UNIVERZITET U SARAJEVU

FAKULTET ZA SAOBRAĆAJ I KOMUNIKACIJE

STUDIJSKI PROGRAMA KOMPJUTERSKE I INFORMACIJSKE TEHNOLOGIJE **I 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.);

OBAVEZNI PREDMETI za sve odsjeke i usmjerenja

R.b	Šifra predmeta	Naziv predmeta	Semestar					
			I	ECTS	II	ECTS	III	ECTS
1.	01ATCOS010101	INŽINJERSKA MATEMATIKA I	3+3	6				
2.	02ATCOS010101	INŽENJERSKA GRAFIKA	4+2	6				
3.	03ATCOS010101	OSNOVI SAOBRAĆAJNIH I KOMUNIKACIJSKIH SISTEMA	4+2	6				
4.	04ATCOS010101	RAČUNARSTVO I INFORMATIKA	4+2	6				
5.	05ATCOS010101	ELEKTROTEHNIČKI SISTEMI U SAOBRAĆAJU I KOMUNIKACIJMA	3+2+1	6				
6.	06ATCOS010102	INŽINJERSKA MATEMATIKA II			3+3	6		
7.	07ATCOS010102	TEHNIČKA MEHANIKA			3+3	6		
8.	08ATCOS010102	SAOBRAĆAJ I PROSTOR			4+2	6		
9.	09ATCOS010102	INDUSTRIJSKI TRANSPORT			3+3	6		
10.	10ATCOS010102	LOGISTIKA U SAOBRAĆAJU I KOMUNIKACIJAMA			4+2	6		
11.	11ATCOS010203	PRIMJENJENA MATEMATIKA I STATISTIKA					4+2	6
12.	12ATCOS010203	SISTEMSKO INŽINJERSTVO					4+2	6
13.	13ATCOS010203	EKONOMIKA U SAOBRAĆAJU I KOMUNIKACIJAMA					3+2+1	6
14.	14ATCOS010203	INFORMACIONI SISTEMI U SAOBRAĆAJU I KOMUNIKACIJAMA					2+2+2	6
15.		IZBORNI PREDMET III semestra					4+2	6
Broj kredita/sati				30		30		30

Izborni predmeti

Šifra predmeta	Naziv predmeta	Broj sati			ECTS	Semestar
		P	V	L/PR		
15-1ATCES010203	ELEMENTI TRANSPORTNIH SREDSTAVA I UREĐAJA	4	2	0	6	**III**
15-2ATCES010203	INFORMACIJE I KOMUNIKACIJE	4	2	0	6	**III**

NASTAVNI PLAN ZA ODSJEK: KOMUNIKACIJE

USMJERENJE: KOMPJUTERSKE I INFORMACIJSKE TEHNOLOGIJE

R.b.	Šifra predmeta	Naziv predmeta	Status	SEMESTAR					
				IV	ECTS	V	ECTS	VI	ECTS
16.	16CITOS010204	**SOFTVERSKO INŽINJERSTVO I**	Obavezni	3+2+1	6				
17.	17CITOS010204	**OPERATIVNI SISTEMI**	Obavezni	3+2+1	6				
18.	18CITOS010204	**RAČUNARSKE MREŽE I PROTOKOLI**	Obavezni	3+2+1	6				
19.		IZBORNI PREDMET: KOMPJUTERSKE I INFORMACIJSKE TEHNOLOGIJE (IV SEMESTAR)	Izborni	3+2+1					
20.		IZBORNI PREDMET: KOMPJUTERSKE I INFORMACIJSKE TEHNOLOGIJE (IV SEMESTAR)	Izborni	3+2+1					
21.	21CITOS010305	**SOFTVERSKO INŽINJERSTVO II**	Obavezni			3+2+1	6		
22.	22CITOS010305	**BAZE PODATAKA**	Obavezni			3+2+1	6		
23.	23CITOS010305	**ADMINISTRACIJA RAČUNARSKIH SISTEMA I MREŽA**	Obavezni			3+2+1	6		
24.		IZBORNI PREDMET: KOMPJUTERSKE I INFORMACIJSKE TEHNOLOGIJE (V SEMESTAR)	Izborni			3+2+1	6		
25.		IZBORNI PREDMET: KOMPJUTERSKE I INFORMACIJSKE TEHNOLOGIJE (V SEMESTAR)	Izborni			3+2+1	6		
26.		PRAKSA	Obavezni			2	2		
27.	27CITOS010306	**RAZVOJ WEB APLIKACIJA**	Obavezni					3+2+1	6
28.	28CITOS010306	**RAZVOJ APLIKACIJA MOBILNIH UREĐAJA**	Obavezni					3+2+1	6
29.	29CITOS010306	**SIGURNOST RAČUNARSKIH SISTEMA I MREŽA**	Obavezni					3+2+1	
30.		IZBORNI PREDMET: KOMPJUTERSKE I INFORMACIJSKE TEHNOLOGIJE (VI SEMESTAR)	Izborni					3+2+1	6

31.		IZBORNI PREDMET: KOMPJUTERSKE I INFORMACIJSKE TEHNOLOGIJE (VI SEMESTAR)	Izborni					3+2+1	6
Broj kredita/sati					30		30		30

Izborni predmeti: usmjerenje: kompjuterske i informacijske tehnologije

Šifra predmeta	Naziv predmeta	Broj sati			ECTS	Semestar
		P	V	L/PR		
19-20-1CITES010204	ARHITEKTURA RAČUNARA	3	2	1	6	**IV**
19-20-2CITES010204	DIGITALNA OBRADA SIGNALA	3	2	1	6	**IV**
19-20-3CITES010204	LINEARNO PROGRAMIRANJE	3	2	1	6	**IV**
24-25-1CITES010305	BEŽIČNI KOMUNIKACIJSKI SISTEMI	3	2	1	6	**V**
24-25-2CITES010305	INTELIGENTNI TRANSPORTNI SISTEMI	3	2	1	6	**V**
24-25-3CITES010305	WEB ARHITEKTURE	3	2	1	6	**V**
30-31-1CITES010306	INFRASTRUKTURA KOMUNIKACIJA	3	2	1	6	**VI**
30-31-2CITES010306	SIMULACIJE U KOMUNIKACIJAMA	3	2	1	6	**VI**
30-31-3CITES010306	TEHNOLOGIJA KOMUNIKACIJA	3	2	1	6	**VI**

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

Šifra predmeta: 01ATCOS010101	**Naziv predmeta:** INŽENJERSKA MATEMATIKA 1		
Ciklus: I	**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	
Učesnici u nastavi	**Nastavnici i saradnici izabrani na oblast kojoj predmet pripada/predmet** [u ovu rubriku ne unositi imena. Ostaviti formulaciju kako je naznačena u ovoj rubrici]		
Preduslov za upis:	Ne		
Cilj (ciljevi) predmeta:	Studenti stiču osnovna znanja za nastavak praćenja matematskih disciplina višeg nivoa koji se javljaju u predmetima: *Inžinjerska matematika II* i *Primjenjena matematika i statistika,* te na taj način stvaraju preduslove za primjenu matematičkog alata u praćenju, razumjevanju i izučavanju fenomena koji se pojavljuju u stručnim predmetima oblasti saobraćaja i komunikacija.		
Tematske jedinice: *(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)*	1. Matematička logika: Logičke operacija sa iskazima. Relacije, skupovi i preslikavanja. 2. Skupovi realnih i kompleksnih brojeva: Prirodni brojevi. Matematička indukcija. Newton-ova binomna formula. Razni oblici kompleksnog broja 3. Linearna algebra: Pojam matrice. Operacije sa matricama. Pojam determinante. Sistemi linearnih jednačina: Gauss-ov metod eliminacije, Kramerovo pravilo i Kroneker-Kapelijev stav. 4. Linearna algebra: Vektorska algebra. Operacije sa vektorima. Skalarni proizvod. Vektorski proizvod. Mješoviti proizvod. 5. Analitička geometrija prostora: Ravan u prostoru. Prava u prostoru. Udaljenost tačke od prave. Međusobni odnos dvije prave u prostoru. Međusobni odnos prave i ravni. 6. Nizovi i redovi: Limes niza. Kriterij konvergencije. Monotoni nizovi. Beskonačni red		

