastavi	**Nastavnici i saradnici izabrani na oblast kojoj predmet pripada/predmet**		

Preduslov za upis:	NE
Cilj (ciljevi) predmeta:	Studenti trebaju u okviru predmeta da steknu potrebna znanja, teorijska i praktična, za rad na poslovima upravljanja odnosima s korisnicima. Osnovni cilj je razumijevanje važnosti korisnika i odnosa koji se sa njima izgrađuju, kao i načina na koji je moguće upravljati tim odnosima.
Tematske jedinice: *(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)*	• Uvod u upravljanje odnosima sa korisnicima (CRM): Pojam i definicija CRM – a. Potreba za CRM. • Evolucijski razvoj marketinškog upravljanja • Pristupi istraživanju zadovoljstva klijenata. Projektiranje i izgradnja procesa kontinuiranog praćenja zadovoljstva klijenata. Orijentacija na kupce kao kultura tvrtke. • Upravljanje odnosima s klijentima kao poslovni proces. Proces upravljanja odnosima s klijentima. Koristi i troškovi upravljanja odnosima s klijentima. Procjena spremnosti tvrtke za uvođenje upravljanja odnosima s klijentima. Organiziranje i integriranje poslovanja, zaposlenika, tehnologije i procesa. Strategije komunikacije u marketingu. Prikupljanje podataka o klijentima. • Upravljanje odnosima s klijentima kao poslovni proces. Predviđanje ponašanja klijenata. Segmentiranje klijenata. Profitabilnost klijenata. Personalizacija i optimiziranje komunikacijskih kanala. Modeliranje interakcije s klijentima. Automatiziranje procesa u marketingu i prodaji. Planiranje programa upravljanja odnosima s klijentima. • Politika odnosa sa klijentima: Definisanje upravljanja odnosima s klijentima. Važnost poznavanja kupaca. Stjecanje novih klijenata naprema zadržavanju postojećih. Lojalnost klijenata. Korištenje podataka o klijentima. • Analitički CRM • Alati upravljanja odnosima sa korisnicima • Tehnološka osnovica upravljanju odnosima s klijentima: Tehnološka osnovica upravljanja odnosima s klijentima. Skladištenje podataka. Analiza podataka o kupcima i rudarenja podataka • Elektroničko poslovanje i upravljanje odnosima s kupcima putem Interneta. Dodatne usluge kupcima putem World Wide Weba. Pitanja privatnosti kupaca. Izbor alata za CRM. • Životni ciklus CRM sistema. Modeliranje i implementacija CRM sistema u telekomunikacijskim kompanijama. • Reinžinjering CRM sistema. • Implementacija CRM rješenja u telekomunikacijskim kompanijama (Implementacija strategije, Implementacija tehnologije). • Operativni CRM
Ishodi učenja:	Znanje: Teorijska i praktična znanja iz oblasti upravljanje odnosima s korisnicima. Predmet proučavanja treba da osigura nivo kompetencija i

	znanja potrebnih za rješavanje svakodnevnih problema u navedenoj oblasti. Vještine: Sposobnost primjene teorijskih i praktičnih znanja iz oblasti upravljanje odnosima s korisnicima. Kompetencije: Sposobnosti samostalnog razumijevanja i korištenja znanja potrebnih za rješavanje specifičnih problema u oblasti upravljanje odnosima s korisnicima.
Cilj održivog razvoja (SDG):	SDG4 – Kvalitetno obrazovanje, SDG8 – Dostojanstven rad i ekonomski rast, SDG9 – Industrija, inovacije i infrstruktura, SDG17 – Partnerstvom do ciljeva
Metode izvođenja nastave:	Nastava se realizira kroz izvođenje predavanja, vježbi, laboratorijskih vježbi/terenskog rada/prakse. Zastupljene su sljedeće metode: metoda usmenog izlaganja, metoda razgovora, metoda demonstracije, metoda grafičkih radova, metoda crtanja i metoda rada u skupini. Na predavanima se obrađuju teorijski koncepti i principi uz prikaz opisnih primjera i rješavanje određenih zadataka. Dodatni primjeri se razmatraju i rješavaju kroz vježbe, laboratorijske vježbe/terenski rad/praksu, što omogućava kontinuiran rad i pripremu za samostalno rješavanje problema. Na laboratorijskim vježbama/terenskom radu/praksi razvijat će se vještine potrebne za individualni i timski rad u cilju izvršavanja zadataka iz zadane oblasti.
Metode provjere znanja sa strukturom ocjene:	Ocjena kreativnosti na nastavi i vježbama uz izradu samostalnih radova, ocjena parcijalnog testa u toku nastave kao i ocjena završnog ispita. Kriterijum praćenja rada i ocjenjivanja studenta u toku nastave i to prema sljedećem načinu: – Seminarski rad/praktični rad/ 20 bodova (%). – Domaća zadaća u toku nastave: 10 bodova (%) – I Parcijalni ispit/test/provjera znanja/35 bodova (%), položen je ako se osvoji preko 50 %. – Završni ispit (Usmeni) 35 bodova (%), položeno ako se osvoji preko 50 %. – Završni ispit (Integralni) 70 bodova (%), položeno ako se osvoji preko 50 %. Ukupan broj bodova (%) koji student prema navedenom praćenju u toku

	nastave može ostvariti iznosi maksimalno 65 bodova (%), što sa Završnim čini 100 bodova (%). Za studente koji nisu položili I Parcijalni ispit, Završni ispit (Integralni) se organizuje iz cjelokupnog pređenog gradiva u toku nastave i vježbi, i vrednuje se sa 85 bodova (%), što sa seminarskim radom/praktičnim radom čini 100 bodova (%). Konačan uspjeh studenta nakon svih predviđenih oblika provjere znanja, vrednuje se i ocjenjuje sistemom ocjenjivanja kako slijedi: a) 10 (A) - izuzetan uspjeh bez grešaka ili sa neznatnim greškama, nosi 95-100 bodova; b) 9 (B) - iznad prosjeka, sa ponekom greškom, nosi 85-94 bodova; c) 8 (C) - prosječan, sa primjetnim greškama, nosi 75-84 bodova; d) 7 (D) - općenito dobar, ali sa značajnijim nedostacima, nosi 65-74 bodova; e) 6 (E) - zadovoljava minimalne uslove, nosi 55-64 bodova; f) 5 (F, FX) - ne zadovoljava minimalne uslove, manje od 55 bodova.
Literatura:	Obavezna: 1. Materijal sa predavanja (dostupan na stranici fakulteta) 2. Dyche, J., Diche, J. (2001). The CRM handbook: A business guide to customer relationship management. Addison-Wesley 3. Greenberg, P. (2002). CRM at the speed of light: Capturing and keeping customers in Internet real time. Osborne McGraw-Hill. 4. Peelen, E.: Customer Relationship Management, Pearson Education Limited, Essex, 2005 5. Buttle, F. Customer Relationship Management. 2nd ed., Butterworth-Heinmann, Amsterdam, London, 2009.

Šifra predmeta: 13-14-15-4CITES020203	**Naziv predmeta:** **KOMUNIKACIJSKE TEHNOLOGIJE I OKOLIŠ**		
Ciklus: II	**Godina: II**	**Semestar: III**	**Broj ECTS kredita: 6**
Status: Izborni predmet		**Ukupan broj sati: 90** Razrada distribucije sati po tipu: Predavanja: 45 Vježbe: 45	
Učesnici u nastavi	**Nastavnici i saradnici izabrani na oblast kojoj predmet pripada/predmet**		

Preduslov za upis:	NE
Cilj (ciljevi) predmeta:	Ovaj kolegij omogućit će studentima potrebna znanja iz oblasti komunikacijskih tehnologija i njegovoj interakciji sa okolinom, uticaju tk.tehnologija na zdravlje ljudi, radom Međunarodnih agencija za zaštitu okoliša, Evropskim Direktivama u pogledu elektronskog otpada, kao i o nastanku, upotrebi i zbrinjavanju elektronskog otpada.
Tematske jedinice: *(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)*	1. EKOLOŠKI ASPEKTI ZAŠTITE OKOLIŠA Koncept upravljanja znanjem. Akvizicija i pohranjivanje sustavskog znanja. Ekologija sustavskog znanja. 2. EKOLOŠKI ASPEKTI ZAŠTITE OKOLIŠA Globalno zagrijavanje. Opasne supstance koje oštećujuu ozonski omotač. 3. MEĐUNARODNE ORGANIZACIJE ZA ZAŠTITU OKOLIŠA. 4. TELEKOMUNIKACIJSKE PROMET U INTERAKCIJI SA OKOLINOM Nove tehnologije u oblasti tk. prometa. Ekološka politika i savremeni trendovi telekomunikacija. 5. TELEKOMUNIKACIJSKE PROMET U INTERAKCIJI SA OKOLINOM Stanje i perspektive razvoja tk. tehnologija u prometu kao posljedica održivog razvoja. Zeleni IT. 6. SAVREMENI TRENDOVI U PROIZVODNJI ICT OPREME. Ekološki aspekti u proizvodnji i korištenju ICT opreme. Preporuke za održivo korištenje. 7. EVROPSKE DIREKTIVE U POGLEDU ELEKTRONSKOG OTPADA WEEE Direktiva o električnom i elektronskom otpadu. RoHS Direktiva o ograničenjima za upotrebu opasnih materija 8. UTICAJ ELEKTROMAGNETNOG ZRAČENJA NA ZDRAVLJE LJUDI. Termički i netermički učinci zračenja. Prodiranje elektromagnetnih talasa u organizam. 9. MEĐUNARODNI SPORAZUMI O KLIMATSKIM PROMJENAMA POTPISANI U KYOTU I MONTREALU. 10. NASTANAK I UPOTREBA ELEKTRONSKOG OTPADA.NAČIN ZBRINJAVANJA ELEKTRONSKOG OTPADA. POSTUPANJE S ELEKTRONSKIM OTPADOM U BIH.

	11. DEKARBONIZACIJA I JAČANJE UDJELA OBNOVLJIVIH IZVORA ENERGIJE KAO ODGOVOR NA KLIMATSKE PROMJENE 12. SUSTAV UPRAVLJANJA OKOLIŠEM. PAMETNI ZELENI GRADOVI 13. CILJEVI ODRŽIVOG RAZVOJA I EDUKACIJA O ODRŽIVOSTI: SVIJEST O KLIMATSKIM PROMJENAMA I POSTIZANJE CILJEVA AGENDE 2030 14. ICNIRP STANDARD. SAR MJERENJA 15. ZELENI IoT
Ishodi učenja:	Znanje: Studenti će steći sveobuhvatno razumijevanje interakcije komunikacijskih tehnologija s okolišem, uključujući njihov utjecaj na ljudsko zdravlje, ekološke aspekte ICT opreme, te relevantne međunarodne i evropske regulative. Također, naučit će kako ciljevi održivog razvoja (SDGs), posebno oni povezani s odgovornom proizvodnjom, klimatskim akcijama, te industrijom i inovacijama, primjenjuju na upravljanje komunikacijskim tehnologijama. Vještine: Studenti će razviti sposobnost analize i prepoznavanja ključnih problema povezanih s utjecajem komunikacijskih tehnologija na okoliš i ljudsko zdravlje, te primjene stečenih znanja u stvarnim situacijama. Također će razviti vještine kritičkog mišljenja i donošenja informiranih odluka u skladu s evropskim direktivama i praksama održivog razvoja. Kompetencije: Studenti će biti kompetentni za identifikaciju i rješavanje problema vezanih za utjecaj komunikacijskih tehnologija na okoliš i zdravlje, koristeći metode održivog razvoja. Moći će primijeniti međunarodne standarde i direktive u praksi te izraditi strategije za održivo upravljanje komunikacijskim tehnologijama.
Cilj održivog razvoja (SDG):	"SDG4 – Kvalitetno obrazovanje", „SDG7-Pristupačna energija iz čistih izvora",SDG9-Industrija, inovacije i infrastruktura", SDG11– Održivi gradovi i zajednice", "SDG 12- Odgovorna potrošnja i proizvodnja", "SDG 13: Odgovorni na klimatske promjene".
Metode izvođenja nastave:	Metoda usmenog izlaganja, metoda razgovora, metoda demonstracije, metoda rada u skupini.
Metode provjere znanja sa strukturom ocjene:	Ocjena kreativnosti na nastavi i vježbama uz izradu samostalnih radova, ocjena parcijalnog testa u toku nastave kao i ocjena završnog ispita. Kriterijum praćenja rada i ocjenjivanja studenta u toku nastave i to

	prema sljedećem načinu: – Domaća zadaća/seminarski rad/testovi/ 20 bodova (%), položeno ako se osvoji najmanje 55 %. – I Parcijalni ispit/test/provjera znanja/30 bodova (%), položen je ako se osvoji najmanje 55 %. – Završni ispit (II Parcijalni) pismeni 40 bodova (%), položeno ako se osvoji najmanje 55 %. Uslov za izlazak uspješno položen prvi parcijalni ispit. – Završni ispit (Integralni pismeni) 70 bodova + 10 bodova usmeni ispit (%), položeno ako se osvoji najmanje 55 %. Završni ispit se organizuje kao pismeni i usmeni. Student na završnom ispitu može da polaže gradivo koje nije polagao i/ili uspješno okončao tokom trajanja semestra. Potreban uslov za uspješno okončan ispit je postignut rezultat od najmanje 55% bodova od maksimalnog broja bodova na parcijalnom i završnom dijelu ispita, a dovoljan uslov je da suma ostvarenih bodova (kroz: domaću zadaću, prisustvo, parcijalni i završni ispit) bude 55. Zadaća se organizuje kroz pisanje domaće zadaće i projekata. Zadaća nema mogućnost popravljanja. Za studente koji nisu uspješno okončali parcijalni ispit, završni ispit se sastoji iz cjelokupnog pređenog gradiva u toku nastave. Popravni ispit se organizuje kao i završni ispit. Konačan uspjeh studenta nakon svih predviđenih oblika provjere znanja, vrednuje se i ocjenjuje sistemom ocjenjivanja kako slijedi: a) 10 (A) - izuzetan uspjeh bez grešaka ili sa neznatnim greškama, nosi 95-100 bodova; b) 9 (B) - iznad prosjeka, sa ponekom greškom, nosi 85-94 bodova; c) 8 (C) - prosječan, sa primjetnim greškama, nosi 75-84 bodova; d) 7 (D) - općenito dobar, ali sa značajnijim nedostacima, nosi 65-74 bodova; e) 6 (E) - zadovoljava minimalne uslove, nosi 55-64 bodova; f) 5 (F, FX) - ne zadovoljava minimalne uslove, manje od 55 bodova. Ukupno vrednovanje svih obaveza studenta u toku semestra, odnosno ocjena na ispitu zasnovana je na ukupnom broju bodova (%) koje je student stekao ispunjavanjem predispitnih obaveza i polaganjem

	parcijalnog i završnog ispita, a prema kvalitetu stečenih znanja i vještina, i sadrži maksimalno 100 bodova, te se utvrđuje prema sljedećoj skali: Obaveze studenta Bodovi (%) Prisutnost na predavanjima i vježbama..... - Zadaća/Seminarski/Testovi/.....20 bodova (%) I Parcijalni ispit/Test/Provjera znanja/.....30 bodova (%) Završni ispit (II Parcijalni) .....40 bodova (%) Završni ispit (Usmeni) .....10 bodova (%) Završni ispit (Integralni) .....70 bodova (%)
Literatura:	Obavezna 6. Interna skripta „Komunikacijske tehnologije i okoliš”, Fakultet za saobraćaj i komunikacije, Sarajevo, 2022. 7. Manatū Mō Te Taiao - Information and Communication Technology Equipment: Good Practice Guidelines for Environmental Sustainability 8. Nik Bessis, Ciprian Dobre Editors, Big Data and Internet of Things: A Roadmap for Smart Environments, Springer, Volume 546, London, 2014. Dopunska 1. The Global Goals Resources: https://www.globalgoals.org/resources 2. UN SDG Knowledge Platform: https://sustainabledevelopment.un.org/ 3. Čaušević S, KOMUNIKACIJSKE TEHNOLOGIJE I OKOLIŠ, Univerzitet u Sarajevu, Fakultet za saobraćaj i komunikacije, Sarajevo, 2006.
	4. Bilješke i prezentacije sa predavanja i vježbi.