	7. Funkcije realne promjenljive: Svojstva funkcija jedne promjenljive. Granična vrijednost funkcija jedne promjenljive. 8. Diferencijalni račun funkcija jedne promjenljive: Neprekidnost funkcija. Elementarne funkcije 9. Diferencijalni račun funkcija jedne promjenljive: Pojam izvoda funkcija jedne promjenljive . Geometrijsko značenje izvoda. Mehaničko značenje izvoda. 10. Diferencijalni račun funkcija jedne promjenljive: Diferencijabilnost i diferencijal funkcije. Izvodi i diferencijali višeg reda. Pravila diferenciranja. 11. Diferencijalni račun funkcija jedne promjenljive:Primjena diferencijalnog računa. Rolleova, Cauchy-jeva i Lagrange-ova teorema. L'Hospital-ovo pravilo. Taylor-ova formula. Maclaurin-ova formula. 12. Ispitivanje funkcija realne promjenljive: Monotonost funkcija . Određivanje lokalnih ekstremnih vrijednosti. Konveksnost, konkavnost i prevojne tačke funkcija. Ispitivanje toka. Crtanje grafika funkcija. 13. Neodređeni integral: Primitivna funkcija i neodređeni integral. Osobine neodređenog integrala. Pravila integriranja. Metode integracije 14. Određeni integral: Osobine određenog integrala. Newton – Leibniz-ova formula. Nesvojstveni (nepravi) integral 15. Primjena određenog integrala u geometriji: Primjena određenog integrala na izračunavanje površine ravne figure, dužine luka krive u ravni, zapremine tijela i površine obrtnih površi.
Ishodi učenja:	Znanje: • rješavaju i primjenjuju sisteme linearnih jednačina, • definiraju i rješavaju probleme opisane vektorima, primjenjujući operacije s vektorima, • pokazaju razumjevanje osnovnih koncepata analize: granične vrijednosti, diferenciranje i integriranje realnih funkcija sa jednom realnom promjenljivom, • primjenjuju procedure diferenciranja u rješavanju problema ekstrema, • crtaju grafike funkcija na bazi primjene prvog i drugog izvoda za njenu analizu, • definiraju i računaju neodređeni integral korištenjem metoda zamjene i parcijalne integracije, • razumiju i primjenjuju procedure za integraciju racionalnih funkcija, koristite integraciju za proračun površine i zapremine. Vještine: potiče kreativnost, preciznost, sistematičnost, apstraktno mišljenje i kritičko razmišljanje koje pomaže pri uočavanju i rješavanju problema, a što je ključno za nastavak školovanja. Kompetencije: prikazivanje i komuniciranje matematičkim jezikom,

	logičko razmišljenje, argumentiranje i zaključivanje
Cilj održivog razvoja (SDG):	SDG 4 – Kvalitetno obrazovanje SDG 9– Industrija, inovacije i infrastruktura
Metode izvođenja nastave:	Predavanja teorijske nastave uz upotrebu multimedijskih sredstava, tehnika aktivnog učenja i diskusije,praktična nastava – vježbe, te samostalno izlaganje i rješavanje pojedinih konkretnih problema.
Metode provjere znanja sa strukturom ocjene:	Kriterijum vrednovanja rada i ocjenjivanja studenta u toku nastave, vrši se na sljedeći način: Testovi tokom semestra od 0 - 15 bodova; I parcijalni ispit/I test/ I provjera znanja/ od 0 - 35 bodova (položeno ako se osvoji preko 50 %). Ukupan broj bodova koji student prema navedenom praćenju u toku nastave može ostvariti iznosi maksimalno 50 bodova. Završni ispit se organizuje iz cjelokupnog pređenog gradiva u toku nastave i iznosi najviše 50 bodova, od čega je II parcijalni ispit od 0 - 25 bodova (položeno ako se osvoji preko 50 %) i Teorija i zadaci od 0 - 25 bodova, koji traje 60 min (studenti polažu teoriju i zadatke koje nisu radili na parcijalnim ispitima). Na završnom ispitu studenti mogu popravljati I parcijalni ispit, ako to ranije nisu zadovoljili. Isto vrijedi i za ispitni rok popravni završnog ispita i oba termina jesenjeg ispitnog roka. 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 85-94,9 bodova; c) 8 (C) - prosječan, sa primjetnim greškama, nosi 75-84,9 bodova; d) 7 (D) - općenito dobar, ali sa značajnijim nedostacima, nosi 65-74,9 bodova; e) 6 (E) - zadovoljava minimalne uslove, nosi 55-64,9 bodova; f) 5 (F, FX) - ne zadovoljava minimalne uslove, 0 – 54,9 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 (%) Mini testovi u toku nastave.....15 bodova (%) I Parcijalni ispit/Test/Provjera znanja/.....35 bodova (%) Završni ispit (II Parcijalni + Teorija) .....50 bodova (%)
Literatura:	Obavezna: 1. M. Uščumlić, P.Miličić, Zbirka zadataka iz više matematike I, Naučna knjiga, Beograd 2. Kostić, V. Hadžiabdić, M. Mehuljić, J. Bektešević, Matematika I – teorija sa urađenim zadacima, Mašinski fakultet Sarajevo, 2011. ISBN 978-9958-601-32-3. 3. Alma Omerspahić, Vahidin Hadžiabdić, Midhat Mehuljić, Jasmin Bektešević, Teorijske osnove i zbirka zadataka iz integralnog računa, Mašinski fakultet Sarajevo, 2012. Dopunska: 1. P. JAVOR: Matematička analiza I, Element, Zagreb,1996. 2. S. KUREPA: Matematička analiza 1 i 2, Tehnička knjiga, Zagreb, 1972.

Šifra predmeta: 02ATCOS010101	**Naziv predmeta:** Inženjerska grafika		
Ciklus: I (prvi)	**Godina: I (prva)**	**Semestar: I (prvi)**	**Broj ECTS kredita:** 6
Status: Obavezni		**Ukupan broj sati: 90**	
Učesnici u nastavi	**Nastavnici i saradnici izabrani na oblast kojoj predmet pripada/predmet**		
Preduslov za upis:	Ne		
Cilj (ciljevi) predmeta:	Osposobljavanje studenata za univerzalno inžinjersko komuniciranje – komuniciranje crtežom, upoznavanje studenata sa osnovama tehničkog crtanja i nacrtne geometrije, te sadržajem i primjenom standarda iz područja grafičkih komunikacija i tehničke dokumentacije. Osposobljavanje studenata za čitanje i razumijevanje tehničkih crteža i različitih tehničkih situacija, sa posebnim osvrtom na saobraćajne situacije. Osposobljavanje studenata za izradu tehničkih crteža upotrebom računarskih alata.		
Tematske jedinice:	– Uvod – Značaj i primjena grafičkih komunikacija u tehnici – Praktični primjeri crteža u oblasti saobraćaja i komunikacija.		