Šifra predmeta: 13-14-15-5CITES020203	**Naziv predmeta: SAOBRAĆAJNA POLITIKA**		
Ciklus: II	**Godina: II**	**Semestar: III**	**Broj ECTS kredita: 6**
Status: Izborni predmet		**Ukupan broj kontakt sati: 90** Opciono razraditi distribuciju sati po tipu: Predavanja: 45	

	Vježbe: 30 Seminari i projektni zadaci: 15
Učesnici u nastavi	**Nastavnici i saradnici izabrani na oblast kojoj predmet pripada/predmet**
Preduslov za upis:	NE
Cilj (ciljevi) predmeta:	Studenti stiču osnovna teorijska znanja potrebna za izučavanje prometne politike: nacionalni značaj transportnog sistema i integracija u europske prometne tokove, alokacija pozitivnih i negativnih učinaka integracije saobraćajne politike. Piramidalna struktura i ingerencija prilikom definisanja i realizacije saobraćajnih prioriteta na nacionalnom i međunardonom nivou.
Tematske jedinice: *(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)*	– Pristupne osnove nacionlanoj prometnoj politici: pojam politike, vrste politike, funkcija politike kao pristupna osnova nacionalne prometne politike, – Komponente nacionalne prometne politike: Nositelji prometne politike, ciljevi prometne politike, instrumenti prometne politike, odnos ciljeva i instrumenata prometne politike, – Načela nacionalne prometne politike – I dio: povezanosti prometa i ekonomije, usklađivanja djelovanja prometnog sustava i društvene rentabilnosti. – Načela nacionalne prometne politike – II dio: Načela jedinstvenog prometnog sustava, alokacije resursa, vlasništva i jednakih mogućnosti rada, izbora prometne politike i ostvarivosti prometne politike – Formuliranje prometne politike: Formuliranje, vrednovanje, efikasnost nacionalne prometne politike. Pojam i značenje determinanata prometne politike. – Usklađenost prometne politike – I dio: Ciljevi zajedničke prometne politike. Opće političke smjernice zajedničke prometne politike. – Usklađenost prometne politike – II dio: Primjena i rasprave o budućnosti prometa u okviru zajedničke prometne politike. – Transeuropska prometne mreža – I dio: Smjernice iz 1996. i revizija smjernica za transeuropsku prometnu mrežu iz 2004. godine. – Transeuropska prometne mreža – II dio: Revizija smjernica iz 2013. godine: integrirana mreža, dvoslojna struktura i koridori transeuropske prometne mreže. – Transeuropska prometne mreža – III dio: Dodatne mogućnosti financiranja projekata transeuropskih mreža. Utvrđivanje općih uvjeta za financiranje projekata transeuropskih mreža. – Transeuropska prometne mreža – IV dio: Instrument i opći ciljevi za povezivanje europe transeuropskom mrežom. Proračun Instrumenta za povezivanje Europe transeuropskom mrežom

	– Sektorske politike EU – I dio: Cilj i područje primjene Direktive 97/67/EZ europskog Parlamenta i Vijeća. Univerzalne poštanske usluge. – Sektorske politike EU – II dio: Usklađenje poštanskih usluga koje se mogu rezervirati. Uvjeti pružanja nerezerviranih poštanskih usluga i pristupa u mrežu. – Sektorske politike EU – III dio: Kvaliteta poštanskih usluga. Usklađenje tehničkih normi prema interesima korisnika. Odbor i nacionalno regulatorno tijelo – Sektorske politike EU – IV dio: Tržišna pravila poštanskog prometa i europska postignuća u oblasti poštanskog prometa.
Ishodi učenja:	**Znanje:** Sposobnost za kreiranje i primjenu saobraćajne politike uvažavajući postavljene predmetne ciljeve. **Vještine:** Identifikacija saobraćajnih I transportnih prioriteta potrebnih za strategijsko planirnje i kreiranje saobraćajne politike u mikro i makro okruženju. Defisnisati ciljeve saobraćajne politike i prihvatljive modele realizacije. Identifikuje prioritete u oblasti planiranja, izgradnje, revitalizacije prometnih tokova, izvrši procjenu potrebe za integracijom i liberalizacijom unutrašnjih prometnih tokova prateći europsku I međunarodnu prometnu politiku, direktive i smjernice kao i prometne tokove, ali i prometne tokove i politike zemalja u okruženju. **Kompetencije:** Krairanje unutrašnjeg efikasnog I efektivnog transportnoog sistema I integracija u međunarodne I EU transportne sisteme
Cilj održivog razvoja (SDG):	Ciljevi održivog razvoja i uticaj na saobraćajnu politiku: 1. SDG 1 - Svijet bez siromaštva 2. SDG 2 - Svijet bez gladi 3. SDG 5 – Rodna ravnopravnost 4. SDG 6 – Čista voda i sanitarni uvjeti 5. SDG 7 – Pristupačna energija iz čistih izvora 6. SDG 8 - Dostojanstven rad i ekonomski rast 7. SDG 9 – Industrija, inovacije i infrastruktura 8. SDG 10 – Smanjenje nejednakosti 9. SDG 11 – Održivi gradovi i zajednice 10. SDG 12 - Održiva ppotrošnja i proizvodnja 11. SDG 13 – Zaštita klime 12. SDG 14 – Očuvanje vodenog svijeta

	13. SDG 15 – Očuvanje života na zemlji 14. SDG 16 – Mir, pravda i snažne institucije 15. SDG 17 – Partnerstvom do cilja
Metode izvođenja nastave:	Nastava se realizira kroz izvođenje predavanja, vježbi i praktičnog dijela nastave koja uključuje izradu projektnih zadataka. Predavanja se realizuju kroz usmeno izlaganje sa prezentacijom i prikazom primjera iz prakse. Inicira diskusija o problemima planiranja, modeliranja i analize informacijskih sistema. Studenti će biti obavezni izraditi i prezentirati seminarske radove i/ili projektne zadatake. U realizaciji nastave se koriste različite metode koje uključuju: usmeno izlaganje i diskusije, demonstracije primjera, metoda grafičkih i video prikaza i potenciranje rada u grupama primjenom odgovarajućih metodoloških pristupa.
Metode provjere znanja sa strukturom ocjene:	Kriterijum vrednovanja rada i ocjenjivanja studenta u toku nastave, vrši se na sljedeći način: Aktivnost (seminarski rad / projektni zadatak): od 0 do 15 bodova; I test / I provjera znanja / I parcijalni ispit: od 0 do 35 bodova. Ukupan broj bodova koji studenta može ostvariti u toku nastave može iznosi maksimalno 50 bodova. Završni / popravni ispit uključuje gradivo koje student nije položio na parcijalnom ispitu što znači da obuhvata drugi dio gradiva (II parcijalni) koji se vrednuje sa 50 bodova ili se sastoji od kompletnog gradiva, tj. I i II parcijalnog ispita. Ukupno vrednovanje svih obaveza studenta u toku semestra, odnosno ocjena na ispitu zasnovana je na ukupnom broju bodova (%) koje je student stekao ispunjavanjem predispitnih obaveza, polaganjem parcijalnog i završnog ispita. Prema kvalitetu stečenih znanja i vještina student može osvojiti maksimalno 100 bodova, a prema sljedećoj skali: Struktura bodovanja Bodovi (%) Seminarski / Projektni zadatak:..... 15 bodova (%) I test / I provjera znanja (I parcijalni ispit):..... 35 bodova (%) Završni ili popravni ispit (II parcijalni ispit):..... 50 bodova (%) Potreban uslov za uspješno okončan ispit je postignut rezultat od 55 bodova pri čemu na svakom dijelu ispita treba ostvariti minimalno 55%

	(aktivnost, parcijalni ispit, završni ispit), tj. da bi student položio ispit mora ostvariti sljedeće uslove: - Aktivnost (seminarski rad / projektni zadatak): 9 bodova - I test / I provjera znanja / parcijalni ispit: 19 bodova - Završni ili popravni ispit (II parcijalni ispit): 27 bodova Studenti koji su položili parcijalni ispit, na završnom / popravnom ispitu polažu samo drugi dio gradiva (dio koji nije obuhvaćen parcijalnim ispitom). Studenti koji nisu položili parcijalni ispit, u okviru završnog / popravnog ispita polažu kompletno gradivo, pri čemu kriteriji za polaganje ispita ostaje identični. Završni / popravni ispit se organizuje kao pismeni i/ili usmeni. Aktivnost se može pratiti kroz izradu zadaće, seminarskih radova, projektnih zadataka ili polaganje kvizova. Konačan uspjeh studenta nakon svih predviđenih oblika provjere znanja, vrednuje se i ocjenjuje sistemom ocjenjivanja kako slijedi: a) 10 - izuzetan uspjeh bez grešaka ili sa neznatnim greškama, nosi 95-100 bodova; b) 9 - iznad prosjeka, sa ponekom greškom, nosi 85-94 bodova; c) 8 - prosječan, sa primjetnim greškama, nosi 75-84 bodova; d) 7 - općenito dobar, ali sa značajnijim nedostacima, nosi 65-74 bodova; e) 6 - zadovoljava minimalne uslove, nosi 55-64 bodova; f) 5 - ne zadovoljava minimalne uslove, manje od 55 bodova. Navedena skala se može korigovati prema Pravilima studiranja na Univerzitetu u Sarajevu (Član 45).
Literatura:	Obavezna: 1. Juraj Padjen, Prometne politikaHrvatske, Masmedia, Zagreb 2003. godina. 2. Piero Soave, „Kratak vodić o Europskoj uniji“, Eurospki parlament,

	oktobar 2016. godine. 3. Marc Thomas, „Kratak vodić o Europskoj uniji“, Eurospki parlament, septembar 2016. godina. 4. Beata Tuszynska i Frederic Gouarderes, „Kratak vodić o Europskoj uniji“, Eurospki parlament, oktobar 2016. Godine. Dopunska: 1. Direktiva 97/67/EZ EUROPSKOG PARLAMENTA I VIJEĆA OD 15.12.1997. godine, „Službeni list Europskih zajednica“ br. 6/Sv. 9 od 21.01.1998. godine. 2. Direktiva 2002/39/EZ EUROPSKOG PARLAMENTA I VIJEĆA OD 10.06.2002. godine, „Službeni list Europskih zajednica“ br. 6/Sv. 1 od 05.07.2002. godine. 3. Direktiva 2008/6/EZ EUROPSKOG PARLAMENTA I VIJEĆA od 20.02.2008. godine o izmjeni i Direktiva 97/67/EZ u pogledu potpunog postizanja unutarnjeg tržišta poštanskih usluga u Zajednici, „Službeni list Europskih zajednica“ br. 06/Sv. 9 od 27.02.2008. godine. 4. Direktiva 2008-68-EZ EUROPSKOG PARLAMENTA I VIJEĆA od 24.09.2008. godine “Službeni list EU 7/Sv.7” Kopneni prijevoz opsanih tvari. 5. Direktiva 2010/40EU EUROPSKOG PARLAMENTA I VIJEĆA od 07.07.2010. “Službeni list EU 7/Sv.8” Okvir za uvođenje inteligentnih prometnih sustava u cestovnom prometu I za veze sa ostalim vrstama prevoza. 6. DIREKTIVA 2004/54/EZ EUROPSKOG PARLAMENTA I VIJEĆA od 29. travnja 2004. o minimalnim sigurnosnim zahtjevima za tunele u transeuropskoj cestovnoj mreži 7. „DIREKTIVA 2008/96/EZ EUROPSKOG PARLAMENTA I VIJEĆA od 19. studenoga 2008. o upravljanju sigurnošću cestovne infrastrukture 8. DIREKTIVA 2009/33/EZ EUROPSKOG PARLAMENTA I VIJEĆA od 23. travnja 2009. o promicanju čistih i energetski učinkovitih vozila u cestovnom prijevozu 9. DIREKTIVA 1999/62/EZ EUROPSKOG PARLAMENTA I VIJEĆA od 17. lipnja 1999. o naknadama koje se naplaćuju za korištenje određenih infrastruktura za teška teretna vozila 10. DIREKTIVA 2004/52/EZ EUROPSKOG PARLAMENTA I VIJEĆA od 29. travnja 2004. o interoperabilnosti elektroničkih sustava za naplatu cestarine u Zajednici 11. DIREKTIVA (EU) 2019/520 EUROPSKOG PARLAMENTA I VIJEĆA od 19. ožujka 2019. o interoperabilnosti elektroničkih sustava za naplatu cestarine i olakőavanju prekogranične razmjene informacija o neplaćanju cestarina u Uniji

	12. UREDBA (EZ) br. 1072/2009 EUROPSKOG PARLAMENTA I VIJEĆA od 21. listopada 2009. o zajedničkim pravilima za pristup tržištu međunarodnog cestovnog prijevoza teret 13. UREDBA (EZ) br. 561/2006 EUROPSKOG PARLAMENTA I VIJEĆA od 15. ožujka 2006. o usklađivanju određenog socijalnog zakonodavstva koje se odnosi na cestovni promet i o izmjeni uredbi Vijeća (EEZ) br. 3821/85 i (EZ) br. 2135/98 te o stavljanju izvan snage Uredbe Vijeća (EEZ) br. 3820/85 14. DIREKTIVA 2002/39/EZ EUROPSKOG PARLAMENTA I VIJEĆA od 10. lipnja 2002. o izmjeni Direktive 97/67/EZ u vezi s daljnjim otvaranjem tržišta poštanskih usluga u Zajednice 15. DIREKTIVA 2008/6/EZ EUROPSKOG PARLAMENTA I VIJEĆA od 20. veljače 2008. o izmjeni Direktive 97/67/EZ u pogledu potpunog postizanja unutarnjeg tržišta poštanskih usluga u Zajednici. 16. UREDBA (EU) br. 952/2013 EUROPSKOG PARLAMENTA I VIJEĆA od 9. listopada 2013. o Carinskom zakoniku Unije. 17. UREDBA (EU) 2018/644 EUROPSKOG PARLAMENTA I VIJEĆA od 18. travnja 2018. o uslugama prekogranične dostave paketa 18. DIREKTIVA (EU) 2019/789 EUROPSKOG PARLAMENTA I VIJEĆA od 17. travnja 2019. o utvrđivanju pravila o ostvarivanju autorskog prava i srodnih prava koja se primjenjuju na određene internetske prijenose organizacija za radiodifuziju i reemitiranja televizijskih i radijskih programa te o izmjeni Direktive Vijeća 93/83/EEZ 19. UREDBA (EU) 2015/2120 EUROPSKOG PARLAMENTA I VIJEĆA od 25. studenoga 2015. o utvrđivanju mjera u vezi s pristupom otvorenom internetu te o izmjeni Direktive 2002/22/EZ o univerzalnoj usluzi i pravima korisnika u vezi s elektroničkim komunikacijskim mrežama i uslugama i Uredbe (EU) br. 531/2012 o roamingu u javnim pokretnim komunikacijskim mrežama u Uniji. 20. UREDBA (EU) 2018/1971 EUROPSKOG PARLAMENTA I VIJEĆA od 11. prosinca 2018. o osnivanju Tijela europskih regulatora za elektroničke komunikacije (BEREC) i Agencije za potporu BEREC-u (Ured BEREC-a), izmjeni Uredbe (EU) 2015/2120 i stavljanju izvan snage Uredbe (EZ) br. 1211/2009 21. UREDBA (EU) 2019/1150 EUROPSKOG PARLAMENTA I VIJEĆA od 20. lipnja 2019. o promicanju pravednosti i transparentnosti za poslovne korisnike usluga internetskog posredovanja 22. UREDBA (EZ) br. 549/2004 EUROPSKOG PARLAMENTA I VIJEĆA od 10. ožujka 2004. o utvrđivanju okvira za stvaranje jedinstvenog europskog neba 23. UREDBA (EZ) br. 550/2004 EUROPSKOG PARLAMENTA I VIJEĆA od 10. ožujka 2004. o pružanju usluga u zračnoj plovidbi u jedinstvenom europskom nebu

	24. UREDBA (EZ) br. 552/2004 EUROPSKOG PARLAMENTA I VIJEĆA od 10. ožujka 2004. o interoperabilnosti Europske mreže za upravljanje zračnim prometom 25. UREDBA (EU) 2019/712 EUROPSKOG PARLAMENTA I VIJEĆA od 17. travnja 2019. o zaštiti tržišnog natjecanja u zračnom prijevozu i stavljanju izvan snage Uredbe (EZ) br. 868/2004 26. DIREKTIVA 2012/34/EU EUROPSKOG PARLAMENTA I VIJEĆA od 21. studenoga 2012. o uspostavi jedinstvenog Europskog željezničkog proctora 27. DIREKTIVA (EU) 2016/797 EUROPSKOG PARLAMENTA I VIJEĆA od 11. svibnja 2016. o interoperabilnosti željezničkog sustava u Europskoj uniji 28. DIREKTIVA (EU) 2016/798 EUROPSKOG PARLAMENTA I VIJEĆA od 11. svibnja 2016. o sigurnosti željeznica, 29. UREDBA (EU) 2016/796 EUROPSKOG PARLAMENTA I VIJEĆA od 11. svibnja 2016. o Agenciji Europske unije za željeznice I stavljanju izvan snage Uredbe (EZ) br. 881/2004 30. UREDBA (EZ) br. 1371/2007 EUROPSKOG PARLAMENTA I VIJEĆA 31. od 23. listopada 2007. o pravima i obvezama putnika u željezničkom prometu 32. Bilješke i slajdovi s predavanja (mogu se preuzeti sa službene internet stranice Fakulteta za saobraćaj i komunikacije i elektronska distribucija svakom pojedinačnom studentu)

Opis silabusa na studijskom programu Kompjuterske i informacijske tehnologije na engleskom jeziku

U nastavku su navedeni silabusi predmeta na Engleskom jeziku.

Prevod nastavnog plana i programa na engleskom jeziku.