(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)	– Računarski programi i CAD sistemi u oblasti saobraćaja i komunikacija. – Standardizacija u grafičkim komunikacijama. – Tehnički crteži, vrste crteža, načini njihovog formiranja, formati crteža, zaglavlja i sastavnice. – Tehničko pismo i tehničko prostoručno skiciranje – Vrste linija i njihova upotreba. – Konstrukcija krivih linija i kružnih lukova. – Mjerila. – Predstavljanje predmeta i situacija na crtežima sa osnovama nacrtne geometrije. – Projiciranje. Vrste projekcija, aksonometrijska projekcija, izometrija, dimetrija i kosa projekcija. Ortogonalna projekcija i ortogonalno projiciranje. – Presjeci, vrste presjeka i srafura. – Kotiranje. – Crtanje osnovnih standardnih elemenata u oblasti saobraćaja i komunikacija. – Računarom potpomognuta izrada 3D modela i tehničke dokumentacije proizvoda i situacija. – Upotreba i uvođenje CAD sistema u inžinjerskoj praksi. – Historijski razvoj CAD sistema. – Osnove CAD sistema. – Principi rada CAD sistema. – Razlika između 2D i 3D CAD Sistema. – Osnove primjene GIS (geografski informacijski sistem) sistema u oblasti saobraćaja i komunikacija.
Ishodi učenja:	**Znanje:** Razvijanje sposobnosti za samostalno postavljanje i rješavanje jednostavnijih problema iz navedenih oblasti. Usvajaje inžinjerskog pristupa pri rješavanju problema. **Vještine:** Sposobnost primjene teorijskih i praktičnih znanja iz oblasti inženjerske grafike. **Kompetencije:** Studenti bi kroz nastavni program i primjere iz realnih situacija trebali biti osposobljeni za grafičko prezentiranje ideja, te univerzalno, nedvosmisleno razumijevanje tehničke dokumentacije uz primjenu standardnih elemenata grafičkog komuniciranja.
Cilj održivog razvoja (SDG):	SDG 4 – Kvalitetno obrazovanje SDG 9– Industrija, inovacije i infrastruktura
Metode izvođenja nastave:	Usmeno iznošenje sa prezentacijom i prikazom različitih problema uz korištenje određenih didaktičkih sredstava, te samostalan rad studenata na konkretnim problemima iz oblasti inženjerske grafike.

Metode provjere znanja sa strukturom ocjene:	Kriterijum praćenja rada i ocjenjivanja studenta u toku nastave i kroz parcijalne, završne i popravne ispite. Prema sljedećem načinu: – Redovno prisustvo predavanjima i vježbama 10 bodova. – Projektni zadaci 25 bodova. – I Parcijalni ispit/test/provjera znanja/30 bodova. – II Parcijalni ispit/test/provjera znanja/35 bodova. Ukupan broj bodova koji student prema navedenom praćenju u toku nastave može ostvariti iznosi maksimalno 100 bodova (%). Položio je student koji skupi minimalno 55 bodova prema gornjim kriterijima. Završni i popravni ispit se organizuje za studente koji nisu položili jednu, drugu ili obje provjere znanja. Na završnom i popravnom ispitu može se osvojiti maksimalno 70 bodova, što sa projektnim zadacima i bodovima na osnovu prisustva nastavi čini ukupno 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. 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... ..... 10 bodova (obavezno je prisustvu svim oblicima nastave min. 80 % i ovo je uslov za ovjeru/potpis urednog pohađanja) Projektni zadaci .....……. 25 bodova

	I Parcijalni ispit/Test/Provjera znanja/..... 30 bodova II Parcijalni ispit/Test/Provjera znanja/..... 35 bodova Završni ispit (I i/ili II parcijalni) ..... 65 bodova Popravni ispit (I i/ili II parcijalni) ..... 65 bodova
Literatura:	Obavezna: 1. Milan Kljajin i Milan Opalić: Inženjerska grafika, Strojarski fakultet u Slavonskom brodu, 2020. Dopunska: 1. Samir Lemeš: Računarska grafika i geometrijsko modeliranje, Zenica, 2017.

Šifra predmeta: 03ATCOS010101	**NAZIV PREDMETA:** **OSNOVI SAOBRAĆAJNIH I KOMUNIKACIJSKIH SISTEMA**		
Ciklus: I	**Godina: I**	**Semestar: I**	**Broj ECTS kredita:** 6
Status: obvezni		**Ukupan broj kontakt sati: 90** Predavanja 60 Vježbe 30	
Učesnici u nastavi	**Nastavnici i saradnici izabrani na oblast kojoj predmet pripada/predmet**		
Preduslov za upis:	nema		
Cilj (ciljevi) predmeta:	Sticanje znanja i vještina potrebnih za razumijevanje strukture i funkcija transportnih,saobraćajnih i komunikacijskih sustava. Usvajanje baznih znanja o transportnim, saobraćajnim i komunikacijskim procesima, načinu njihovog odvijanja i upravljanja.		
Tematske jedinice: *(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)*	1. Pojam i značaj prometnog i komunikacijskog sustava 2. Osnovne karakteristike transportnog supstrata 3. Transportni uređaji 4. Manipulacijska sredstva i transportna oprema 5. Čovjek kao komponenta prometnog i transportnog sustava 6. Osnovni koncept i funkcije modova transporta 7. Kapacitet i razina usluge transportnog sustava 8. Osnovne karakteristike i izazovi mobilnosti 9. Mod cestovnog transporta 10. Mod željezničkog transporta 11. Mod zrakoplovnog transporta 12. Mod vodnog transporta 13. Mod cjevovodnog transporta 14. Poštanske i komunikacijske tehnologije		

	15. Informacijsko komunikacijske tehnologije u transportu
Ishodi učenja:	Znanje: Predmet Osnovi saobraćajnih i komunikacijskih sistema treba osigurati potreban nivo znanja o osnovim komponentama i funkcijama transportnih, prometnih i komunikacijskih sustava i specifičnim karakteristikama pojedinih modova transporta te načina odvijanja transportnih i komunikacijskih procesa. Vještine: Predmet Osnovi saobraćajnih i komunikacijskih sistema omogućava stjecanje vještina neophodnih za mjerenje, analizu i procjenu učinkovitosti, sigurnosti, utjecaja na okoliš i ekonomskih koristi od transportnog sustava i pojedinih modova transporta. Kompetencije: Studenti kroz nastavni proces predavanja, vježbe, i seminarski rad trebaju steći odgovarajuće kompetencije za analizu funkcija i karakteristika komponenti transportnog i komunikacijskog sustava i mogućnosti korištenja različitih modova transporta kako bi se iskoristile prednosti svakog moda transporta.
Cilj održivog razvoja (SDG):	"SDG3 – Zdravlje i blagostanje"; "SDG 9 Industrija, inovacije i infrastruktura ", „SDG11- Održivi gradovi i zajednce", SDG 13-Zaštita klime"
Metode izvođenja nastave:	Predavanja, vježbe i seminarski rad.
Metode provjere znanja sa strukturom ocjene:	1. Prisustvo na na nastavi i semiraski rad 15 bodova 2. Prva provjera znanja 35 bodova 3. Završna provjera znanja 50 bodova
Literatura:	Obavezna: -Nastavni materijal dostupan na online platformi za učenje Fakulteta za saobraćaj i komunikacije Dopunska: - Bert van Wee, Jan Anne Annema: The Transport System and Transport Policy, Edward Elgar, Massachusett s, 2013. - Milan Janić : Advanced Transport Systems, Springer, London, 2014. - Mehrdad Ehsani, Fei-Yue Wang: Transportation Technologies for Sustainability, Springer, London, 2012

Šifra predmeta:	**Naziv predmeta: Računarstvo i informatika**
04ATCOS010101	

Ciklus: I	**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 Računarstvo i informatika je sticanje znanja i ovladavanje vještinama koje doprinose razvoju informatičke pismenosti neophodne za daljni studij. Studenti se trebaju upoznati sa osnovnim karakteristikama računara, načinu rada i njihovim mogućnostima, tj. postići razumjevanje arhitekture računarskih sistema, operativnih sistema i aplikacionog softvera.		
Tematske jedinice:	- Uvod u računarstvo i informatiku - Osnovni pojmovi u računarstvu i informatici i razvoj računara - Brojni sistemi i kodovi u računarstvu - Arhitektura i komponente računara - Uređaji za pohranu podataka - Operativni sistemi - Aplikativni softver - Računarske mreže i usluge - Bežične i mobilne mreže - Mrežne multimedijalne usluge - Alati za izradu web stranica - Programski jezici za razvoj softvera - Baze podataka - Kriptovalute - Vještačka inteligencija - Sigurnost u računarstvu i informatici - Budućnost u računarstvu i informatici		
Ishodi učenja:	Znanje: Studenti će steći teorijska i praktična znanja o računarstvu i informatici, te će se osigurati osnovni nivo znanja o harveru i softveru, te njihovoj primjeni u različitim poljima saobraćaja i komunikacija. Vještine: Očekuje se da studenti ovladaju vještinama i alatima koji se koriste u računarstvu i informatici. Kompetencije: Studenti će biti osposobljeni da učestvuju u aktivnostima		

	u vezi računarstva i informatike 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: <u>Struktura bodovanja Bodovi (%)</u> 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: - Milosavljević, M., Veinović, M., Grubor, G.: „Informatika“, Univerzitet Singidunum, Beograd, 2009. - Kozić, M.: „Uvod u informatiku i računarstvo“, Mostar, 2006. - Baraković, S., Baraković Husić, J.: „Osnove modelovanja prijetnji u oblasti informaciono-komunikacijskih sistema“, Dobra knjiga, 2022. Dopunska: – Plazibat, B., Jerčić, S.: „Informatika“, Veleučilište u Splitu, Split, 2005. – Tanenbaum, A.S.: "Structured Computer Organization", 4 izdanje, Prentice Hall, 1999.

	– Mark Burel, „Fundamentals of Computer Architecture“, Palgrave Macmillan, 2003. – Hennessy J. L., Patterson D. J.: "Computer Architecture: A Quantitative Approach", Morgan Kaufman. – Tanenbaum, A.S.: „Računarske mreže“, prevod četvrtog izdanja, Mikro knjiga, 2005.

Šifra predmeta: 05ATCOS010101	**Naziv predmeta: ELEKTROTEHNIČKI SISTEMI U SAOBRAĆAJU I KOMUNIKACIJAMA**		
Ciklus: I	**Godina: I**	**Semestar: I**	**Broj ECTS kredita: 6**
Status: obavezni predmet		**Ukupan broj 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:	Kurs ima za cilj studentima prezentirati osnovne koncepte iz elektrotehničkih sistema u saobraćaju i komunikacijama, te njihovo tretiranje pomoću matematičkih termina. Izlažu se bazni koncepti fenomena u elektrotehnici koji su nužni za bazno oblikovanje budućih inženjera saobraćaja i komunikacija. Studenti trebaju postići znanja vezana za znanstvenu metodologiju i prorodne zakone na način da se fenomenima u elektrotehnici susretnu kako sa kvalitiativnog tako i sa kvantitativnog aspekta.		
Tematske jedinice: *(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)*	1. Električno naelektrisanje i materija, Kulonov zakon sile, raspodjela električnih naelektrisanja. Električno polje: definicija, primjeri proračuna. Gausova teorema za električno polje u integralnoj formi. Električni potencijal: rad sila električnog polja, konzervativna priroda električnog polja. Potencijal i razlika potencijala, princip superpozicije pri računanju potencijala. Električni kapacitet: Sistem nabijenih vodiča, izolirani vodič. Definicija električnog kapaciteta, primjeri proračuna kapaciteta. Vezivanje kondenzatora. Elektrostatička energija. Ponašanje i primjena kondenzatora u istosmjernim i izmjeničnim električnim krugovima. Dielektrici i polarizacija materije. 2. Električni krugovi stalnih jednosmjernih struja: definicija električne vodljivosti i stacionarne električne struje, Ohmov		

	zakon, električna vodljivost, električni otpor, specifični električni otpor, serijski i paralelno spojeni otpornici. Joulov zakon. Razmjena energije u električnom krugu. Kirchhoffovi zakoni. Zakon o očuvanju energije u električnom krugu. Metode analize električni krugovi stalnih jednosmjernih struja 3. Magnetno polje: magnetna interakcija, elektricitet i magnetizam. Magnetna sila na električno naelektrisanje u kretanju, magnetna sila na vodič protjecan strujom. Izvori magnetnog polja, Amperov zakon u osnovnom obliku, magnetna svojstva materije: magnetno polje proizvedeno strujom, Biot–Savartov zakon, elektrodinamička sila, magnetna svojstva materije. Električna i magnetna polja promjenjiva u vremenu: karakteristike elektromagnetnog polja, Faradayov zakon elektromagnetne indukcije, Lanzov princip, inducirana elektromotorna sila. Primjena Faradayevog zakona: generatori izmjenične struje, električni motori. Samoindukcija, induktivni električni krug. 4. Električni krugovi vremenski promjenjivih struja sa koncentriranim parametrima. Osnovne električne veličine: napon, struja, snaga. Kirchoffovi zakoni. Dvopoli: otpornik, strujni i naponski izvori, kratak spoj i otvoreni krug. Serijski i paralelni spoj. Elementarni dinamički krugovi: Zavojnica i kondenzator: energija i početno stanje. Krugovi prvog reda (RC i RL) priključeni na istosmjerni napon. 5. Krugovi u stacionarnom sinusoidalnom režimu: Periodički signali i efektivna vrijednost. Odnos između sinusoidalnih signala i fazora. Kirchoffovi zakoni u fazorskom načinu predstavljanja. Impedansa, admitansa, reaktansa i susceptansa dvopola u sinusoidalnom režimu. Analiza dinamičkih krugova u sinusoidalnom režimu (RC, RL i RLC). Aktivna, reaktivna i prividna snaga. 6. Trofazni sistemi, spoj u trokut i zvijezdu, simetrični i nesimetrični režim. Trofazno obrtno polje, princip rada električnih motora. 7. Transformatori, princip rada, Linearni transformator. Osnove rada kolektorskih i asinhronih električnih mašina: Principi i energetski bilans elektromehaničke pretvorbe energije. 8. Osnovna mjerenja električnih veličina. Osnovi mjerne tehnike i račun greške. Osnovna mjerna oprema. Analogni i digitalni mjerni instrumenti. Metode mjerenja električnih velićina. 9. Analogna elektronika, Električne osobine poluvodiča, Elektroni i šupljine. Donori i akceptori. Karakteristike *p*-*n* (diodnog) spoja: Otvoreni *p*-*n* spoj. Dioda (*p*-*n* spoj) kao ispravljač. Direktno polarizirani *p*-*n* spoj. Inverzno polarizirani *p*-*n* spoj. Statička karakteristika diode. Primjena linearnog modela diode. Princip rada tranzistora. Struje u tranzistoru. Spoj sa zajedničkim emiterom. Područja rada tranzistora. 10. Osnovi digitalne tehnike. Bullova algebra. Osnovna logička kola. Osnovni spojevi AD I DA konvertora
Ishodi učenja:	**Znanje:** Teorijska i praktična znaja iz oblasti električnih sistema u saobraćaju i komunikacijama. Osnovne zakonitosti elektrotehnike i