Course code: 01ATCOS020101	**Course title: Management in Traffic and Communications**		
Level: II	**Year: I**	**Semester: I**	**Number of ECTS credits: 6**
Status: Mandatory Course		**Total number of contact hours: 90** Optional breakdown of hours by type: Lectures: 45 Tutorials: 45 Seminars	

	Fieldwork: Laboratory Tutorials: Practice Concert activies …
Course participants:	**Academic staff and associates selected in the field to which the course belongs/course**
Prerequisite for enrollment:	None
Course goal (goals):	The goal of the course is to familiarize students with the functioning of transport systems in market conditions and international standards to ensure effective and efficient operations. The course aims to equip students with knowledge about standards and standardization, as well as the interconnections between various parts of production and economic processes affected by technical standardization.
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	1. Basics of Management: Concept, management process, and interdependence with the organization. The concept of management and the management process. Characteristics of a modern manager. Managerial functions. 2. General and Specific Characteristics of Management in the Transport System: Issues of organization and management in the transport system. Definitions and content of management. Management and entrepreneurship in transport and telecommunications companies. 3. General and Specific Characteristics of Management in the Transport System: Managerial tasks in administrations, institutes, and agencies. Development of logistics management. Relationships between transport policy and management. Development of the transport system and spatial-economic structuring. 4. Managerial Concepts for Improving and/or Innovating Business Processes: Process-oriented management. Innovation and/or reengineering of business processes. 5. Planning as a Function and Activity of Management: Planning in a transport company. Policies and strategies of a transport company. Process approach to strategic planning. 6. Planning as a Function and Activity of Management; Strategic analysis of competitive structure in the transport sector. Scenario methods for selecting effective business strategies. 7. Organizational Structure and Processes: Concept and broader understanding of organization. Organizational structure. 8. Organizational Structure and Processes: Organizing relationships within the organization.

	9. Organizational Structure and Processes: Process-based and knowledge-based organization. Examples of organizational structures in some transport and telecommunications companies. 10. Business Management and Motivation: Business management and leadership. 11. Business Management and Motivation: Influences on human behavior and motivation. 12. Human Resource Management: Human resource management as a function of management. 13. Human Resource Management: Activities in the human resource management process. Personal development of managers. 14. Managerial Control and Quality Management: Basics of modern standardization. Methods of adopting and labeling standards, levels of conformity, and terminology related to standard adoption. Quality infrastructure. 15. Managerial Control and Quality Management: Management system standards (MSS). Integrated management systems (IMS).
Learning outcomes:	**Knowledge**: Acquired knowledge will be used to recognize key technological processes and management models specific to transport systems. **Skills**: Ability to apply theoretical and practical knowledge in transport management. **Competencies**: A systematic approach to understanding standardization, mastering modern business terminology, and practical examples from the field of transport and communications will assist students in their integration into technical and other activities upon graduation and employment.
Sustainable Development Goal (SDG):	• SDG4 – Quality Education • SDG8 – Decent Work and Economic Growth • SDG9 – Industry, Innovation, and Infrastructure • SDG11 – Sustainable Cities and Communities • SDG 12 - Responsible Consumption and Production • SDG 16 - Peace, Justice, and Strong Institutions
Teaching methods:	Oral presentation, discussion, demonstration, group work.
Assessment methods with grading structure:	Assessment includes creativity in lectures and exercises through independent work, partial tests during the course, and the final exam. The criteria for monitoring and evaluating student performance are as follows: • Homework/Seminar/Practical Work: 15 points (%), passed if at least 55% is achieved.

	• First Partial Exam/Test/Knowledge Check: 35 points (%), passed if at least 55% is achieved. • Final Exam (Second Partial): 50 points (%), passed if at least 55% is achieved. • Final Exam (Comprehensive): 85 points (%), passed if at least 55% is achieved. The final exam is organized as written/oral. The student may take the material that was not covered and/or successfully completed during the semester. The required condition for a successful exam is achieving at least 55% of the total points on the partial and final exam parts. A sufficient condition is that the sum of points earned (through homework, attendance, partial, and final exams) is 55. Homework is organized through writing assignments and projects, with no option for resubmission. For students who did not successfully complete the partial exam, the final exam consists of the entire material covered during the course. The make-up exam is organized similarly to the final exam. Student performance after all forms of assessment is graded as follows: a) 10 (A) – Outstanding success with no or minor errors, 95-100 points; b) 9 (B) – Above average, with some errors, 85-94 points; c) 8 (C) – Average, with noticeable errors, 75-84 points; d) 7 (D) – Generally good, but with significant deficiencies, 65-74 points; e) 6 (E) – Meets minimal conditions, 55-64 points; f) 5 (F, FX) – Does not meet minimal conditions, less than 55 points. The overall evaluation of all student obligations during the semester, or the exam grade, is based on the total number of points (%) earned through fulfilling pre-exam obligations and taking partial and final exams, with a maximum of 100 points, determined by the following scale: **Student Obligations** • Attendance in lectures and exercises: - • Homework/Seminar/Practical Work: 15 points (%)

	• First Partial Exam/Test/Knowledge Check: 35 points (%) • Final Exam (Second Partial): 50 points (%) • Final Exam (Comprehensive): 85 points (%)
Literature:	**Mandatory**: 1. Vujadin B. Vešović, „MENADŽMENT U SAOBRAĆAJU“, Univerzitet u Beogradu, Saobraćajni fakultet, 1997. 2. Šefkija Čekić, Ivan Bošnjak, „MENADŽMENT U TRANSPORTU I KOMUNIKACIJAMA“, Fakultet za saobraćaj i komunikacije UNSA, Fakultet prometnih znanosti UNIZG, Sarajevo, Zagreb, 2000. **Supplementary**: 1. Alija Behmen, Sabira Salihović: MATERIJALI I ROBE U TRANSPORTU - Knjiga I, klasifikacija, standardizacija, identifikacija, Fakultet za saobraćaj i komunikacije Sarajevo i DES-Sarajevo, Sarajevo, 2007. 2. Alija Behmen, Sabira Salihović: MATERIJALI I ROBE U TRANSPORTU - Knjiga II, kvalitet: osnove, principi, kontrola, Fakultet za saobraćaj i komunikacije Sarajevo i DES-Sarajevo, Sarajevo, 2008. 3. International/Regional/National Standards

Course code: 02CITOS020101	**Course title: Geographic Information Systems**		
Level: II	**Year: I**	**Semester: I**	**Number of ECTS credits:** 6
Status: Mandatory		**Total number of contact hours: 90** Lectures: 45; Practical Exercises: 30; Seminars and Project Tasks: 15	
Course participants:	Academic staff and associates selected in the field to which the course belongs/course		
Prerequisite for enrollment:	No		
Course goal (goals):	**Familiarizing students with the fundamental concepts of GIS systems, their operational methods, planning, implementation, and potential applications.**		
Topics covered (Units of study):	□ The concept of Geographic Information Systems (GIS) □ Components of GIS □ The process of collecting and manipulating GIS data		

	☐ Structure and models of spatial data ☐ Database management ☐ Coordinate systems, projections, georeferencing ☐ Geographic data bases ☐ Standardization in GIS ☐ Output data and cartography ☐ Techniques for graphical representation ☐ Principles of layered representation of spatial data ☐ Areas of application and basic GIS functions ☐ Web and mobile GIS ☐ Application of GIS in telecommunications infrastructure planning ☐ Application of GIS in transportation infrastructure planning
Learning outcomes:	**Knowledge:** Students will become familiar with the fundamental concepts of GIS development and standardization, the principles of web and mobile GIS systems, and their specific applications with a particular focus on transportation and communications. They will learn about the process of developing GIS systems, from the initial idea and need for GIS, through data collection and formation of GIS databases, to georeferencing, graphical representation, and the use of GIS systems. **Skills:** Students will acquire proficiency in specific software tools needed for designing and developing GIS systems. **Competencies:** After passing the exam, students will be capable of planning, designing, and developing GIS systems, and selecting appropriate technologies for developing specific solutions.
Sustainable Development Goal (SDG):	**SDG 9 – Industry, Innovation, and Infrastructure** **SDG 11 – Sustainable Cities and Communities**
Teaching methods:	The course is delivered through lectures, practical exercises, and hands-on laboratory work. Lectures are conducted through oral presentations with slides and practical examples. Exercises and laboratory work involve the use of software tools to address specific problems and practical tasks. Students will be required to prepare and present seminar papers and/or project tasks. Various methods are employed during the course, including oral presentations, discussions, demonstrations, individual and group work, etc.
Assessment methods with grading structure:	**Grading and Evaluation:**

	The total number of points a student can earn during the course is 50, with another 50 points available in the final exam. The points for the course are distributed among assignments and activities and/or seminar papers and/or project tasks, and the partial exam. The final/re-sit exam covers material not included in the partial exam, meaning it includes the second part of the material worth 50 points for students who have passed the partial exam. Students who have not passed the material covered in the partial exam will take the material from both the partial and final exams. The final/re-sit exam will be organized as a written and/or oral exam, including a practical component. The overall evaluation of all student obligations during the semester, including the exam grade, is based on the total number of points earned from fulfilling pre-exam obligations, the partial exam, and the final exam. Based on the quality of acquired knowledge and skills, a student can earn a maximum of 100 points, according to the following scale: **Grading Structure:** • Seminar / Class Participation / Project Task: 20 points (20%) • First Test / First Knowledge Check (Partial Exam): 30 points (30%) • Final or Re-sit Exam (Second Partial Exam): 50 points (50%) **Passing Criteria:** To pass, a student must earn at least 55 points in total and achieve at least 55% of the points on the knowledge checks (partial exam and final/re-sit exam). **Final Grade System:** After all forms of knowledge assessment, the student's performance is evaluated and graded as follows: a) 10 - Excellent performance with no errors or minimal errors (95-100 points) b) 9 - Above average, with a few errors (85-94 points) c) 8 - Average, with noticeable errors (75-84 points) d) 7 - Generally good, but with significant deficiencies (65-74 points) e) 6 - Meets minimum requirements (55-64 points) f) 5 - Does not meet minimum requirements (less than 55 points)
Literature:	Mandatory:

	– Alem Čolaković, "Geographic Information Systems (LECTURE NOTES)," Faculty of Traffic and Communications, Sarajevo, 2023. Supplementary: – Kang Tsung Chang, „*Introduction to Geographic Information Systems*“, McGraw-Hill Education, 2019. – Paul Bolstad, „*GIS Fundamentals A First Text on Geographic Information Systems,*“ Eider Press, 2016. – Ian Heywood, Sarah Cornelius, „*An introduction to geographical information systems*“, Pearson Education Limited, 2006. – Kurt Menke, Richard Smith Jr., Luigi Pirelli, John Van Hoesen, „*Mastering QGIS*“,“ Packt Publishing Ltd., 2016. – Gábor Farkas, „Practical GIS,“ Packt Publishing Ltd., 2017. – Anita Graser, „*Learning QGIS*,“ Packt Publishing Ltd., 2016. – Ralph M. Stair, George W. Reynolds, „*Fundamentals of Information Systems*,“ Cengage Learning, 2016. – Alan Dennis, Barbara Haley Wixom, Roberta M. Roth, „*Systems analysis and design*,“ Wiley, 2015. – Patricia Wallace, „*Introduction to Information Systems*,“ Pearson Education, 2015. – Arthur M. Langer, „*Analysis and Design of Information Systems, Springer-Verlag*,“ 2008. – John Wang, „*Innovations in Supply Chain Management for Information Systems*,“ Business Science Reference, 2010. – Christos Kalloniatis: “*Modern Information Systems*,“ InTech Croatia, 2012.

Course code: 03CITOS020101	**Course title: Optimal Solutions Theory**		
Level: II	**Year: I**	**Semester: I**	**Number of ECTS credits:** 6
Status: Mandatory course		**Total number of contact hours: 90** Optional breakdown of hours by type: Lectures 45 Tutorials 45	
Course participants:	**Academic staff and associates selected in the field to which the course belongs/course**		

Prerequisite for enrollment:	No
Course goal (goals):	To provide students with knowledge related to the concepts and methods of solving optimization problems, with a special emphasis on solving problems that are present in transport and communication technologies.
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	• Introduction to operational research. Models and methods of operational research. Mathematical models in operational research tasks. • Linear programming. Definition of the LP problem. Characteristics of the LP model. Duality. Solving the LP problem using the simplex method. • Transport problem. Formulation and mathematical model of the transport problem. The method of determining the base allowable solution. • Transport problem. Diagonal method. Method of minimum prices in rows. The method of past prices in columns. Determining the optimal solution of the transport task. • Non-linear programming. Introduction to nonlinear programming. Application of the optimization method of nonlinear programming. • Graph theory. Basic terms in graph theory. • Graph theory. Application of graph theory in traffic • Network planning. Introduction to network planning. Structure analysis and basic elements of network planning. CPM critical path method. • Network planning. PERT METHOD. The concept of a PERT network. Comparison of parameter calculations by CPM and PERT methods • Dynamic programming. Characteristics of the dynamic programming model. The procedure for solving the minimum flow in the network. Procedure for solving the problem of maximum flow in the network. • Dynamic programming. The problem of optimal investment. The problem of optimal production planning. • Algorithms. Concept and properties of algorithms. Basic algorithmic structures. • Solving vehicle routing problems • Matrix gamesNumerical optimization methods with application in the MATLAB program
Learning outcomes:	Knowledge: After listening and passing the course, the student should have the basic theoretical knowledge necessary for the application of various optimization methods. Skills: With the knowledge acquired in this course, the student will be able to see the role and significance of optimization for the decision-

	making process and the benefits that can be realized through its application. Competencies: Students are trained to model optimization problems using appropriate methodologies in order to solve various real problems from traffic and communications with the help of computers.
Sustainable Development Goal (SDG):	SDG4 – Quality Education, SDG8 - Decent work and economic growth, SDG9 - Industry, innovation and infrastructure
Teaching methods:	The content of the course is carried out through three activities: Lectures in the hall for all students conducted by the teacher during which theoretical aspects are presented along with solving numerical problems and practical examples. The lecture takes place with the use of video and audio recordings. Exercises: The topics studied in the lectures are elaborated on in the tutorials (solving specific problems and discussions) Laboratory exercises: Implementation and demonstration of algorithms discussed in lectures. Solving classes of problems covered in lectures. Matlab/Simulink will be used for implementation.
Assessment methods with grading structure:	Student obligations ..... Points (%) Attendance at lectures and exercises.....Record without points Tasks during the lesson.....15 points (%) I Partial exam/Test/Knowledge check/*.....20 points + 15 theory points (%) II Partial /Test/Knowledge check/*.....20 points + 15 theory points (%) Oral examination..... .....20 points (%) *For a positive check of the partial exams, it is necessary to score a minimum of 10 on the assignments or 7.5 on the theory. The final success of the student, after all the foreseen forms of knowledge verification, is evaluated and evaluated by the grading system as follows: a) 10 (A) - exceptional success without mistakes or

	with minor mistakes, carries 95-100 points; b) 9 (B) - above average, with some errors, carries 85-94 points; c) 8 (C) - average, with noticeable errors, carries 75-84 points; d) 7 (D) - generally good, but with significant shortcomings, carries 65-74 points; e) 6 (E) - meets the minimum requirements, carries 55-64 points; f) 5 (F, FX) - does not meet the minimum requirements, 0 – 55 points.
Literature:	Mandatory: 4. Husein Pašagić, Matematičko modeliranje i teorija grafova, FPZ, Zagreb, 1998. 5. D. Lipovac, D. Letić, Metode operacionih istraživanja, Univerzitet u Novom Sadu, Zrenjanin, 1999. 6. Corne, D., Dorigo, M., Glover, F.: New Ideas in Optimization, Mc Graw Hill, 1999 Crainic, T.G., Laporte, G.: Fleet Managment and Logistics, Kluwer, 1998 Supplementary: 3. Damir Vučina, Metode inženjerske numeričke optimizacije, FESB, Split, 2005. 4. Dr. Aleksandar Zečević, Operaciona istraživanja, Viša poslovna škola Beograd, 2000.

Course code: 04CITOS020101	**Course title: Safety and Protection of Information and Communications Systems**		
Level: II	**Year: I**	**Semester: I**	**Number of ECTS credits: 6**
Status: Mandatory course		**Total number of contact hours: 90**	
Course participants:	**Academic staff and associates selected in the field to which the course belongs/course**		
Prerequisite for enrollment:	None		
Course goal (goals):	The goal of the course Security and protection of information and communication systems is to acquire knowledge and master skills that contribute to the development of security and protection of modern information and communication systems necessary for work in a modern digital environment. Students should familiarize themselves with the basic principles of information security and information and communication systems, standards, types of threats and protections, threat modeling, penetration testing, risk management, computer crime,		

	social engineering, etc.
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	- Introduction to the security and protection of information and communication systems - Challenges in security and protection of modern information and communication systems - Basics of information security - Basics of security of information and communication systems - Information security standards - Types of attacks and threats - Types of protection - Physical security - Risk management - Threat modeling - Computer crime - Computer Incident Response Teams - Penetration testing and ethical hacking - Social engineering
Learning outcomes:	Knowledge: Students will acquire theoretical and practical knowledge about security and protection of information and communication systems and their application in various fields of traffic and communications. Skills: Students are expected to master the skills and tools used in security and protection of information and communication systems. Competencies: Students will be trained to participate in activities related to security and protection of information and communication systems in the context of traffic and communications.
Sustainable Development Goal (SDG):	SDG 4 – Quality education SDR 9 – Industry, innovation and infrastructure
Teaching methods:	The teaching is realized through lectures, exercises and the practical part of the teaching, which includes the creation of seminar papers. Lectures are carried out through oral presentation with presentation and presentation of examples from practice, and initiation of discussion. Students will be required to create and present seminar papers and/or

	project assignments. Different methods are used in teaching, including: oral presentations and discussions, demonstration of examples, methods of graphic and video presentations and strengthening of work in groups by applying appropriate methodological approaches.
Assessment methods with grading structure:	The criteria for evaluating the student's work and evaluation during classes is as follows: Activity (seminar paper / project assignment): from 0 to 15 points; 1st test / 1st knowledge test / 1st partial exam: from 0 to 35 points. The total number of points that a student can obtain during classes is a maximum of 50 points. The final/remedial exam includes the material that the student did not pass on the partial exam, which means that it includes the second part of the material (II partial) which is evaluated with 50 points or consists of the complete material, i.e. I and II partial exam. The total evaluation of all the student's obligations during the semester, i.e. the grade on the exam, is based on the total number of points (%) that the student obtained by fulfilling the pre-exam obligations, passing the partial and final exams. According to the quality of acquired knowledge and skills, a student can win a maximum of 100 points, and according to the following scale: Scoring structure Points (%) Seminar / Project assignment:..... 15 points (%) 1st test / 1st knowledge test (1st partial exam). 35 points (%) Final or remedial exam (II partial exam):..... 50 points (%) The required condition for successfully completing the exam is a score of 55 points, where a minimum of 55% must be achieved in each part of the exam (activity, partial exam, final exam), i.e. in order to pass the exam, the student must meet the following conditions: - Activity (seminar paper / project assignment): 9 points - 1st test / 1st knowledge test / partial exam: 19 points - Final or remedial exam (II partial exam): 27 points

	Students who passed the partial exam take only the second part of the material (the part that is not included in the partial exam) on the final/remedial exam. Students who did not pass the partial exam take the complete material as part of the final/remedial exam, while the criteria for passing the exam remain identical. The final / make-up exam is organized as written and/or oral. The activity can be followed through the creation of homework, seminar papers, project tasks or taking quizzes. The final success of the student, after all the foreseen forms of knowledge verification, is evaluated and graded by the grading system as follows: a) 10 - exceptional success without errors or with minor errors, carries 95-100 points; b) 9 - above average, with some errors, carries 85-94 points; c) 8 - average, with noticeable errors, carries 75-84 points; d) 7 - generally good, but with significant shortcomings, carries 65-74 points; e) 6 - meets the minimum requirements, carries 55-64 points; f) 5 - does not meet the minimum requirements, less than 55 points.
Literature:	Mandatory: - Whitman, M.E., Mattord, H.J.: Principles of Information Security, Course Technology, Cengage Learning, 2012. - Baraković, S., Baraković Husić, J.: „Osnove modelovanja prijetnji u oblasti informaciono-komunikacijskih sistema“, Dobra knjiga, 2022. Supplementary: – Stamp, M.: Information Security: Principles and Practice, Wiley, 2011. – Rao, U.H., Nayak, U.: The InfoSec Handbook: An Introduction to Information Security, Apress Open, 2014. – Mrdović, S.: Sigurnost računarskih sistema, Univerzitet u Sarajevu, 2014. – Internet.

Course code: 05CITOS020101	**Course title: Advanced Methods in Software Engineering**

Level: II	**Year: I**	**Semester: I**	**Number of ECTS credits:** 6
Status: Mandatory		**Total number of contact hours: 90** Lectures: 45 Tutorials: 30 Seminars: 15	
Course participants:	**Academic staff and associates selected in the field to which the course belongs/course**		
Prerequisite for enrollment:	No		
Course goal (goals):	Acquisition of knowledge from advanced methods of software engineering through selected chapters, as well as acquisition of skills required for a practical and professional approach to software engineering in various types of software projects.		
Topics covered (Units of study):	• Introduction to software engireering • Software processes, tools and methods of SE • Software requirements engineering • System modeling, UML • Design, Object oriented approach • Implementation • Verification, Validation • Maintenance, Software evolution • Software measurement, Software metrics • Project management • Software reuse, Component based SE • Agile methods • Service oriented SE		
Learning outcomes:	Knowledge: Demonstrate advanced knowledge and skills in software engineering, as well as a professional approach to practical software engineering. Skills: Plan and create major activities and deliverables throughout the software development life cycle. Participate as an individual or team member in creating and delivering quality software systems. Apply object-oriented methodology in SE. Apply project management approaches in EE environment. Competencies: Understand and interpret other advanced and modern SE methods and approaches.		

	Differentiate and compare software development models. Use the principles of software engineering.
Sustainable Development Goal (SDG):	SDG5 - Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. Target 4.3 - By 2030, ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university.
Teaching methods:	The teaching is realized through lectures, exercises and the practical part of the teaching, which includes the creation of project tasks. Lectures are conducted through oral presentation with presentation and presentation of examples from practice. Discussions are initiated on various issues and problems in software engineering. Students will be required to prepare and present seminar papers and/or project assignments. Different methods are used in teaching, including: oral presentations and discussions, demonstration of examples, methods of graphic and video presentations and strengthening of work in groups by applying appropriate methodological approaches.
Assessment methods with grading structure:	The criteria for evaluating the student's work and evaluation during classes is as follows: Individual activity (seminar work / project assignment): from 0 to 10 points; Group activity (seminar work / project assignment): from 0 to 20 points; I test / I partial exam: from 0 to 35 points. The final/remedial exam includes the material that the student did not pass on the partial exam, which means that it includes the second part of the material (II partial) which is evaluated with 35 points or consists of the complete material, i.e. I and II partial exam. The total evaluation of all the student's obligations during the semester, i.e. the grade on the exam, is based on the total number of points (%) that the student earned by fulfilling the pre-exam obligations, passing the partial and final exams. According to the quality of acquired knowledge and skills, a student can acquire a maximum of 100 points, and according to the following scale: <u>Scoring structure</u> <u>Points (%)</u>

	Individual project/Seminar work: 10 points (%) Group project: 20 points (%) I test (I partial exam): 35 points (%) Final or remedial exam (II parc.exam): 35 points (%) The required condition for successfully completing the exam is a score of 55 points, where a minimum of 50% must be achieved in the following parts, i.e. in order to pass the exam, the student must meet the following conditions: • I test/partial exam: 17.5 points • Final or remedial exam (II partial exam): 17.5 points Students who passed the partial exam take only the second part of the material (the part that is not included in the partial exam) on the final/remedial exam. Students who did not pass the partial exam take the complete material as part of the final/remedial exam, while the criteria for passing the exam remain identical. The final / make-up exam is organized as written and/or oral. The activity can be followed through the creation of homework, seminar papers, project tasks or taking quizzes. The final success of the student, after all the foreseen forms of knowledge verification, is evaluated and graded by the grading system as follows: a) 10 - exceptional success without errors or with minor errors, carries 95-100 points; b) 9 - above average, with some errors, carries 85-94 points; c) 8 - average, with noticeable errors, carries 75-84 points; d) 7 - generally good, but with significant shortcomings, carries 65-74 points; e) 6 - meets the minimum requirements, carries 55-64 points; f) 5 - does not meet the minimum requirements, less than 55 points. The above scale can be adjusted according to the Rules of studying at the University of Sarajevo (Article 45).

Literature:	Mandatory: Teaching material available on the teaching portal of the Faculty of Traffic and Communications. Bakir Karahodža, Metode i procesi softverskog inžinjeringa, FSK Sarajevo, 2023. Dženana Đonko, Objektno orijentirana analiza i dizajn primjernom UML notacije, ETF Sarajevo, 2009. Supplementary: I.Sommerville: Software Engineering, 10-th Edition. Pearson Education Inc, Boston MA, USA, 2015. S.R.Schach: Object-Oriented and Classical Software Engineering, 8-th Edition. McGraw-Hill, New York, 2010. R.S.Pressman: Software Engineering - A Practitioner's Approach, 8-th Edition. McGraw-Hill, New York, 2009. E.J. Braude, M.E. Bernstein: Software Engineering – Modern Approaches. John Wiley and Sons, New York, 2010. S.L. Pfleeger, J.M. Atlee: Software Engineering - Theory and Practice, 4-th Edition. Prentice Hall, Englewood Cliffs NJ, 2009. F. Tsui, O. Karam, B. Bernal: Essentials of Software Engineering, 3-rd Edition. Jones & Bartlett Publishers, Sudbury MA, 2013.

Course code: 06CITOS020102	**Course title: Systems Engineering and Management**		
Level: II	**Year: I**	**Semester: II**	**Number of ECTS credits: 6**
Status: Mandatory Course		**Total number of contact hours: 90** Optional breakdown of hours by type: Lectures: 45 Tutorials: 45 Seminars Fieldwork: Laboratory Tutorials: Practice Concert activies …	

Course participants:	**Academic staff and associates selected in the field to which the course belongs/course**
Prerequisite for enrollment:	None
Course goal (goals):	Understanding the basic principles of network planning and application to practical problems.
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	1. Introduction 2. Fundamental Definitions of Systems Engineering and Management 3. Development of Systems Thinking and Methodologies 4. Critical Systems Thinking and Complementarism 5. Systems Diagrams and Tools 6. Defining and Developing Systems 7. Systems Analysis 8. Systems Dynamics 9. Software Engineering 10. Clios Methodological Approach 11. Systems Knowledge Management 12. Ecology of Systems Knowledge and Professional Ethics 13. Klir-Orchard Paradigm 14. GSPS. Morphological Network for Problem Solving 15. Development of GSPS with Examples
Learning outcomes:	**Knowledge**: Acquired knowledge will be used for recognizing key technological processes and solving specific problems in transportation systems, based on a systems approach. **Skills**:: Ability to apply theoretical and practical knowledge from the field of management in transportation. **Competencies**: A systems approach to understanding systems management and its application in the field of management, mastering modern business terminology, as well as presented practical examples from the areas of transportation and communications, will aid students in their involvement in technical and other activities upon graduation and employment.
Sustainable Development Goal (SDG):	• SDG4 – Quality Education • SDG8 – Decent Work and Economic Growth • SDG9 – Industry, Innovation, and Infrastructure • SDG11 – Sustainable Cities and Communities • SDG12 – Responsible Consumption and Production • SDG16 – Peace, Justice, and Strong Institutions
Teaching methods:	Oral presentation, discussion, demonstration, group work.
Assessment methods with	Assessment of creativity in lectures and exercises through independent

grading structure:	work, assessment of partial tests during the course as well as the final exam. The criteria for monitoring work and assessing students during the course are as follows: • Homework/Seminar/Practical Work: 15 points (%), passed if at least 55% is achieved. • First Partial Exam/Test/Knowledge Check: 35 points (%), passed if at least 55% is achieved. • Final Exam (Second Partial): 50 points (%), passed if at least 55% is achieved. • Final Exam (Comprehensive): 85 points (%), passed if at least 55% is achieved. The final exam is organized as a written/oral exam. Students may take the final exam for material they did not complete or pass during the semester. The necessary condition for a successful exam is achieving at least 55% of the maximum points on partial and final exams, and a sufficient condition is that the total number of points (through homework, attendance, partial exams, and final exam) is 55. Homework is organized through writing assignments and projects. Homework cannot be revised. For students who did not pass the partial exam, the final exam covers all the material taught during the semester. A retake exam is organized similarly to the final exam. The final success of the student after all forms of knowledge assessment is evaluated and graded using the following grading system: g) 10 (A) – Outstanding success with no or minor errors, 95-100 points; h) 9 (B) – Above average, with some errors, 85-94 points; i) 8 (C) – Average, with noticeable errors, 75-84 points; j) 7 (D) – Generally good, but with significant deficiencies, 65-74 points; k) 6 (E) – Meets minimal conditions, 55-64 points; l) 5 (F, FX) – Does not meet minimal conditions, less than 55 points. The overall evaluation of all student obligations during the semester, or the grade on the exam, is based on the total number of points (%) obtained by fulfilling pre-exam obligations and taking partial and final exams, according to the quality of acquired knowledge and skills, and

	includes a maximum of 100 points, determined according to the following scale: **Student Obligations** **Points (%)** Attendance at lectures and exercises - Homework/Seminar/Practical Work 15 points (%) First Partial Exam/Test/Knowledge Check 35 points (%) Final Exam (Second Partial) 50 points (%) Final Exam (Comprehensive) 85 points (%)
Literature:	**Mandatory**: 1. Čaušević S, Bošnjak I, SUSTAVSKO INŽENJERSTVO U TRANSPORTU I KOMUNIKACIJAMA, Univerzitet u Sarajevu, Fakultet za saobraćaj i komunikacije, Sarajevo, 2006. 2. Čaušević S, Bošnjak I, SUSTAVSKO INŽENJERSTVO I MENADŽMENT, Univerzitet u Sarajevu, Fakultet za saobraćaj i komunikacije, Sarajevo, 2011. 3. Lecture notes and slides **Supplementary**:

Course code: 07CITOS020102	**Course title:** Web Programming		
Level: II	**Year: I**	**Semester: II**	**Number of ECTS credits:** 6
Status: Mandatory		**Total Hours**: 90 45 hours of lectures, 30 hours of exercises 15 seminars/labs	
Course participants:	**Academic staff and associates selected in the field to which the course belongs/course**		
Prerequisite for enrollment:	None		
Course goal (goals):	To provide theoretical and practical knowledge of advanced web development. Equip students with practical skills in developing advanced web applications. Introduce students to the implementation of artificial intelligence in business solutions. Acquaint students with advanced web programming. Build competencies to enable students to		

	be competitive in the labor market and gain sufficient expertise to offer their services to business entities as mid-level full-stack developers.
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	1. Advanced JavaScript functionalities 2. JavaScript development frameworks 3. Promises 4. JS OOP 5. Advanced events 6. .NET Core 7. Entity Framework 8. ML.NET – AI in business solutions – Recommendation systems 9. Other AI functionalities in web applications – Predictions and classifications 10. Container-based application delivery 11. DevOps 12. Web-based applications
Learning outcomes:	**Knowledge:** Advanced full-stack development knowledge **Skills:** Back-end and front-end development **Competencies:** Mid-level full-stack developer
Sustainable Development Goal (SDG):	"SDG4 – Quality Education,"
Teaching methods:	Lectures – Theoretical foundations Exercises – Practical application of theoretical knowledge Laboratory exercises – Hands-on project work
Assessment methods with grading structure:	Seminar paper and exam
Literature:	Mandatory: 1. *Basics of Web Development and Design* Babovic E., Music D., 2021 Supplementary: 1. *Beginning ASP.NET 4.5 in C#* MacDonald M. 2. *You Don't Know JS (Yet)* Simpson K. 3. *Pro ASP.NET Core 6* Freeman A.