	elektronike i njihova primjena u inženjerstvu. **Vještine:** Nakon uspješnog savladavanja kursa student će biti u stanju u daljem školovanju koristiti osnovne zakonitosti iz oblasti električnih sistema. **Kompetencije:** Student će moći analizirati i predložiti moguće modele i metode rješavanja problema u električnim sistemima
Cilj održivog razvoja (SDG):	SDG4 – Kvalitetno obrazovanje; SDG12 – Održiva potrošnja i proizvodnja
Metode izvođenja nastave:	Sadržaj kursa se izvodi kroz tri aktivnosti: Predavanja u suli 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 tokom kojih se rješavaju i drugi numerički i praktični problemi, a što uključuje rješavanje problema sa prethodnih ispita s ciljem postizanja boljeg razumijevanja prezentiranih teorijskih tema. Laboratorijsve vježbe na kojima se studenti upoznavaju sa praktičnim mjerenjima i načinima korištenja mjerne opreme za prezentaciju pojedinih zakonitosti iz oblasti elektrotehnike. Od studenata se stoga očekuje da redovito sudjeluju u odvijanju svih oblika nastave, kao i da kontinuirano samostalno rade.
Metode provjere znanja sa strukturom ocjene:	Kriterijum praćenja rada i ocjenjivanja studenta u toku nastave i to prema sljedećem načinu: – Domaća zadaća/seminarski rad/ 15 bodova (%), položeno ako se osvoji preko 50 %. – I Parcijalni pismeni ispit/provjera znanja/35 bodova (%), položen je ako se osvoji preko 50 %. – Završni ispit 50 bodova (%) koji se sastoji iz dva dijela: - II parcijalni pismeni ispit/provjera znanja 35 bodova (%), položen je ako se osvoji preko 50 %. - Usmeni ispit 15 bodova (%), nema bodovne granice Ukupan broj bodova (%) koji student prema navedenom može ostvariti u toku nastave iznosi maksimalno 50 bodova (%), što sa Završnim ispitom

	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. 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 (%) Zadaća/Seminarski.....15 bodova (%) I Parcijalni ispit/Provjera znanja.....35 bodova (%) Završni ispit (II Parcijalni/usmeni.....50 bodova (%) Završni ispit (Integralni) .....85 bodova (%)
Literatura:	Obavezna: 1. I. Turković: Bilješke i slajdovi sa predavanja i vježbi 2. E. Hot: Osnovi elektrotehnike, knjiga prva, Sarajevo, 1996. 3. E. Hot: Osnovi elektrotehnike, knjiga druga, Sarajevo, 1996. 4. D Milatović: Osnovi elektronike, Svjetlost, Sarajevo 1995.

Šifra predmeta:	**Naziv predmeta:** : **INŽINJERSKA MATEMATIKA 2**

06ATCOS010102			
Ciklus: I	**Godina: I**	**Semestar: II**	**Broj ECTS kredita:** 6
Status: Obavezni predmet		**Ukupan broj kontakt sati: 90** Opciono razraditi distribuciju 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:	Studenti nadograđuju osnovna znanja sa matematskim tematskim cjelinama višeg nivoa razumjevanja. Na taj način studenti postaju osposobljeni da prepoznaju primjenu tih općih znanja na konkretne praktične probleme (koji proizilaze iz oblasti stručnih predmeta), te da ih samostalno definiraju i rješavaju.		
Tematske jedinice: *(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)*	1. Funkcije više varijabli: Osnovni pojmovi. Granična vrijednost i neprekidnost 2. Diferencijalni račun funkcija više varijabli: Diferenciranje. Tangentna ravan i normala prostorne površi. Pracijalni izvod višeg reda. Diferencijal višeg reda. Taylor-ova formula za funkcije dvije promjenljive 3. Diferencijalni račun funkcija više varijabli: Ekstremne vrijednosti funkcija više promjenljivih. Uslovni ekstrem funkcija više promjenljivih. 4. Integralni račun funkcija više varijabli: Izračunavanje dvojnog integrala. Izračunavanje trojnog integrala. 5. Diferencijalne jednačine: Diferencijalne jednačine prvog reda: Diferencijalna jednačina sa razdvojenim promjenljivim. Homogena jednačina. Linearna diferencijalna jednačina. Bernulijeva jednačina. Rikatijeva jednačina. Klerova jednačina. Lagranžeova jednačina. 6. Diferencijalne jednačine: Diferencijalne jednačine višeg reda koje dopuštaju snižavanje reda. Linearne diferencijalne jednačine višeg reda. 7. Diferencijalne jednačine. Sistemi diferencijalnih jednačina. 8. Linijski integrali: Linijski integrali I i II tipa (definicija, osobine, računanje). Nezavisnost linijskog integrala od puta. Greenova formula u ravni. 9. Površinski integrali: Površinskog integrala I i II tipa (definicija, osobine, računanje). Formula Gauss-Ostrogradskog. Stokesova formula. 10. Elementi teorije polja i vektorske analize: Skalarno polje i njegove osnovne karakteristike. Vektorsko polje i njegove osnovne karakteristike. Vektorske linije.		

	11. Elementi teorije polja i vektorske analize: Divergencija vektorskog polja. Green – Gauss-Ostrogradski teorema. Cirkulacija vektorskog polja. Rotor vektorskog polja. Stoksova teorema u vektorskom obliku. Potencijalno polje, soledoidno pole, Laplaceovo polje. 12. Teorija redova: Brojni redovi. Redovi s pozitivnim članovima. Redovi s kompleksnim članovima. 13. Teorija redova: Nizovi i redovi funkcija. Uniformna konvergencija reda. Stepeni red. 14. Teorija redova: Laurentov red. Fourijeov red. 15. Laplasova tranformacija.
Ishodi učenja:	Znanje: - Studenti ovladaju diferencijalnim računom funkcija više promjenljivih, - postavljaju i rješavaju diferencijalne jednačine i primjenjuju ih na konkretnim problemskim zadacima, - rješavaju i primjenjuju sisteme diferncijalnih jednačina, - primjenjuju procedure diferenciranja u rješavanju problema ekstrema funkcija više promjenljivih, - definiraju i računaju dvostruki, trostruk, linijski i površinski integral uz mogućnost prepoznavanje njihove primjene na konkretnim problemima, - pokazaju razumjevanje osnovnih koncepata vektorske analize Vještine: potiče kreativnost, preciznost, sistematičnost, apstraktno mišljenje i kritičko razmišljanje koje pomaže pri uočavanju i rješavanju problema, a što je ključno za nastavak školovanja. Kompetencije: prikazivanje i komuniciranje matematičkim jezikom, logičko razmišljenje, argumentiranje i zaključivanje
Cilj održivog razvoja (SDG):	SDG 4 – Kvalitetno obrazovanje SDG 9– Industrija, inovacije i infrastruktura
Metode izvođenja nastave:	Predavanja teorijske nastave uz upotrebu multimedijskih sredstava, tehnika aktivnog učenja i diskusije,praktična nastava – vježbe, te samostalno izlaganje i rješavanje pojedinih konkretnih problema.
Metode provjere znanja sa strukturom ocjene:	Kriterijum vrednovanja rada i ocjenjivanja studenta u toku nastave, vrši se na sljedeći način: Testovi u toku semestra 0 - 15 bodova; I parcijalni ispit/I test/ I provjera znanja/ od 0 - 35 bodova (položeno ako se osvoji preko 50 %). Ukupan broj bodova koji student prema navedenom praćenju u toku nastave može ostvariti iznosi maksimalno 50 bodova. Završni ispit se organizuje iz cjelokupnog pređenog gradiva u toku nastave i iznosi najviše 50 bodova, od čega je II parcijalni ispit od 0 - 25