Course code: 08CITOS020102	**Course title: Distributed Computer Systems**		
Level: II	**Year: II**	**Semester: I**	**Number of ECTS credits: 6**
Status: Mandatory		**Total number of contact hours: 90**	

	Lectures: 45 Tutorials: 30 Seminars: 15
Course participants:	**Academic staff and associates selected in the field to which the course belongs/course**
Prerequisite for enrollment:	No
Course goal (goals):	Acquiring knowledge about the concept of cloud computing, how it works and the positive sides and problems in using this concept.
Topics covered (Units of study):	• Introduction to cloud computing, standardization • Architecture of cloud computing • Delivery models: IaaS, PaaS, SaaS • Public, private, national and hybrid clouds • Infracture-as-a-service from perspectives of cloud providers and users • Positive aspects and problems in using cloud computing • Security aspects and privacy protection • Migration from the classic concept to the cloud • Data centers • Capacity planning • Service quality management in cloud computing • Advanced technologies and concepts
Learning outcomes:	Knowledge: Students who complete this course will gain knowledge about the basic concepts of cloud computing and how cloud computing techniques are implemented in commercial cloud systems. Skills: Cooperation in learning through pair or group work, presentation skills, research skills on a given topic. Competencies: Students who complete this course will acquire competencies related to the infrastructure needed for the implementation and use of cloud services, what cloud computing services look like and how they are implemented from the user and provider side, security mechanisms, as well as economic and technical aspects of using cloud computing.
Sustainable Development Goal (SDG):	SDG5 - Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. Target 4.3 - By 2030, ensure equal access for all women and men to

	affordable and quality technical, vocational and tertiary education, including university.
Teaching methods:	The teaching is realized through lectures, exercises and the practical part of the teaching, which includes the creation of project tasks. Lectures are conducted through oral presentation with presentation and presentation of examples from practice. Discussions are initiated on various issues and problems in software engineering. Students will be required to prepare and present seminar papers and/or project assignments. Different methods are used in teaching, including: oral presentations and discussions, demonstration of examples, methods of graphic and video presentations and strengthening of work in groups by applying appropriate methodological approaches.
Assessment methods with grading structure:	The criteria for evaluating the student's work and evaluation during classes is as follows: Individual activity (seminar work / project assignment): from 0 to 10 points; Group activity (seminar work / project assignment): from 0 to 20 points; I test / I partial exam: from 0 to 35 points. The final/remedial exam includes the material that the student did not pass on the partial exam, which means that it includes the second part of the material (II partial) which is evaluated with 35 points or consists of the complete material, i.e. I and II partial exam. The total evaluation of all the student's obligations during the semester, i.e. the grade on the exam, is based on the total number of points (%) that the student earned by fulfilling the pre-exam obligations, passing the partial and final exams. According to the quality of acquired knowledge and skills, a student can acquire a maximum of 100 points, and according to the following scale: Scoring structure — Points (%) Individual project/Seminar work: 20 points (%) Group project: 10 points (%) I test (I partial exam): 35 points (%) Final or remedial exam (II parc.exam): 35 points (%)

	The required condition for successfully completing the exam is a score of 55 points, where a minimum of 50% must be achieved in the following parts, i.e. in order to pass the exam, the student must meet the following conditions: • I test/partial exam: 17.5 points • Final or remedial exam (II partial exam): 17.5 points Students who passed the partial exam take only the second part of the material (the part that is not included in the partial exam) on the final/remedial exam. Students who did not pass the partial exam take the complete material as part of the final/remedial exam, while the criteria for passing the exam remain identical. The final / make-up exam is organized as written and/or oral. The activity can be followed through the creation of homework, seminar papers, project tasks or taking quizzes. The final success of the student, after all the foreseen forms of knowledge verification, is evaluated and graded by the grading system as follows: a) 10 - exceptional success without errors or with minor errors, carries 95-100 points; b) 9 - above average, with some errors, carries 85-94 points; c) 8 - average, with noticeable errors, carries 75-84 points; d) 7 - generally good, but with significant shortcomings, carries 65-74 points; e) 6 - meets the minimum requirements, carries 55-64 points; f) 5 - does not meet the minimum requirements, less than 55 points. The above scale can be adjusted according to the Rules of studying at the University of Sarajevo (Article 45).
Literature:	Mandatory: Teaching material available on the teaching portal of the Faculty of Traffic and Communications. Supplementary: T. ERL: Cloud Computing: Concepts, Technology & Architecture, Prentice Hall, Massachusetts, 2013. R. Rafaels: Cloud Computing: From Beginning to End, 2015.,

	M. Cavis: Architecting the Cloud, Prentice-Hall, Wiley, 2014

Course code: 09-10-1CITES020102	**Course title: LOCATION AND NAVIGATION SYSTEMS**		
Level: II	**Year: I**	**Semester: II**	**Number of ECTS credits:** 6
Status: Mandatory/Elective		**Total number of contact hours:** 90 **Lectures:** 45 **Tutorials:** 30 **Laboratory work:** 15	
Course participants:	**Academic staff and associates selected in the field to which the course belongs/course**		
Prerequisite for enrollment:	None		
Course goal (goals):	The goal of the course is to introduce students to the reasons for the emergence, development, application, and importance of LCS and LBS services. The course will cover user positioning techniques in communication networks and networks designed exclusively for positioning, as well as positioning techniques in both indoor and outdoor systems.		
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	1. Origins and terminology in location and navigation systems 2. Classification of positioning methods 3. Standardization of LCS services 4. Integrated and standalone positioning methods 5. Mobile-based and network-based positioning methods 6. Radio signal propagation 7. Satellite positioning methods 8. Positioning methods in cellular radio systems 9. Indoor positioning methods (WLAN and Bluetooth) 10. Indoor positioning methods (infrastructure systems, cameras, infrared technology) 11. Algorithms for determining user location 12. User positioning in LTE networks 13. Application of location and navigation systems 14. Privacy and security aspects of user protection 15. Future of LBS services: User requirements and expectations		
Learning outcomes:	**Knowledge:** Students will acquire theoretical and technical knowledge of the realization of location and navigation services. They will learn		

	about the technologies and mathematical methods used for user positioning in various systems. **Skills:** Students will develop the ability to assess the accuracy, cost, and feasibility of implementing positioning and navigation systems. They will be capable of selecting appropriate positioning methods for specific areas through comparative analysis. **Competencies:** Students will be competent in independently selecting, analyzing, and solving problems related to user positioning in both indoor and outdoor environments. They will also be capable of applying privacy and security measures to protect user data in location-based services.
Sustainable Development Goal (SDG):	SDG9 – Industry, Innovation, and Infrastructure SDG11 – Sustainable Cities and Communities
Teaching methods:	Lectures, tutorials, laboratory work/fieldwork/practice. The following methods will be employed: oral presentations, discussions, demonstrations, graphical and software visualizations, and group work. Lectures will cover theoretical concepts, with examples and problem-solving tasks. Additional examples will be explored in tutorials using relevant software tools. Laboratory work/fieldwork will develop individual and team skills necessary to complete tasks from the given field.
Assessment methods with grading structure:	Assessment methods with grading structure: Creativity in class and exercises will be evaluated through independent work, partial exams during the course, and a final exam. The grading criteria during the course are as follows: • Homework/seminar work/practical work: 15 points (%), passed if more than 50% is achieved. • I Partial exam/test/knowledge check: 35 points (%), passed if more than 50% is achieved. • Final exam (II Partial): 50 points (%), passed if more than 50% is achieved. The total number of points (%) that a student can achieve during the course is a maximum of 50 points (%), and with the Final exam (II Partial) it totals 100 points (%). For students who do not pass the I Partial exam or the Final exam, a make-up exam is organized, where both parts

	must be passed with at least 50% of the points. The final success of the student, after all the forms of knowledge assessment, is graded as follows: a) 10 (A) - exceptional success without mistakes or with minor mistakes, 95-100 points b) 9 (B) - above average, with some mistakes, 85-94 points c) 8 (C) - average, with noticeable mistakes, 75-84 points d) 7 (D) - generally good, but with significant shortcomings, 65-74 points e) 6 (E) - meets the minimum requirements, 55-64 points f) 5 (F, FX) - does not meet the minimum requirements, less than 55 points The overall evaluation of the student's obligations during the semester and the exam grade is based on the total number of points (%) the student has earned by fulfilling pre-exam obligations and passing partial and final exams, with a maximum of 100 points, and is determined according to the following scale: Student obligations: • Attendance at lectures and exercises • Homework/Seminar/Practical work: 15 points (%) • I Partial exam/Test/Knowledge check: 35 points (%) • Final exam (II Partial): 50 points (%)
Literature:	Mandatory: • Course material available on the Faculty website. Supplementary: • A. Bensky, Wireless Positioning Technologies and Applications, Artech House, 2008 • R. Mautz, Indoor Positioning Technologies, Školska knjiga, Zurich, 2012 • J. Figueiras, S. Frattasi, Mobile Positioning and Tracking, Wiley, 2010 • A. Tanenbaum, D. Wetherall, Computer Networks (5th edition), Mikro knjiga, 2012

Course code: 09-10-2CITES020102	**Course title: Information Systems of Network Operators**

Level: II	**Year: I**	**Semester: II**	**Number of ECTS credits:** 6
Status: Elective		**Total number of contact hours: 90** □ Lectures: 45 □ Exercises: 30 □ Seminars and project tasks: 15	
Course participants:	**Academic staff and associates selected in the field to which the course belongs/course**		
Prerequisite for enrollment:	No		
Course goal (goals):	Introduction to the principles, tools, and methodologies of designing and developing information systems, with a focus on systems used by network operators.		
Topics covered (Units of study):	□ Introduction to the fundamental concepts of information systems development □ Types of information systems and their application in network operators □ Modeling and design of information systems □ Requirements for information systems: gathering and analysis of requirements (Use Case; UML) □ CASE tools for planning, designing, construction, and documentation □ Tools for supporting teamwork and project progress tracking □ Information systems development models: waterfall models, iterative and incremental models, Boehm's spiral model □ Prototyping-based information systems development models □ Agile development methods: SCRUM, XP, FDD, DSDM, Crystal, ASD □ Process modeling and reengineering: Workflow, blueprint, Gantt charts, and DFD diagrams □ IT service management and ITIL □ Concepts of Service-Oriented Architecture (SOA) □ ERP systems and their application in transportation and communications		

Learning outcomes:	**Knowledge:** Students will acquire the knowledge and skills necessary for planning, modeling, and designing information systems. They will also become familiar with some of the most commonly used methodologies, with a focus on agile approaches such as SCRUM, and tools for process modeling and reengineering. **Skills:** Students are expected to master the skills and CASE tools used in the design and development of information systems. **Competencies:** The acquired knowledge and skills will enable students to participate in development teams engaged in planning, designing, and developing information systems, using appropriate methodological approaches and CASE tools.
Sustainable Development Goal (SDG):	**SDG 9 – Industry, Innovation, and Infrastructure** **SDG 11 – Sustainable Cities and Communities**
Teaching methods:	Teaching is carried out through lectures, exercises, and practical components that include the completion of project assignments. Lectures are delivered through oral presentations with the aid of visual examples from practice. Discussions are initiated on the issues of planning, modeling, and analyzing information systems. Students will be required to prepare and present seminar papers and/or project assignments. Various methods are used in teaching, including: oral presentations and discussions, demonstrations of examples, graphical and video presentations, and an emphasis on group work using appropriate methodological approaches.
Assessment methods with grading structure:	Evaluation and Grading of Student Work During the Course: Evaluation and grading of student work during the course are carried out as follows: • Activity (seminar paper and in-class activities): 0 to 20 points • Partial Exam: 0 to 30 points The total number of points a student can earn during the course is a maximum of 50 points. The final/make-up exam covers material not passed in the partial exam and is worth 50 points. If a student has not passed the partial exam, they will take a separate section on the material covered in the partial exam during the final/make-up exam.

	Based on the quality of the acquired knowledge and skills, a student can earn a maximum of 100 points, according to the following scale: Scoring Structure • In-Class Activities: 20 points (%) • Partial Exam: 30 points (%) • Final/Make-up Exam: 50 points (%) Overall student evaluation and grade formation are based on the total number of points (%) earned through completing exam obligations and meeting specific criteria. A passing result requires achieving at least 55 points, with a minimum of 55% in each exam component (partial exam, final/make-up exam). The final/make-up exam may be organized as written and/or oral. Activity can be evaluated through assignment completion, seminar papers, quizzes, and in-class activities. Students are required to attend classes in accordance with the Study Regulations. The final success of the student, after all forms of knowledge verification, is graded according to the following system: • 10 (Outstanding): 95-100 points, flawless or with minor errors • 9 (Above Average): 85-94 points, with some errors • 8 (Average): 75-84 points, with noticeable errors • 7 (Generally Good): 65-74 points, with significant deficiencies • 6 (Satisfactory): 55-64 points, meets minimal requirements • 5 (Unsatisfactory): Less than 55 points, does not meet minimal requirements
Literature:	Mandatory: – Alem Čolaković, " Information Systems of Network Operators (LECTURE NOTES)," Faculty of Traffic and Communications, Sarajevo, 2023. Supplementary:

	– Andrew Stellman, Jennifer Greene, "Learning Agile: Understanding Scrum, XP, Lean, and Kanban," O'Reilly Media, 2014. – Klaus-Dieter Gronwald, "Integrated Business Information Systems: A Holistic View of the Linked Business Process Chain ERP-SCM-CRM-BI-Big Data," Springer-Verlag Berlin Heidelberg, 2017. – Avraham Shtub, Reuven Karni, "ERP: The Dynamics of Supply Chain and Process Management," Springer US, 2010. – Ralph Kimball, Margy Ross, "The Data Warehouse Toolkit: The Complete Guide to Dimensional Modeling," Wiley, 2002. – Ralph M. Stair, George W. Reynolds, „Fundamentals of Information Systems," Cengage Learning, 2016. – Anita Pickerden, „Planning and Managing your Work Based Projects," bookboon.com, 2015. – Richard T. Watson (editor), „Information Systems," Global Text Project (Creative Commons Attribution 3.0 License), 2017, – Patricia Wallace, „Introduction to Information Systems," Pearson Education, 2015. – Alan Dennis, Barbara Haley Wixom, Roberta M. Roth, „Systems analysis and design," Wiley, 2015. – Arthur M. Langer, „Analysis and Design of Information Systems, Springer-Verlag," 2008.

Course code: 09-10-3CITES020102	**Course title: Multimedia Communications and Services**		
Level: II	**Year: II**	**Semester: III**	**Number of ECTS credits:** 6
Status: Elective course		**Total number of contact hours: 45 + 45** Lectures: 45 Tutorials: 45	
Course participants:	**Academic staff and associates selected in the field to which the course belongs/course**		
Prerequisite for enrollment:	No		
Course goal (goals):	The goal of the course is to enable students to understand and apply techniques for processing, encoding, and distributing multimedia signals, and to familiarize them with the infrastructure necessary for the transmission of multimedia services.		
Topics covered (Units of study):	Week 1: Introduction: Concept, sources, and types of multimedia.		

(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)	Division and basics of multimedia: Basics of multimedia, basics of encoding, procedures for creating and executing multimedia content. Planned time: Week 2-3: Formats and multimedia components: Properties and compression of text. Digital image processing. Properties and compression of audio and video. Planned time: Week 4-6: Multimedia services: Basic categories and types of multimedia services. Examples of multimedia services such as videoconferencing, IPTV, internet-based multimedia services, WebRTC. Planned time: Week 7-8: Interactive multimedia content: Introduction to tools and techniques for creating interactive multimedia content, including interactive websites, animations, and games. Planned time: Week 9: Multimedia protocols: Overview of protocols relevant to the implementation of multimedia services. Planned time: Week 10-11: Methods for storing, transmitting, processing, and displaying multimedia data: Overview of different methods for storing, transmitting, and processing multimedia data. Planned time: Week 12-13: UX/UI design for multimedia applications: Basics of user experience (UX) and user interface (UI) design in multimedia applications.

	Planned time: Week 14-15 Software tools for multimedia: Overview of software tools and projects using those tools. Multimedia in virtual reality (VR).
Learning outcomes:	**Knowledge:** The student gains fundamental knowledge of multimedia signals, formats, and protocols, as well as technologies for their processing, compression, and transmission. The student also becomes familiar with basic concepts of digital media, including audio, video, and textual data, and their integration into multimedia systems. **Skills:** Developing practical skills in encoding and compressing various types of multimedia signals, including sound, image, and video. The student is trained to use specific software tools and algorithms for processing multimedia data and optimizing them for different platforms and media. **Competencies:** Competencies for applying acquired knowledge in the design, implementation, and evaluation of multimedia communication systems. The student is capable of analyzing requirements for the transmission and storage of multimedia data and developing solutions that meet technical and user needs in the context of multimedia services and applications.
Sustainable Development Goal (SDG):	**SDG4 – Quality Education:** The course "Multimedia Communications and Services" contributes to ensuring inclusive and quality education by acquiring technical skills and knowledge necessary for the development and application of multimedia technologies, thus providing students with better employment opportunities. **SDG9 – Industry, Innovation, and Infrastructure:** The course "Multimedia Communications and Services" equips students to participate in the construction of modern and innovative infrastructure through the application of advanced multimedia technologies, thereby promoting sustainable industrialization and technological innovation. **SDG11 – Sustainable Cities and Communities:**

	Through the course "Multimedia Communications and Services," students acquire skills necessary for the development and application of multimedia solutions that can contribute to the creation of smart cities and sustainable communities, enabling better connectivity and management of urban resources. **SDG12 – Responsible Consumption and Production:** The course "Multimedia Communications and Services" encourages students to adopt technologies that enable efficient processing and transmission of multimedia data, contributing to the reduction of resource consumption and the optimization of production processes.
Teaching methods:	Lectures: Focused on theoretical aspects of multimedia communications and services, including examples and analysis of the latest research and technologies. Laboratory Exercises: Practical exercises aimed at developing skills in multimedia signal processing, compression, and transmission. Seminars: Students research specific topics related to multimedia communications and prepare seminar papers to present to the group. Practical Projects: Students work on practical projects that involve designing and implementing multimedia communication systems, including the use of relevant software tools.
Assessment methods with grading structure:	**Tests:** 0-10% **Seminar papers:** 0-20% **Partial exam:** 0-35% **Final exam:** 0-35% **Final grade (Total):** 100%
Literature:	Mandatory: Lecture notes and: Quality Control of Communication Services, Nermin Goran, Alem Čolaković, Sarajevo, 2024. Multimedia and Coding, Jasmina Baraković Husić, Enisa Brka, Mesud Hadžialić, Mirko Škrbić, Sarajevo, 2014. Multimedia Communications: Applications, Middleware, Networks, Zoran S. Bojkovic, Dragorad A. Milovanovic, Branko M. Vucetic, CET,

	Belgrade, 2008. Basics of Multimedia Systems, Dragan Milovanović, Akademska misao, Belgrade, 2009. Compression and Transmission of Multimedia Data, Miloš Savić, University of Novi Sad, 2012. Supplementary: Digital Multimedia: Concepts, Methodologies, Tools, and Applications, Information Resources Management Association (IRMA), IGI Global, 2020. Multimedia Foundations: Core Concepts for Digital Design, Vic Costello, Susan Weinschenk, Focal Press, 2016. Multimedia Processing, Communication, and Computing Applications, Sudeep Tanwar, Anup Kumar, N. S. Chaudhari, Springer, 2019.