	bodova (položeno ako se osvoji preko 50 %) i Teorija i zadaci od 0 - 25 bodova, koji traje 60 minuta (studenti polažu teoriju i zadatke koje nisu radili na parcijalnim ispitima). Na završnom ispitu studenti mogu popravljati I parcijalni ispit, ako to ranije nisu zadovoljili. Isto vrijedi i za ispitni rok popravni završnog ispita i oba termina jesenjeg ispitnog roka. 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 85-94,9 bodova; c) 8 (C) - prosječan, sa primjetnim greškama, nosi 75-84,9 bodova; d) 7 (D) - općenito dobar, ali sa značajnijim nedostacima, nosi 65-74,9 bodova; e) 6 (E) - zadovoljava minimalne uslove, nosi 55-64,9 bodova; f) 5 (F, FX) - ne zadovoljava minimalne uslove, 0 – 54,9 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 (%) Mini testovi u toku nastave.....15 bodova (%) I Parcijalni ispit/Test/Provjera znanja/.....35 bodova (%) Završni ispit (II Parcijalni + Teorija) .....50 bodova (%)
Literatura:	Obavezna: 1. J. Bektešević, V. Hadžiabdić, M. Mehuljić, E. Pilav Teorijske osnove i zbirka riješenih zadataka iz višestrukih, krivolinijskih i površinskih integrala, PMF, Sarajevo 2018. 2. P. Miličić, M. Uščumlić, Zbirka zadataka iz više matematike II, Nauka, Beograd, 1998 3. A.Omerspahić, V.Hadžiabdić, M.Mehuljić, J.Bektešević, Teorijske osnove i zbirka zadataka iz integralnog računa, Mašinski fakultet Sarajevo, Sarajevo 2012.

	4. D. Mihailović, D. Đ. Tošić, Elementi matematičke analize II, (Funkcije više promjenljivih, 5. vektorska analiza, višestruki integrali i teorija polja), Naučna knjiga, Beograd, 1976; 1988; 1991. 6. B.P. Demidovič: Zadaci I riješeni primjeri iz više matematike s primjenom na tehničke nauke, Tehnička knjiga, Zagreb, 1963 Dopunska: 1. S. Kurepa: Matematička analiza 2 i 3, Tehnička knjiga, Zagreb, 1976. 2. A.Omerspahić, Matematika 3, Mašinski fakultet Sarajevo, Sarajevo 2012.

Šifra predmeta: 07ATCOS010102	**Naziv predmeta: Tehnička mehanika**		
Ciklus: I	**Godina: I**	**Semestar: II**	**Broj ECTS kredita:** 6
Status: OBAVEZNI PREDMET		**Ukupan broj kontakt sati: 90** Predavanja 45 Vježbe 45	
Učesnici u nastavi	**Nastavnici i saradnici izabrani na oblast kojoj predmet pripada/predmet**		
Preduslov za upis:	Ne		
Cilj (ciljevi) predmeta:	Usvajanje osnovnih pojmova i zakona: Statike krutog i čvrstog tijela, Kinamatike i Dinamike u cilju osposobljavanja za uspješno praćenje i usvajanja znanja iz drugih stručnih predmeta. Razumjevanje mehaničkih procesa i primjena usvojenih znanja pri rješavanju problema koji se odnose na uslove ravnoteže krutih tijela, analizu naprezanja i dimenzionisanje čvrstih tijela, rješavanje problema koji su vezani za geometriju i kinematičke karakteristike kretanja kao i problema koji uzimaju u obzir i uzroke kretanja. Razvijanje sposobnosti za samostalno postavljanje i rješavanje jednostavnijih problema iz navedenih oblasti. Usvajaje inžinjerskog pristupa pri rješavanju problema.		
Tematske jedinice: *(po potrebi plan izvođenja po sedmicama se utvrđuje*	– Uvod. Statika krutih tijela. Veze i reakcije veza. – Sistemi sučeljnihi sila. Statički moment sile za tačku. Spreg sila – Redukcija sile na tačku. Proizvoljni sistem sila u ravni. – Gredni nosači u ravni		

uvažavajući specifičnosti organizacionih jedinica)	– Trenje. Težišta – Uvod u otpornost materijala.Vanjske sile. Naprezanje. Deformacije – Veza između napona i deformacija. Aksijalno naprezanje. – Smicanje. Geometrijske karakteristike ravnih presjeka. – Savijanje. Uvijanje. – Uvod u kinematiku. Kinematika čestice. Pravolinijsko harmonijsko oscilatorno krtanje. – Kinematika krutog tijela. Translatorno kretanje. – Obrtanje tijela oko nepomične ose. Analiza mehanizama – Uvod u dinamiku. Zakoni dinamike.Diferencijalne jednačine kretanja tačke i njihovo integriranje. – Opšti zakoni dinamike tačke Rad i snaga – Prinudno kretanje tačke i Dalamberov princip, Teorija udara
Ishodi učenja:	Znanje: Poznavanje osnovnih pojmova i zakona: Statike krutog i čvrstog tijela, Kinamatike i Dinamike. Vještine: Sposobnost prepoznavanja problema koji se odnose na uslove ravnoteže krutih tijela, analizu naprezanja i dimenzionisanje čvrstih tijela, rješavanje problema koji su vezani za geometriju i kinematičke karakteristike kretanja kao i problema koji uzimaju u obzir i uzroke kretanja. Sposobnost prepoznavanja osnovnih karakteristika naučnog istraživanja i prenošenja zaključaka i razloga koji su do njih doveli. Kompetencije: Kroz nastavni proces predavanja i vježbi, student će biti sposoban, na osnovu usvojenog znanja da: – Razumije i ukaže na uzroke koji dovode promjene stanja mirovanja i mehaničkog kretanja tijela u prirodi, da odredi kinematičke i dinamičke karakteristike kretanja. – Prati i usvaja znanja iz drugih stručnih predmeta. – Koristi tehničku literaturu, priručnike i tabele iz ove oblasti. – Samostalno postavljati i rješavati jednostavne problema iz navedenih oblasti
Cilj održivog razvoja (SDG):	SGD4 – Kvalitetno obrazovanje; SDG12 – Održiva potrošnja i proizvodnja
Metode izvođenja nastave:	– Samostalno izlaganje – Diskusija – Analiza primjera iz prakse(zadaci na vježbama i domaće zadaće)
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 55 %. – I Parcijalni ispit/test/provjera znanja/35 bodova (%), položen je ako se osvoji preko 55 %. – Završni ispit (II Parcijalni) 50 bodova (%), položeno ako se osvoji preko 55 %. – Završni ispit (Integralni) 85 bodova (%), položeno ako se osvoji preko 55 %. 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, 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. 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.....80 (%) - 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: – Dacić,S.: Mehanika u saobraćajnom inženjerstvu, Fakultet za saobraćaj i komunikacije, Sarajevo, 2021. – Dacić,S.: Osnovi mašinstva, Fakultet za saobraćaj i komunikacije, Sarajevo, 2007. – Dacić,S.:Odabrana poglavlja iz statike krutih i čvrstih tijela, kinematike i dinamike-skripta, Fakultet za saobraćaj i komunikacije, Sarajevo, 2013. – Jurum- Kipke , J.: Mehanika u prometnom inžinjerstvu, Fakultet prometnih znanosti, Zagreb, 2001. – Kuzmanović, D., Kastratović, G., Vidanović, N.: Mehanika 1, Univerzitet u Beograd, Sabraćajni fakultet, 2012. – Kuzmanović,D., Kastratović, G., Vidanović, N.: Mehanika 2, Univerzitet u Beogradu, Sabraćajni fakultet, 2012. Dopunska: – Rusov,L. Mehanika –Statika, Naučna knjiga ,Beograd, 1992. – Rusov,L. Mehanika – Kinematika, Naučna knjiga ,Beograd, 1992 – Rusov,L. Mehanika – Dinamika, Naučna knjiga, Beograd, 1992 – Beer, F., E.Russel, L., J.Kornwell. P., Vector Mechanics for Engineers, McGraw Hill, 2010. – Kuzmanović,D., Kastratović, G., Vidanović, N.: Zbirka zadataka izMehanika 1, Univerzitet u Beograd, Sabraćajni fakultet, 2012.