Course code: 09-10-4CITES020102	**Course title:** **Information Technologies and Freight Forwarding**		
Level: II	**Year: I**	**Semester: II**	**Number of ECTS credits:** 6
Status: Elective		**Total number of contact hours: 90** Optionally elaborate the distribution of hours by type: Lectures 45 Exercises 30 Seminar and project task: 15	
Course participants:	**Academic staff and associates selected in the field to which the course belongs/course**		
Prerequisite for enrollment:	No		
Course goal (goals):	Familiarization with modern information and communication technologies applied in the field of logistics and freight forwarding, specific software tools, and the methods and effects of their application.		
Topics covered (Units of study): *(if necessary, the weekly implementation plan is*	1. Introduction 2. Identification of technological processes in logistics and freight forwarding 3. Identification of key stakeholders in the logistics and freight forwarding chain		

established taking into account the specificities of organizational units)	4. Theoretical foundations of current information technology solutions applied in freight forwarding 5. Importance and application of software applications in managing logistics and freight forwarding systems and implementation of best practices 6. Methodological approaches in designing information technology solutions in logistics and freight forwarding 7. CRM (Customer Relationship Management) in Freight Forwarding and Logistics Companies Planning and optimizing forwarding services - maximizing utility and reducing costs of ordering, booking, and shipping processes 8. Management of import, export, and global foreign trade exchange (harmonized tariffs, foreign trade agreements, INCOTERMS) 9. Software applications for business-to-business SCM (Supply Chain Management) 10. Software applications for managing customs procedures based on EU legislation 11. Software applications for managing warehousing operations 12. Software applications for managing the transport chain 13. Web applications and online services for foreign trade compliance, tariff classification, import-export documentation, electronic reporting, verification 14. Integrating segmented software applications into a holistic logistics- freight forwarding information system (end-to-end management)
Learning outcomes:	Knowledge: Through lectures, exercises, laboratory work, and practical activities, students should acquire the necessary knowledge and skills for practical application through: the development of IT and evaluation of its effects in logistics forwarding, as well as the independent formulation of research objectives and the application of appropriate methods and models for their realization. Skills: A systemic approach to designing IT business processes in logistics forwarding and understanding algorithms as the basis for forwarding software solutions; identifying and using relevant IT solutions in the field of logistics forwarding, critical analysis, evaluation, and synthesis of available knowledge; developing and applying forwarding software management models, and presenting acquired knowledge to professional and scientific audiences. Competencies: Application of acquired knowledge in specific models.
Sustainable Development Goal (SDG):	SDG 4: Quality Education - Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

	SDG 8: Decent Work and Economic Growth - Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all. SDG 9: Industry, Innovation, and Infrastructure - Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation. SDG 12: Responsible Consumption and Production - Ensure sustainable consumption and production patterns. SDG 16: Peace, Justice, and Strong Institutions - Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions at all levels.
Teaching methods:	During the course delivery, the instructor presents individual thematic units (ex cathedra), allows students to follow educational video content (DVDs, video presentations) related to the subject area, and organizes discussions on a given topic (interactive teaching). In practical classes, the discussion and resolution of examples and tasks related to theoretical topics are conducted, and assistance is provided to students in independently solving tasks, and in the preparation of programs, projects, and seminar papers.
Assessment methods with grading structure:	Criteria for assessing and grading students' work during the course are as follows: Seminar Paper / Project Task: 0 to 15 points, passed if over 50% is achieved First Test / First Knowledge Check / First Partial Exam: 0 to 35 points, passed if over 50% is achieved Final Exam – Written exam: 20 points Final Exam – Oral exam: 30 points Final Exam (Integral) – Written exam: 40 points Final Exam (Integral) – Oral exam: 45 points To pass the exam, the student must pass the oral part of exam. The total

	number of points a student can achieve during the course is a maximum of 50 points. The final exam includes the material that the student did not pass in the partial exam, which means it covers the second part of the material (second partial exam) which is valued at 50 points or consists of the entire material, i.e., both the first and second partial exams. The total evaluation of all student obligations during the semester, i.e., the exam grade, is based on the total number of points (%) that the student has earned by fulfilling pre-exam obligations, passing the partial and final exams. Based on the quality of the acquired knowledge and skills, the student can achieve a maximum of 100 points, according to the following scale: Grading Structure: Points (%) Seminar Paper / Project Task: 15 points (%) First Test / First Knowledge Check (First Partial Exam): 35 points (%) Final Exam (Second Partial Exam): 50 points (%) The necessary condition for successfully completing the exam is a result of 55 points, with a minimum of 50% required on each part of the exam (activity, partial exam, final written exam). This means that to pass the exam, the student must meet the following conditions: Activity (Seminar Paper / Project Task): 7,5 points First Test / First Knowledge Check / Partial Exam: 17.5 points Final Exam (Second Partial Exam) – Written Part: 10 points Students who pass the partial exam only need to take the second part of the material (the part not covered in the partial exam) during the final exam. Students who do not pass the partial exam will take the entire material during the final exam, with the criteria for passing the exam remaining identical. The final exam is organized as a written and/or oral exam. Activity can be tracked through homework, seminar papers, project tasks, or quizzes.

	Note: Students are required to attend at least 80% of the total class hours, and attendance is a condition for verifying proper class participation. In justified cases (illness), a student may be excused from classes, for which they must provide a medical excuse. Seminar papers and homework will be graded only if submitted by the defined deadlines. Late submissions will not be graded. Final student performance after all forms of knowledge assessment is evaluated and graded according to the following system: a) 10 - Exceptional performance with no errors or only minor errors, 95-100 points; b) 9 - Above average, with some errors, 85-94 points; c) 8 - Average, with noticeable errors, 75-84 points; d) 7 - Generally good, but with significant shortcomings, 65-74 points; e) 6 - Meets minimum requirements, 55-64 points; f) 5 - Does not meet minimum requirements, less than 55 points.
Literature:	Mandatory: 1. R. Zelenika: Logistics Forwarding, Faculty of Economics, Zagreb, 2000. 2. Zelenika, R.: Logistics Systems, Faculty of Economics in Rijeka, 2005. 3. Gordana M. Radivojević, Information Management in Logistics. Belgrade 2023. 4. Ivanković, Č.: Forwarding and Logistics, Faculty of Transport Sciences, Zagreb, 2005. 5. R. Zelenika: International Forwarding, Faculty of Economics, Zagreb, 1996. 6. Deljanin: Logistics in Transport and Communications, Script, FSK, 2013. 7. Deljanin: Logistics Systems, Script, FSK, 2014. Supplementary: 1. Andrijanić I., Aržek Z., Prebežac D., Zelenika R.: Transport and Forwarding Business, Zagreb, 2001. 2. Z. Aržek, G. Badovinac: Transport and Insurance, Publishing and Instruction Bureau, Zagreb, 1986. 3. J. Mađarić: International Forwarding, Faculty of Transport Sciences, Zagreb, 1991.

	4. Grabovac: Responsibility of Multimodal Transport Entrepreneurs, Traffic Faculty, Split, 1986. 5. Shipping and Logistics Management, Y H V Lun; Kee-hung Lai; T C E Cheng, Publisher: New York; London: Springer, 2010. 6. International Logistics Supply Chain Outsourcing: From Local to Global, Alan Rushton; Steve Walker, Publisher: London: Kogan Page, 2007. 7. Transportation Management with SAP TM, Bernd Lauterbach, Stefan Sauer, Jens Kappauf, Jens Gottlieb, Dominik Metzger, Christopher Sürie, 2nd, updated and revised edition, 2016. 8. Warehouse Management with SAP EWM, Balaji Kannapan, Hari Tripathy, Vinay Krishna, 2nd, updated and revised edition, 2016. Journals: • International Journal of Physical Distribution • Computers and Operations Research • International Journal of Information Management • European Journal of Operational Research • Journal of Business Logistics

Course code: 11CITOS020203	**Course title: Software Testing and Quality Management**		
Level: II	**Year: I**	**Semester: II**	**Number of ECTS credits: 6**
Status: Mandatory		**Total number of contact hours: 90** Lectures: 45 Tutorials: 30 Seminars: 15	
Course participants:	**Academic staff and associates selected in the field to which the course belongs/course**		
Prerequisite for enrollment:	No		
Course goal (goals):	Acquisition of knowledge on software quality management and software solutions, as well as acquisition of skills required for a practical and professional approach to software quality and implementation of techniques and methods for software testing.		
Topics covered (Units of	• Basic terms and terminology		

study):	• Quality parameters of software solutions • Processes of quality management • Safety and reliability • Verification and validation • Quality management techniques • Analysis of errors - defects (error, fault, failure, mistake) • Measuring the quality of software solutions • Basics of software testing • Key concepts of testing • Testing techniques • Management of testing process • Evaluation of tested solutions • Software documentation management
Learning outcomes:	Knowledge: Demonstrate advanced knowledge and skills in software engineering, as well as a professional approach to practical software engineering. Skills: Application of appropriate methods and tools in determining the cause of problems and debugging software solutions. Participate as an individual or team member in creating and overseeing the development of quality software systems. Knowledge of software testing techniques, their evaluation and testing process management. Competencies: Samostalno razumijevanja i interpretacija razlličitih pitanja i problema iz domena upravljanja kvalitetom softvera. Razlikovati i porediti principa testiranja softvera u različitim softverskim projektima.
Sustainable Development Goal (SDG):	SDG5 - Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. Target 4.3 - By 2030, ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university.
Teaching methods:	The teaching is realized through lectures, exercises and the practical part of the teaching, which includes the creation of project tasks. Lectures are conducted through oral presentation with presentation and presentation of examples from practice. Discussions are initiated on various issues and problems in software engineering. Students will be required to prepare and present seminar papers and/or project assignments. Different methods are used in teaching, including: oral

	presentations and discussions, demonstration of examples, methods of graphic and video presentations and strengthening of work in groups by applying appropriate methodological approaches.
Assessment methods with grading structure:	The criteria for evaluating the student's work and evaluation during classes is as follows: Individual activity (seminar work / project assignment): from 0 to 10 points; Group activity (seminar work / project assignment): from 0 to 20 points; I test / I partial exam: from 0 to 35 points. The final/remedial exam includes the material that the student did not pass on the partial exam, which means that it includes the second part of the material (II partial) which is evaluated with 35 points or consists of the complete material, i.e. I and II partial exam. The total evaluation of all the student's obligations during the semester, i.e. the grade on the exam, is based on the total number of points (%) that the student earned by fulfilling the pre-exam obligations, passing the partial and final exams. According to the quality of acquired knowledge and skills, a student can acquire a maximum of 100 points, and according to the following scale: Scoring structure — Points (%) Individual project/Seminar work: 10 points (%) Group project: 20 points (%) I test (I partial exam): 35 points (%) Final or remedial exam (II parc.exam): 35 points (%) The required condition for successfully completing the exam is a score of 55 points, where a minimum of 50% must be achieved in the following parts, i.e. in order to pass the exam, the student must meet the following conditions: • I test/partial exam: 17.5 points • Final or remedial exam (II partial exam): 17.5 points Students who passed the partial exam take only the second part of the

	material (the part that is not included in the partial exam) on the final/remedial exam. Students who did not pass the partial exam take the complete material as part of the final/remedial exam, while the criteria for passing the exam remain identical. The final / make-up exam is organized as written and/or oral. The activity can be followed through the creation of homework, seminar papers, project tasks or taking quizzes. The final success of the student, after all the foreseen forms of knowledge verification, is evaluated and graded by the grading system as follows: a) 10 - exceptional success without errors or with minor errors, carries 95-100 points; b) 9 - above average, with some errors, carries 85-94 points; c) 8 - average, with noticeable errors, carries 75-84 points; d) 7 - generally good, but with significant shortcomings, carries 65-74 points; e) 6 - meets the minimum requirements, carries 55-64 points; f) 5 - does not meet the minimum requirements, less than 55 points. The above scale can be adjusted according to the Rules of studying at the University of Sarajevo (Article 45).
Literature:	Mandatory: Teaching material available on the teaching portal of the Faculty of Traffic and Communications. Bakir Karahodža, Metode i procesi softverskog inžinjeringa, FSK Sarajevo, 2023. Supplementary: 1. P. Ammann and J. Offutt. Introduction to Software Testing. Cambridge University Press, 2008. 2. Daniel Galin, Software Quality Assurance, Pearson Addison Wesley, Harlow, 2004. 3. G. Gordon Schulmeyer, Handbook of Software Quality Assurance, Artech House, 2007.

Course code:	**Course title: Sophisticated Databases**
12CITOS020203	

Level: II	**Year: II**	**Semester: III**	**Number of ECTS credits:** 6
Status: Mandatory		**Total number of contact hours: 90** Lectures 3 times per week - a total of 45, Exercises 3 times per week - a total of 45	
Course participants:	**Academic staff and associates selected in the field to which the course belongs/course**		
Prerequisite for enrollment:	No		
Course goal (goals):	Introduction to advanced database concepts, database management system administration, and types of advanced databases.		
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	**1. Advanced SQL Features** a. Working with scripts and error handling b. Triggers c. Cursors d. Common Table Expressions (CTE) e. Limitations and challenges of the relational model f. Indexes **2. Transactions. Errors and recovery.** **3. Database Security** a. Login accounts b. User accounts c. Roles d. Cryptography e. Transparent data encryption f. Always encrypted data g. Dynamic data masking **4. DBMS Administration** **5. High Availability Technologies** a. Replication b. Database mirroring c. AlwaysOn solutions **6. NoSQL Databases** a. Features of NoSQL databases b. Types of NoSQL databases i. Key/Value databases ii. Document databases iii. Column-oriented databases iv. Graph databases c. Advantages and disadvantages of NoSQL databases **7. Data Warehouses** a. OLAP b. Multidimensional models c. Architecture d. Implementation e. Efficiency		

	8. Temporal Databases **9. Geospatial Databases** **10. Data Streams**
Learning outcomes:	**Knowledge:** Understanding of advanced database management concepts. Basic concepts of non-relational databases and data warehouses. **Skills:** Advanced SQL concepts; SQL administration; Creating NoSQL databases; Creating data warehouses. **Competencies:** Administration of database management systems, knowledge of NoSQL database concepts, and special types of databases (temporal, geospatial, data streams).
Sustainable Development Goal (SDG):	SDG 4: Quality Education - Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. SDG 9: Industry, Innovation, and Infrastructure - Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation.
Teaching methods:	Theoretical lectures presenting the concepts covered by the thematic units. Exercises include solving practical problems where the application of concepts learned in lectures will be demonstrated. The exercises encourage students to actively solve the given problems.
Assessment methods with grading structure:	Seminar paper: up to 15 points Midterm exam: up to 35 points A student who achieves more than 55% on the midterm exam earns the right to take the final exam: up to 50 points A student who does not achieve 55% on the midterm exam takes the comprehensive makeup exam, which brings a maximum of 85%. A student who does not achieve 55% on the final exam takes the makeup final exam, which brings a maximum of 50 points.
Literature:	5. SQL & NoSQL Databases: Models, Languages, Consistency Options and Architectures for Big Data Management, Andreas Meier and Michael Kaufmann 2019 6. MODELIRANJE, IMPLEMENTACIJA I ADMINISTRACIJA BAZA PODATAKA, Željko Kovačević,2018

	7. H.Garcia-Molina, J. D. Ullman, J. D. Widom: Database Systems: The Complete Book, Prentice-Hall, 2001 8. SKLADIŠTENJE PODATAKA Put do znanja i poslovne inteligencije, Ćurko, Katarina; Španić Kezan, Maja 2016