Šifra predmeta: 08ATCOS010102	**Naziv predmeta: SAOBRAĆAJ I PROSTOR**		
Ciklus: I	**Godina: I**	**Semestar: II**	**Broj ECTS kredita:** 6
Status: Obavezni 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:	Sticanje edukacijskih znanja iz oblasti saobraćajnog planiranja, i praktična analiza urbanističkog, regionalnog i okolinskog planiranja saobraćaja. Sticanje znanja iz oblasti planskog upravljanja, korištenja zemljišta, zaštite prostora, određivanja dugoročnih ciljeva i mjera prostornog razvoja u skladu sa planiranim ukupnim privrednim, društvenim i historijskim razvojem prostora koji se tretira.		
Tematske jedinice:	1. Uvod – osnove prostornog planiranja 2. Osnovne karakteristike okolinske problematike		

	3. Mjerenje nivoa društvenog razvoja 4. Prostorna organizacija 5. Razvoj prostornog planiranja i prostorne organizacije u BiH 6. Procjena uticaja na okolinu 7. Zakonski okvir za prostorno planiranje 8. Trendovi razvoja i novi pristup prostornom planiranju 9. Marketing rada 10. Elementi održivog razvoja 11. Prostorni modeli 12. Lokalne inicijative i strateški planovi na lokalnom nivou 13. Nove dimenzije europske politike u prostornom planiranju 14. Prostorni rezultati značajni za Evropu 15. Digitalna tehnologija u prostornom planiranju
Ishodi učenja:	Znanje: Teorijska i praktična znanja iz oblasti prostornog planiranja saobraćaja. Osnovni propisi, pravila, metode i postupci u oblasti prostornog planiranja u kontekstu saobraćajnog planiranja, kao i analiza saobraćajnih prostornih planova. Vještine: Sposobnost primjene teorijskih i praktičnih znanja iz oblasti prostornog planiranja saobraćaja. Kompetencije: Sposobnosti samostalnog razumijevanja i korištenja propisa, korištenja stručne literature, primjene metoda i postupaka, mjerenja i istraživanja, izrada analiza, procjena i praktičnih rješenja u funkciji realizacije i daljeg poboljšanja prilikom prostornog planiranja saobraćaja.
Cilj održivog razvoja (SDG):	SDG 4 – Kvalitetno obrazovanje SDG 9– Industrija, inovacije i infrastruktura
Metode izvođenja nastave:	Usmeno iznošenje sa prezentacijom i prikazom različitih sistema i procesa iz oblasti prostornog planiranja saobraćaja uz korištenje video i audio zapisa, te samostalno izlaganje pojedinih konkretnih problema na konkretnom području istraživanja. Iniciranje rasprava i diskusija o problemima iz prakse, pojedinačnih zapažanja iz različitih okruženja, izrada samostalnih istraživanja i analiza postojećih prostornih planova saobraćaja odabranog područja.
Metode provjere znanja sa strukturom ocjene:	Ocjena aktivnosti i 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 (pismena i usmena provjera) 15 bodova (%), položeno ako se osvoji preko 50 %. – I Parcijalni ispit/test/provjera znanja/ (pismena provjera) 35 bodova (%), položen je ako se osvoji preko 50 %. – Završni ispit (II Parcijalni) (pismena provjera) 50 bodova (%), položeno ako se osvoji preko 50 %. – Završni ispit (Integralni) (pismena provjera) 85 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, 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 (%). Studenti da bi položili ispit, trebaju položiti svaki od navedenih dijelova (svaki dio minimalno 50%) i to: seminarski rad, prvi parcijalni ispit (test) i završni ispit (drugi parcijalni ili integralni). Evaluacija seminarskog rada i prvog parcijalnog ispita (testa) se realizira u toku trajanja nastave. Studenti ponovci koji u prethodnoj akademskoj godini nisu položili ispit, a koji su ispunili određene obaveze i ostvarili određene bodove, iste mogu prenijeti u tekuću akademsku godinu. Studenti ponovci koji žele izvršiti prenos bodova, trebaju informisati predmetnog nastavnika na početku semestra, do kraja prve sedmice nastave. Prenos bodova se može izvršiti samo jednom. 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.....0 bodova (Studenti su obavezni prisustvovati svim oblicima nastave minimalno 80%, a prisustvo na nastavi je uslov za ovjeru urednog pohađanja nastave. Ukoliko postoje opravdani razlozi, koji moraju biti pisano dokumentirani, studenti mogu izostati i do 30%, a odluku o pravdanju donosi predmetni nastavnik) Seminarski rad/.....15 bodova (%) I Parcijalni ispit/Test/Provjera znanja/.....35 bodova (%) Završni ispit (II Parcijalni) .....50 bodova (%) Završni ispit (Integralni) .....85 bodova (%)
Literatura:	Obavezna: 1. Bublin, M., Planiranje saobraćaja i saobraćajnica, Sarajevo 2007. 2. Bublin, M., Prostorno planiranje i zaštita okoline, Univerzitetska knjiga Sarajevo, 2010 3. Bublin, M., Saobraćaj i prostor, Univerzitetska knjiga Sarajevo, 2000 Dopunska: 1. Appleyard, D., Kerin, L., Majer, R., The viev from the road, Harwaed 2. Čekić, Š., Osnovi metodologije i tehnologije znanstvenog i stručnog dijela, Fakultet za saobraćaj i komunikacije, Sarajevo, 1996. 3. Okvirna prometna strategija BiH, Sarajevo, 2016. 4. The study on the transport master plan in Bosnia and Herzegovina, 2001. 5. Zelenika, R., Livio, J., Suvremeni transportni sustavi, Ekonomski fakultet Rijeka, Rijeka, 1995.