Course code: 13-14-15-1CITES020203	**Course title: Sophisticated Internet Technologies**		
Level: II	**Year: II**	**Semester: III**	**Number of ECTS credits:** 6
Status: Mandatory		**Total number of contact hours: 90** **Lectures:** 45 **Exercises:** 30 **Seminars and Project Assignments:** 15	
Course participants:	**Academic staff and associates selected in the field to which the course belongs/course**		
Prerequisite for enrollment:	No		
Course goal (goals):	• Acquiring knowledge about the IoT (Internet of Things) paradigm and its potential applications. • Familiarization with architectures, technologies, and tools for developing IoT systems, as well as challenges, open issues, and development potentials.		
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	• IoT Concept and Application • IoT Standardization • IoT Architecture and Infrastructure • Sensor Technologies and Sensor Networks • Hardware Platforms • Communication Technologies for Developing Smart Solutions • SDN (Software-Defined Networking) and NFV (Network Functions Virtualization) • IoT Protocol Architecture • Software and Cloud Platforms for IoT • Security Aspects of IoT • QoS (Quality of Service) in IoT Systems		
Learning outcomes:	**Knowledge:** Students will be able to recognize the potential applications of IoT technologies for solving various problem situations, with a particular focus on improving the security and efficiency of traffic systems. They will also be capable of designing and developing IoT		

	systems based on the interaction of different technologies, hardware, and cloud platforms. **Skills:** Students will be able to use specific tools needed for designing and developing IoT systems, including software tools, network configuration, and hardware. **Competencies:** After passing the exam, students will be able to plan, design, and develop IoT systems and select appropriate technologies for developing specific solutions.
Sustainable Development Goal (SDG):	**SDG 9 – Industry, Innovation, and Infrastructure** **SDG 11 – Sustainable Cities and Communities**
Teaching methods:	The teaching is conducted through lectures, exercises, seminars, and practical components, including laboratory exercises and/or fieldwork/internships. Lectures are delivered through oral presentations with slides and practical examples. During the course, discussions on the challenges of designing and developing systems based on advanced internet technologies are encouraged. Students will be required to prepare and present seminar papers and/or project assignments. Various methods are used during the course, including: oral presentations, discussions, demonstrations, individual and group work, etc.
Assessment methods with grading structure:	The total number of points a student can earn during the course is 50, with an additional 50 points available on the final exam. The points during the course are distributed among assignments and activities and/or seminars and/or project tasks, as well as the partial exam. The final/retake exam covers material not passed in the partial exam, which means it includes a second part of the material worth 50 points for students who have passed the partial exam. Students who have not passed the material from the partial exam will need to take both the material from the partial exam and the final exam. The final/retake exam is organized as a written and/or oral exam, along with a practical component. The overall evaluation of all student obligations during the semester, including the final grade, is based on the total number of points earned by fulfilling pre-exam obligations and passing the partial and final exams. According to the quality of acquired knowledge and skills,

	students can earn a maximum of 100 points, distributed as follows: Grading Structure Points (%) • Seminar / Class Activity / Project Task: 20 points (20%) • First Test / Knowledge Check (First Partial Exam): 30 points (30%) • Final or Retake Exam (Second Partial Exam): 50 points (50%) The required condition to pass the exam is 55 points in total, with at least 55% of points earned in the knowledge checks (partial and final/retake exams). The final student performance, after all planned knowledge checks, is graded according to the following system: a) 10 - Excellent performance with no errors or minor errors (95-100 points); b) 9 - Above average, with some errors (85-94 points); c) 8 - Average, with noticeable errors (75-84 points); d) 7 - Generally good, but with significant shortcomings (65-74 points); e) 6 - Meets minimal requirements (55-64 points); f) 5 - Does not meet minimal requirements (less than 55 points).
Literature:	Mandatory: – Alem Čolaković, "Advanced Internet Technologies (LECTURE NOTES)," Faculty of Traffic and Communications, Sarajevo, 2020. Supplementary: – Yang Yang, Xu Chen, Rui Tan, Yong Xiao, "Intelligent IoT for the Digital World: Incorporating 5G Communications and Fog/Edge Computing Technologies," Wiley, 2021. – Vangelis Angelakis, Elias Tragos, Henrich C. Pöhls, Adam Kapovits, Alessandro Bassi, "Designing, Developing, and Facilitating Smart Cities: Urban Design to IoT Solutions," Springer International Publishing, 2017. – Shree Krishna Sharma, Dushantha Nalin K. Jayakody, Symeon Chatzinotas, Alagan Anpalagan, "Communication Technologies for Networked Smart Cities," The Institution of Engineering and Technology, 2021.

	– John R. Vacca, "Solving Urban Infrastructure Problems Using Smart City Technologies: Handbook on Planning, Design, Development, and Regulation," Elsevier, 2020. – Constandinos X. Mavromoustakis, George Mastorakis, Jordi Mongay Batalla, "Internet of Things (IoT) in 5G Mobile Technologies," Springer International Publishing, 2016. – Anuradha, J., Tripathy, B. K, "Internet of things (IoT) : technologies, applications, challenges and solutions," CRC Press;Taylor & Francis, 2018. – Kayhan Zrar Ghafoor, Kevin Curran, Linghe Kong, Ali Safa Sadiq, "Security and Organization within IoT and Smart Cities," CRS Press, 2020. – Hongjian Sun, Chao Wang, Bashar I. Ahmad, "From Internet of Things to Smart Cities: Enabling Technologies," CRC Press;Chapman and Hall/CRC, 2017. – Fadi Al-Turjman (editor), Muhammad Imran (editor), "IoT Technologies in Smart-Cities: From sensors to big data, security and trust (Control, Robotics and Sensors)," The Institution of Engineering and Technology, 2020. – David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things," Cisco Press, 2017. – Al-Turjman, Fadi, "Intelligence in IoT-enabled smart cities," Taylor & Francis;CRC, 2019. – Bharat Chaudhari, Marco Zennaro, "LPWAN Technologies for IoT and M2M Applications," Elsevier, 2020.

Course code: 13-14-15-2CITES020203	**Course title:** Managing Projects and Investments in Traffic and Communications		
Level: II	**Year: II**	**Semester: III**	**Number of ECTS credits:** 6
Status: Elective		**Total Hours**: 90 45 hours of lectures, 30 hours of exercises/seminars, Seminar/Project Assignment: 15	
Course participants:	**Academic staff and associates selected in the field to which the course belongs/course**		
Prerequisite for enrollment:	None		
Course goal (goals):	The main objectives of the course are to acquire knowledge in project and investment management, understand methods and techniques		

	applied in project and investment management processes, and enable students to practically apply knowledge in this field.
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	1. General investment concepts: Concept and definition of investments. Types of investments in transportation. 2. Preparation of investment projects: Preliminary feasibility study. Feasibility study. 3. Feasibility study assessment: Financial evaluation. National assessment. Evaluation of investments under uncertainty. 4. Cost-Benefit Analysis: Principles of cost-benefit analysis. Determining costs and benefits. Valuation of costs and benefits. Criteria used in cost-benefit analysis. Applications of cost-benefit analysis. 5. Business Plan: Concept of a business plan. Content of a business plan. 6. UNIDO Methodology: Preparation of industrial projects. Evaluation of industrial projects. 7. Evaluation of investment projects by the World Bank: Global procedure for reviewing and assessing investment projects. Project profitability evaluation. 8. Project Management: Project management concept. Organization for project management. 9. Standard computer programs for project management. 10. Application of project management concepts in transportation. 11. Project realization: Project realization planning. Time planning. Cost and resource planning. 12. Monitoring and control of project realization: Time tracking and control of project realization. Monitoring and control of project resources and costs. 13. Change management in projects. 14. Risk management in projects. 15. Report: Project realization reporting system. Project closure.
Learning outcomes:	Knowledge: Students will acquire knowledge in project and investment management, methods, and techniques applied in project and investment management processes, enabling students to practically apply the knowledge in this field. Skills: Upon completing the course, students will be able to understand project and investment management processes, evaluate appropriate methods in the project management process, evaluate appropriate methods in the investment management process, plan activities for both processes, apply the concept of managing a specific project in a real system and business environment, apply the concept of managing investment activities in a real system and business environment, plan, manage, and control the realization of different types of projects in business systems. Competences: Application of acquired knowledge in concrete models.
Sustainable Development	· SDG 8: Decent work and economic growth - Promote sustained,

Goal (SDG):	inclusive, and sustainable economic growth, employment, and decent work for all. · SDG 9: Industry, Innovation, and Infrastructure - Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation. · SDG 12: Responsible Consumption and Production - Ensure sustainable consumption and production patterns.
Teaching methods:	During the course, the professor presents individual thematic units (ex cathedra), allows students to follow video materials with educational content (DVD video presentations) in the subject area, and organizes discussions on a given topic (interactive teaching). In the exercises, examples and tasks corresponding to theoretical topics are considered and solved, helping students independently solve tasks and develop project programs and seminar papers.
Assessment methods with grading structure:	The criteria for evaluating and grading student work during the course are as follows: • Seminar/Project task: 0 to 15 points; • First Test / First Knowledge Check / First Partial Exam: 0 to 35 points. The total number of points a student can achieve during the course can be a maximum of 50 points. The final/examination includes the material that the student did not pass in the partial exam, which means it covers the second part of the material (second partial) evaluated with 50 points, or it consists of the complete material, i.e., both the first and second partial exams. The total evaluation of all student obligations during the semester and the exam is based on the total number of points (%) that the student achieved by fulfilling pre-exam obligations and passing partial and final exams. Based on the quality of acquired knowledge and skills, the student can score a maximum of 100 points according to the following scale: Grading Structure..... Points (%) Seminar/Project task:.....15 points (%)

	First Test / First Knowledge Check / First Partial Exam: 35 points (%) Final Exam (Second Partial Exam):.....50 points (%) To successfully pass the exam, the student must achieve a result of 55 points, with at least 55% in each part of the exam (activity, partial exam, final exam). That is, to pass the exam, the student must meet the following conditions: • Activity (seminar work/project task): 8 points • First Test / First Knowledge Check / Partial Exam: 19 points • Final Exam (Second Partial Exam): 27 points Students who passed the partial exam take only the second part of the material (the part not covered by the partial exam) in the final exam. Students who did not pass the partial exam take the complete material, and the criteria for passing the exam remain identical. The final exam is organized as a written and/or oral exam. Activity can be monitored through the preparation of homework, seminar papers, project tasks, or taking quizzes. Note: Students are required to attend all forms of teaching, at least 80% of the total number of hours, and attendance is a prerequisite for verification of regular attendance. In justified cases (illness), the student may be absent from classes, for which they must provide a medical certificate. Seminar work and homework will only be graded if submitted by the defined deadlines. Late submissions will not be graded. The final success of the student after all the predicted forms of knowledge assessment is evaluated according to the following grading system: a) 10 - exceptional success without mistakes or with negligible mistakes (95-100 points); b) 9 - above average with occasional mistakes (85-94 points);

	c) 8 - average with noticeable mistakes (75-84 points); d) 7 - generally good but with significant shortcomings (65-74 points); e) 6 - meets the minimum requirements (55-64 points); f) 5 - does not meet the minimum requirements, less than 55 points.
Literature:	Mandatory: 1. Written materials, seminar papers, and lecture slides (available on the Faculty website). 2. Vujadin Vešović, „Upravljanje projektima“, 9. Izdanje, Beograd, 2010. 3. Vladimir B. Depolo, „Upravljanje projektima u saobraćajnom inžinjerstvu“, Beograd, 2010. Supplementary: 1. Petar Jovanović, “Upravljanje investicijama”, 8. izdanje, Beograd, 2013.

Course code: 13-14-15-3CITES020203	**Course title: Customer Relations Management**		
Level: II	**Year: II**	**Semester: III**	**Number of ECTS credits:** 6
Status: Optional course		**Total number of contact hours: 90** Optional breakdown of hours by type: Lectures 30 Tutorials 30 Laboratory Tutorials/Practice/Concert activies 30	
Course participants:	**Academic staff and associates selected in the field to which the course belongs/course**		
Prerequisite for enrollment:	No		
Course goal (goals):	Within the scope of the course, students need to acquire the necessary knowledge, theoretical and practical, to work in customer relations management. The main goal is to understand the importance of cuatomers and the relationships that are built with them, as well as how these relationships can be managed.		
Topics covered (Units of study):	• Introduction to customer relationship management (CRM): Concept and definition of CRM - a. The need for CRM. • Evolutionary development of marketing management		

(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)	• Approaches to customer satisfaction research. Designing and building the process of continuous monitoring of client satisfaction. Customer orientation as a company culture. • Customer relationship management as a business process. Customer relationship management process. Benefits and costs of customer relationship management. Assessment of the company's readiness to introduce customer relationship management. Organizing and integrating business, employees, technology and processes. Communication strategies in marketing. Collection of customer data. • Customer relationship management as a business process. Predicting customer behavior. Customer segmentation. Customer profitability. Personalization and optimization of communication channels. Modeling interaction with customers. Automating processes in marketing and sales. Planning the customer relationship management program. • Customer relations policy: Defining customer relations management. The importance of knowing your customers. Acquisition of new clients towards retention of existing ones. Customer loyalty. Use of customer data. • Analytical CRM • Customer relationship management tools • Technological basis for client relationship management: Technological basis for client relationship management. Data storage. Customer data analysis and data mining • Electronic business and customer relationship management via the Internet. Additional services to customers via the World Wide Web. Customer privacy issues. Choice of tools for CRM. • CRM system life cycle. Modeling and implementation of CRM systems in telecommunications companies. • CRM system reengineering. • Implementation of CRM solutions in telecommunications companies (strategy implementation, technology implementation). • Operational CRM
Learning outcomes:	Knowledge: Theoretical and practical knowledge in the field of customer relationship management. The subject of study should ensure the level of competence and knowledge necessary to solve everyday problems in the specified field. Skills: Ability to apply theoretical and practical knowledge in the field of customer relationship management Competencies: Ability to independently understand and use the knowledge needed to solve specific problems in the field of customer relationship management.
Sustainable Development	SDG4 - Quality education, SDG8 - Decent work and economic growth,

Goal (SDG):	SDG9 - Industry, innovation and infrastructure, SDG17 - Partnership for the goals
Teaching methods:	Teaching is realized through lectures, exercises, laboratory exercises/field work/practice. The following methods are represented: the oral presentation method, the conversation method, the demonstration method, the graphic works method, the drawing method and the group work method. In the lectures, theoretical concepts and principles are covered with the presentation of descriptive examples and the solving of specific tasks. Additional examples are considered and solved through exercises, laboratory exercises/field work/practice, which enables continuous work and preparation for independent problem solving. During laboratory exercises/field work/practice, the skills necessary for individual and team work will be developed in order to perform tasks in the given area.
Assessment methods with grading structure:	Assessment of creativity in classes and exercises with creation of independent works, assessment of partial test during class as well as assessment of the final exam. The criteria for monitoring the student's work and evaluating it during classes, according to the following method: – Seminar work/practical work/ 20 points (%). – Homework during class: 10 points (%) – I Partial exam/test/knowledge check/35 points (%), passed if more than 50% is won. – Final exam (Oral) 35 points (%), passed if over 50% is won. – Final exam (Integral) 70 points (%), passed if more than 50% is won. The total number of points (%) that a student can achieve according to the mentioned monitoring during classes is a maximum of 65 points (%), which with the Final makes 100 points (%). For students who did not pass the 1st Partial exam, the Final exam (Integral) is organized from the entire material covered during classes and exercises, and is evaluated with 85 points (%), which with the seminar work/practical work makes 100 points (%). The final success of the student, after all the foreseen forms of

	knowledge verification, is evaluated and evaluated by the grading system as follows: a) 10 (A) - exceptional success without mistakes or with minor mistakes, carries 95-100 points; b) 9 (B) - above average, with some errors, carries 85-94 points; c) 8 (C) - average, with noticeable errors, carries 75-84 points; d) 7 (D) - generally good, but with significant shortcomings, carries 65-74 points; e) 6 (E) - meets the minimum requirements, carries 55-64 points; f) 5 (F, FX) - does not meet the minimum requirements, less than 55 points.
Literature:	Mandatory: 1. Lecture material (available on the faculty website) 2. Dyche, J., Dyche, J. (2001). The CRM handbook: A business guide to customer relationship management. Addison-Wesley 3. Greenberg, P. (2002). CRM at the speed of light: Capturing and keeping customers in the Internet in real time. Osborne McGraw-Hill. 4. Peelen, E.: Customer Relationship Management, Pearson Education Limited, Essex, 2005 5. Buttle, F. Customer Relationship Management. 2nd ed., Butterworth-Heinmann, Amsterdam, London, 2009.

Course code: 13-14-15-4CITES020203	**Course title:** Communication Technologies and the Environment		
Level: II	**Year: II**	**Semester: III**	**Number of ECTS credits:** 6
Status: Elective		**Total Hours**: 90 45 hours of lectures, 45 hours of exercises/seminars	
Course participants:	**Academic staff and associates selected in the field to which the course belongs/course**		
Prerequisite for enrollment:	None		
Course goal (goals):	This course will provide students with the necessary knowledge in the field of communication technologies and their interaction with the environment, the impact of these technologies on human health, the work of international environmental protection agencies, European Directives regarding electronic waste, as well as the generation, use, and disposal of electronic waste.		
Topics covered (Units of	1. ECOLOGICAL ASPECTS OF ENVIRONMENTAL PROTECTION		

study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	The concept of knowledge management. Acquisition and storage of system knowledge. Ecology of system knowledge. 2. ECOLOGICAL ASPECTS OF ENVIRONMENTAL PROTECTION Global warming. Hazardous substances that damage the ozone layer. 3. INTERNATIONAL ORGANIZATIONS FOR ENVIRONMENTAL PROTECTION 4. TELECOMMUNICATION TRAFFIC IN INTERACTION WITH THE ENVIRONMENT New technologies in the field of telecommunications traffic. Environmental policy and modern trends in telecommunications. 5. TELECOMMUNICATION TRAFFIC IN INTERACTION WITH THE ENVIRONMENT The state and perspectives of the development of telecommunications technologies in traffic as a consequence of sustainable development. Green IT. 6. MODERN TRENDS IN ICT EQUIPMENT PRODUCTION Ecological aspects in the production and use of ICT equipment. Recommendations for sustainable use. 7. EUROPEAN DIRECTIVES REGARDING ELECTRONIC WASTE WEEE Directive on electrical and electronic waste. RoHS Directive on the restriction of hazardous substances. 8. IMPACT OF ELECTROMAGNETIC RADIATION ON HUMAN HEALTH Thermal and non-thermal effects of radiation. Penetration of electromagnetic waves into the body. 9. INTERNATIONAL CLIMATE CHANGE AGREEMENTS SIGNED IN KYOTO AND MONTREAL 10. GENERATION AND USE OF ELECTRONIC WASTE. METHODS OF DISPOSAL OF ELECTRONIC WASTE. HANDLING ELECTRONIC WASTE IN BOSNIA AND HERZEGOVINA

	11. DECARBONIZATION AND INCREASING THE SHARE OF RENEWABLE ENERGY SOURCES AS A RESPONSE TO CLIMATE CHANGE 12. ENVIRONMENTAL MANAGEMENT SYSTEM. SMART GREEN CITIES 13. SUSTAINABLE DEVELOPMENT GOALS AND EDUCATION FOR SUSTAINABILITY: AWARENESS OF CLIMATE CHANGE AND ACHIEVING THE GOALS OF AGENDA 2030 14. ICNIRP STANDARD. SAR MEASUREMENTS 15. GREEN IoT
Learning outcomes:	Knowledge: Students will gain a comprehensive understanding of the interaction between communication technologies and the environment, including their impact on human health, the ecological aspects of ICT equipment, and relevant international and European regulations. They will also learn how the Sustainable Development Goals (SDGs), particularly those related to responsible production, climate action, and industry and innovation, apply to the management of communication technologies. Skills: Students will develop the ability to analyze and identify key issues related to the impact of communication technologies on the environment and human health, and apply the acquired knowledge in real-world situations. They will also enhance their critical thinking skills and the ability to make informed decisions in line with European directives and sustainable development practices. Competencies: Students will be competent in identifying and solving problems related to the impact of communication technologies on the environment and health, using sustainable development methods. They will be able to apply international standards and directives in practice and develop strategies for the sustainable management of communication technologies.
Sustainable Development Goal (SDG):	"SDG4 – Quality Education," "SDG7 – Affordable and Clean Energy," "SDG9 – Industry, Innovation, and Infrastructure," "SDG11 – Sustainable Cities and Communities," "SDG12 – Responsible Consumption and Production," "SDG13 – Climate Action."

Teaching methods:	Oral Presentation Method Discussion Method Demonstration Method Group Work Method
Assessment methods with grading structure:	**Assessment of creativity during lectures and exercises through independent work, evaluation of the partial test during the course, and the final exam. The criteria for student monitoring and assessment during the course are as follows:** • Homework/Seminar Paper/Tests: 20 points (%), passed if at least 55% is achieved. • First Partial Exam/Test/Knowledge Assessment: 30 points (%), passed if at least 55% is achieved. • Final Exam (Second Partial) written: 40 points (%), passed if at least 55% is achieved. The condition for taking this exam is a successfully passed first partial exam. • Final Exam (Integral written) 70 points + 10 points oral exam (%), passed if at least 55% is achieved. The final exam is organized as both a written and an oral exam. During the final exam, the student can take the material that was not covered and/or successfully completed during the semester. A required condition for successfully passing the exam is achieving at least 55% of the maximum number of points on both the partial and final parts of the exam. The sufficient condition is that the total sum of points (from homework, attendance, partial, and final exams) reaches 55. Homework is organized through writing assignments and projects and cannot be revised. For students who have not successfully completed the partial exam, the final exam covers the entire material taught during the course. The make-up exam is organized in the same manner as the final exam. **The final student success after all forms of knowledge assessment is evaluated and graded according to the following system:** • a) 10 (A) - outstanding performance with no or minor errors, 95-100 points; • b) 9 (B) - above average, with some errors, 85-94 points; • c) 8 (C) - average, with noticeable errors, 75-84 points;

	• d) 7 (D) - generally good, but with significant shortcomings, 65-74 points; • e) 6 (E) - meets the minimum requirements, 55-64 points; • f) 5 (F, FX) - does not meet the minimum requirements, less than 55 points. **The overall evaluation of all student obligations during the semester, and the exam grade, is based on the total number of points (%) the student has acquired by fulfilling pre-exam obligations and taking partial and final exams. The grading system is defined as follows, with a maximum of 100 points:** **Student Obligations Points (%)** • Attendance at lectures and exercises: - • Homework/Seminar Paper/Tests: 20 points (%) • First Partial Exam/Test/Knowledge Assessment: 30 points (%) • Final Exam (Second Partial): 40 points (%) • Final Exam (Oral): 10 points (%) • Final Exam (Integral): 70 points (%)
Literature:	Mandatory: 4. Internal Script "Communication Technologies and the Environment," Faculty of Traffic and Communications, Sarajevo, 2022. 5. Manatū Mō Te Taiao - Information and Communication Technology Equipment: Good Practice Guidelines for Environmental Sustainability 6. Nik Bessis, Ciprian Dobre (Editors), "Big Data and Internet of Things: A Roadmap for Smart Environments," Springer, Volume 546, London, 2014. Supplementary: 1. The Global Goals Resources: https://www.globalgoals.org/resources 2. UN SDG Knowledge Platform: https://sustainabledevelopment.un.org/ 3. Čaušević S, "Communication Technologies and the Environment," University of Sarajevo, Faculty of Traffic and Communications, Sarajevo, 2006. 4. Lecture notes and presentations.

Course code: 13-14-15-5CITES020203	**Course title: TRAFFIC POLICY**		
Level: II	**Year: II**	**Semester: III**	**Number of ECTS credits:** 6

Status: Optional subject	**Total number of contact hours: 90** Optional breakdown of hours by type: Lectures: 45 Tutorials: 30 Seminars and project tasks: 15
Course participants:	**Academic staff and associates selected in the field to which the course belongs/course**
Prerequisite for enrollment:	No
Course goal (goals):	Students acquire the basic theoretical knowledge necessary for the study of transport policy: the national importance of the transport system and its integration into European traffic flows, the allocation of positive and negative effects of the integration of transport policy. Pyramidal structure and authority when defining and implementing traffic priorities at the national and international level.
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	- Approaches to the national transport policy: the concept of politics, types of policies, the function of politics as an approach to the national transport policy, - National transport policy components: Transport policy holders, transport policy objectives, transport policy instruments, relationship between transport policy objectives and instruments, - Principles of the national transport policy - Part I: the connection between transport and the economy, coordination of the operation of the transport system and social profitability. - Principles of national transport policy - Part II: Principles of a unified transport system, allocation of resources, ownership and equal work opportunities, choice of transport policy and feasibility of transport policy - Formulation of transport policy: Formulation, evaluation, efficiency of national transport policy. The concept and meaning of determinants of transport policy. - Harmonization of transport policy – Part I: Objectives of common transport policy. General political guidelines of the common transport policy. - Harmonization of transport policy – Part II: Application and discussions on the future of transport within the framework of the common transport policy. - Trans-European transport network – Part I: Guidelines from 1996 and revision of the guidelines for the trans-European transport network from 2004.

	- Trans-European transport network – Part II: Revision of the 2013 guidelines: integrated network, two-layer structure and corridors of the trans-European transport network. - Trans-European transport network – Part III: Additional funding opportunities for trans-European network projects. Determination of general conditions for financing projects of trans-European networks. - Trans-European transport network - Part IV: Instrument and general objectives for connecting Europe with the trans-European network. Budget of the Instrument for Connecting Europe with the Trans-European Network - Sectoral policies of the EU - Part I: Objective and scope of application of Directive 97/67/EC of the European Parliament and of the Council. Universal postal services. - EU sectoral policies – Part II: Harmonization of bookable postal services. Conditions for providing non-reserved postal services and access to the network. - Sectoral policies of the EU – Part III: Quality of postal services. Harmonization of technical standards according to the interests of users. Board and National Regulatory Authority - Sectoral policies of the EU - Part IV: Market rules of postal traffic and European achievements in the field of postal traffic.
Learning outcomes:	**Knowledge:** The ability to create and apply traffic policy respecting the set objectives. **Skills:** Identification of traffic and transport priorities necessary for strategic planning and creation of traffic policy in the micro and macro environment. Define traffic policy goals and acceptable implementation models. Identifies priorities in the area of planning, construction, revitalization of traffic flows, assesses the need for integration and liberalization of internal traffic flows following European and international traffic policy, directives and guidelines as well as traffic flows, but also traffic flows and policies of neighboring countries. **Competencies:** Creation of internal efficient and effective transport system and integration into international and EU transport systems
Sustainable Development Goal (SDG):	Goals of sustainable development and impact on traffic policy: 1. SDG 1 - A world without poverty 2. SDG 2 - A world without hunger 3. SDG 5 – Gender equality 4. SDG 6 – Clean water and sanitation

	5. SDG 7 – Affordable energy from clean sources 6. SDG 8 - Decent work and economic growth 7. SDG 9 – Industry, innovation and infrastructure 8. SDG 10 – Reducing inequality 9. SDG 11 – Sustainable cities and communities 10. SDG 12 - Sustainable consumption and production 11. SDG 13 – Climate protection 12. SDG 14 – Conservation of the aquatic world 13. SDG 15 – Preservation of life on earth 14. SDG 16 – Peace, justice and strong institutions 15. SDG 17 – Partnership to the goal
Teaching methods:	The teaching is realized through lectures, exercises and the practical part of the teaching, which includes the creation of project tasks. Lectures are conducted through oral presentation with presentation and presentation of examples from practice. It initiates a discussion on the problems of planning, modeling and analysis of information systems. Students will be required to create and present seminar papers and/or project assignments. Different methods are used in teaching, including: oral presentations and discussions, demonstration of examples, methods of graphic and video presentations and strengthening of work in groups using appropriate methodological approaches.
Assessment methods with grading structure:	The criteria for evaluating the student's work and evaluation during classes is as follows: Activity (seminar paper / project assignment): from 0 to 15 points; 1st test / 1st knowledge test / 1st partial exam: from 0 to 35 points. The total number of points that a student can earn during classes is a maximum of 50 points. The final/remedial exam includes the material that the student did not pass on the partial exam, which means that it includes the second part of the material (II partial) which is evaluated with 50 points or consists of the complete material, i.e. I and II partial exam. The total evaluation of all the student's obligations during the semester, i.e. the grade on the exam, is based on the total number of points (%) that the student earned by fulfilling the pre-exam obligations, passing the partial and final exams. According to the quality

	of acquired knowledge and skills, a student can win a maximum of 100 points, and according to the following scale: Scoring structure: Points (%) Seminar / Project task:..... 15 points (%) 1st test / 1st knowledge test (1st partial exam):..... 35 points (%) Final or remedial exam (II partial exam):..... 50 points (%) The required condition for successfully completing the exam is a score of 55 points, where a minimum of 55% must be achieved in each part of the exam (activity, partial exam, final exam), i.e. in order to pass the exam, the student must meet the following conditions: - Activity (seminar paper / project assignment): 9 points - 1st test / 1st knowledge test / partial exam: 19 points - Final or remedial exam (II partial exam): 27 points Students who passed the partial exam take only the second part of the material (the part that is not included in the partial exam) on the final/remedial exam. Students who did not pass the partial exam take the complete material as part of the final/remedial exam, while the criteria for passing the exam remain identical. The final / make-up exam is organized as written and/or oral. The activity can be followed through the creation of homework, seminar papers, project tasks or taking quizzes. The final success of the student, after all the foreseen forms of knowledge verification, is evaluated and graded by the grading system

	as follows: a) 10 - exceptional success without errors or with minor errors, carries 95-100 points; b) 9 - above average, with some errors, carries 85-94 points; c) 8 - average, with noticeable errors, carries 75-84 points; d) 7 - generally good, but with significant shortcomings, carries 65-74 points; e) 6 - meets the minimum requirements, carries 55-64 points; f) 5 - does not meet the minimum requirements, less than 55 points. The above scale can be adjusted according to the Rules of studying at the University of Sarajevo (Article 45).
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	6. DIRECTIVE 2004/54/EC OF THE EUROPEAN PARLIAMENT AND COUNCIL 7 of April 29, 2004 on minimum safety requirements for tunnels in the trans-European road network 7. "DIRECTIVE 2008/96/EC OF THE EUROPEAN PARLIAMENT AND COUNCIL of November 19, 2008 on road infrastructure safety management 8. DIRECTIVE 2009/33/EC OF THE EUROPEAN PARLIAMENT AND COUNCIL of April 23, 2009 on the promotion of clean and energy-efficient vehicles in road transport 9. DIRECTIVE 1999/62/EC OF THE EUROPEAN PARLIAMENT AND COUNCIL of June 17, 1999 on charges for the use of certain infrastructures for heavy goods vehicles 10. DIRECTIVE 2004/52/EC OF THE EUROPEAN PARLIAMENT AND COUNCIL of April 29, 2004 on the interoperability of electronic toll collection systems in the Community 11. DIRECTIVE (EU) 2019/520 OF THE EUROPEAN PARLIAMENT AND COUNCIL of March 19, 2019 on the interoperability of electronic toll collection systems and facilitating the cross-border exchange of information on non-payment of tolls in the Union 12. REGULATION (EC) no. 1072/2009 OF THE EUROPEAN PARLIAMENT AND COUNCIL of October 21, 2009 on common rules for access to the international road freight transport market 13. REGULATION (EC) no. 561/2006 OF THE EUROPEAN PARLIAMENT AND COUNCIL of March 15, 2006 on the harmonization of certain social legislation related to road transport and on the amendment of Council Regulation (EEC) no. 3821/85 and (EC) no. 2135/98 and repealing Council Regulation (EEC) no. 3820/85 14. DIRECTIVE 2002/39/EC OF THE EUROPEAN PARLIAMENT AND COUNCIL of June 10, 2002 amending Directive 97/67/EC regarding the further opening of the postal services market in the Community 15. DIRECTIVE 2008/6/EC OF THE EUROPEAN PARLIAMENT AND COUNCIL of 20 February 2008 amending Directive 97/67/EC with regard to the full achievement of the internal market for postal services in the Community. 16. REGULATION (EU) no. 952/2013 OF THE EUROPEAN PARLIAMENT AND COUNCIL of October 9, 2013 on the Customs Code of the Union. 17. REGULATION (EU) 2018/644 OF THE EUROPEAN PARLIAMENT AND COUNCIL of April 18, 2018 on cross-border package delivery services 18. DIRECTIVE (EU) 2019/789 OF THE EUROPEAN PARLIAMENT AND COUNCIL of April 17, 2019 on

	establishing rules on the exercise of copyright and related rights that apply to certain internet transmissions by organizations for broadcasting and rebroadcasting of television and radio programs and on amending the Council Directive 93/83/EEC 19. REGULATION (EU) 2015/2120 OF THE EUROPEAN PARLIAMENT AND COUNCIL of November 25, 2015 on establishing measures related to open Internet access and amending Directive 2002/22/EC on universal service and user rights in connection with electronic communications networks and services and Regulation (EU) no. 531/2012 on roaming in public mobile communication networks in the Union. 20. REGULATION (EU) 2018/1971 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2018 on the establishment of the Body of European Regulators for Electronic Communications (BEREC) and the BEREC Support Agency (BEREC Office), amending Regulation (EU) 2015 /2120 and repealing Regulation (EC) no. 1211/2009 21. REGULATION (EU) 2019/1150 OF THE EUROPEAN PARLIAMENT AND COUNCIL of June 20, 2019 on promoting fairness and transparency for business users of online mediation services 22. REGULATION (EC) no. 549/2004 OF THE EUROPEAN PARLIAMENT AND COUNCIL of March 10, 2004 on establishing the framework for the creation of a single European sky 23. REGULATION (EC) no. 550/2004 OF THE EUROPEAN PARLIAMENT AND COUNCIL of March 10, 2004 on the provision of air navigation services in the single European sky 24. REGULATION (EC) no. 552/2004 OF THE EUROPEAN PARLIAMENT AND COUNCIL of 10 March 2004 on the interoperability of the European air traffic management network 25. REGULATION (EU) 2019/712 OF THE EUROPEAN PARLIAMENT AND COUNCIL of April 17, 2019 on the protection of market competition in the air 26. DIRECTIVE 2012/34/EU OF THE EUROPEAN PARLIAMENT AND COUNCIL of 21 November 2012 on the establishment of a single European railway proctor 27. DIRECTIVE (EU) 2016/797 OF THE EUROPEAN PARLIAMENT AND COUNCIL of 11 May 2016 on the interoperability of the railway system in the European Union 28. DIRECTIVE (EU) 2016/798 OF THE EUROPEAN PARLIAMENT AND COUNCIL of May 11, 2016 on railway safety, 29. REGULATION (EU) 2016/796 OF THE EUROPEAN PARLIAMENT AND COUNCIL of May 11, 2016 on the European Union Agency for Railways and repealing Regulation (EC) no. 881/2004

	30. REGULATION (EC) no. 1371/2007 OF THE EUROPEAN PARLIAMENT AND COUNCIL31 of October 23, 2007 on the rights and obligations of passengers in rail traffic 31. Notes and slides from lectures (can be downloaded from the official website of the Faculty of Traffic and Communications and distributed electronically to each individual student)