Šifra predmeta: 09ATCOS010102	**Naziv predmeta: INDUSTRIJSKI TRANSPORT**		
Ciklus: I	**Godina:** II	**Semestar: IV**	**Broj ECTS kredita:** 6
Status: OBAVEZNI PREDMET		**Ukupan broj sati: 90** Opciono razraditi distribuciju sati po tipu:	

<table>
<tr><td colspan="2"></td><td>Predavanja 45
Vježbe 45</td></tr>
<tr><td colspan="2">Učesnici u nastavi:</td><td>Nastavnici i saradnici izabrani na oblast kojoj predmet pripada/predmet</td></tr>
<tr><td colspan="2">Preduslov za upis:</td><td>Ne</td></tr>
<tr><td colspan="2">Cilj (ciljevi) predmeta:</td><td>Sticanje edukacijskih oblika u realizaciji programa iz projektovanja i upravljanja u industrijskim tokovima.</td></tr>
<tr><td colspan="2">Tematske jedinice:
(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)</td><td>
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<tr><th>R.b.</th><th>Nastavne cjeline</th><th>Broj sati (P+V)</th></tr>
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<tr><td>2.</td><td>Podjela i osnovna obilježja transportne mehanizacije</td><td>(3+3)</td></tr>
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</td></tr>
<tr><td colspan="2">Ishodi učenja:
(Znanje; vještine; kompetencije)</td><td>Studenti kroz nastavni proces predavanja, vježbe, i praktičan rad trebaju steći odgovarajuća znanja i iskustva za praktičnu primjenu u oblasti projektovanja, izbora, upravljanja i održavanja sredstava unutrašnjeg transporta. Kroz ovaj predmet obezbjeđuje se nivo</td></tr>
</table>

	znanja za optimizaciju industrijskih tokova.
Cilj održivog razvoja (SDG):	Za predmet "Industrijski transport" ciljevi i podciljevi održivog razvoja (SDG) su: Cilj 8: Promovirati inkluzivni i održivi ekonomski rast, zaposlenost i dostojanstven rad za sve Cilj 9: Izgraditi izdržljivu infrastrukturu, promovirati uključivu i održivu industrijalizaciju i poticati inovativnost Cilj 12: Osigurati održive oblike potrošnje i proizvodnje:
Metode izvođenja nastave:	Predavanja, vježbe i izrada seminarskog rada sa praktičnim osvrtom.
Metode provjere znanja sa strukturom ocjene:	Kriterijum vrednovanja rada i ocjenjivanja studenta u toku nastave, vrši se na sljedeći način: Prisustvo nastavi i vježbama od 0 – 10 bodova (%); Domaća zadaća/seminarski rad/praktični rad/ od 0 do 10 bodova (%);I parcijalni ispit/I test/ I provjera znanja/ od 0 do 15 bodova (%);II parcijalni ispit/II test/ II provjera znanja / od 0 do 20 bodova (%). Ukupan broj bodova (%) koji studenta prema navedenom praćenju u toku nastave može ostvariti iznosi maksimalno 55 bodova (%). Završni ispit iznosi najviše 45 bodova odnosno 45 (%). Završni ispit se organizuje iz cjelokupnog pređenog gradiva u toku nastave.
Literatura:	Obavezna: 1. Ahmić, A., Pretovarna i transportna mehanizacija, Univerzitetska knjiga, Sarajevo, 1996. 2. Marvin I., Prekrcajna mehanizacija, Zagreb, 1997. 3. Dedijer S., Osnovi transportnih uređaja, Građevinska knjiga, Beograd, 1989.

Šifra predmeta: 10ATCOS010102	**Naziv predmeta: Logistika u saobraćaju i komunikacijama**		
Ciklus: I	**Godina: I**	**Semestar: II**	**Broj ECTS kredita:** 6
Status: obavezni predmet		**Ukupan broj kontakt sati: 90** Opciono razraditi distribuciju sati po tipu:	

	Predavanja: 60 Vježbe: 30
Učesnici u nastavi	**Nastavnici i saradnici izabrani na oblast kojoj predmet pripada/predmet**
Preduslov za upis:	NE
Cilj (ciljevi) predmeta:	Osnovni cilj predmeta „Logistika u saobraćaju i komunikacijma“ je sticanje znanja o logistici kao filozofiji kvaliteta usluga, tehnološkim promjenama u saobraćaju i komunikacijama, zahtjevima u razvoju logistike, strukturi i potrebama razvoja modernih logističkih centara.
Tematske jedinice: *(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)*	1. Pojam, definicija i razvoj logistike naučne discipline koje se koriste u logistici 2. Podjela i sadržaj logistike prema oblastima u kojima se koristi 3. Pojam, struktura i pocesi logističkih sistema 4. Logistički operatori 5. Skladišta 6. Skladišni procesi 7. Transportni lanac u logističkim sistemima, snabdijevanje i lanac snabdjevanja 8. Skladišni proces u lancu snabdjevanja 9. Zalihe i vrste zaliha 10. Povratna logistika 11. Informacijske i komunikacijske tehnologije u logistici 12. Logistička strategija 13. Utvrđivanje kvaliteta logističke usluge 14. Upravljanje kvalitetom u logistici 15. Savremeni koncept razvoja logističkih centara i logistički centar kao strateški značajan faktor povečanja kvalitete usluga
Ishodi učenja:	**Znanje:** Predmet proučavanja treba da osigura nivo kompetencija i znanja potrebnih za rješavanje konkretnih problema u oblasti logistike. Teorijska i praktična znanja iz oblasti logistike u saobraćaju i komunikacijama. **Vještine:** Razvijene sposobnosti primjene teorijskih i praktičnih znanja iz oblasti logističkih procesa u saobraćaju i komunikacijama.

	Kompetencije: Razvijene sposobnosti samostalnog razumijevanja i korištenja znanja potrebnih za rješavanje specifičnih problema u oblasti logistike i logističkih procesa.
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:	Nastava se realizira kroz usmeno iznošenje sa prezentacijom (ex-katedra) i prikazom različitih sistema i procesa iz oblasti logistike u saobraćaju i komunikacijama uz korištenje video i audio zapisa, te samostalno izlaganje pojedinih konkretnih problema u oblasti logističkih procesa na konkretnom području istraživanja. Iniciranje rasprava i diskusija sa studentima o problemima iz prakse, pojedinačnih zapažanja iz različitih okruženja, izrada samostalnih istraživanja i analiza iz oblasti logistike i logističkih sistema.
Metode provjere znanja sa strukturom ocjene:	Kriterijum praćenja rada i ocjenjivanja studenta u toku nastave i to prema sljedećem načinu: 1. Domaća zadaća/seminarski rad/praktični rad/ max 15 bodova (%), položeno ako se osvoji preko 50 %. 2. I Parcijalni ispit/test/provjera znanja / max 35 bodova (%), položen je ako se osvoji preko 50 %. 3. Završni ispit - pismeni 20 bodova 4. Završni ispit - usmeni 30 bodova 5. Završni ispit (Integralni) - pismeni - 40 bodova 6. Završni ispit (Integralni) - Usmeni - 45 bodova Da bi student položio ispit mora položiti usmeni dio ispita. 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, 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. 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 - obavezno se vodi evidencija. Prisustvo nastavi i vježbama se ne boduje. Zadaća/Seminarski/Praksa/.....max 15 bodova I Parcijalni ispit/Test/Provjera znanja/.....max 35 bodova Završni ispit - pismeni .....max 20 bodova Završni ispit - usmeni .....max 30 bodova Završni ispit (Integralni) - pismeni.....max 40 bodova Završni ispit (Integralni) - usmeni.....max 45 bodova Završni ispit se organizuje na način da studenti koji su položili prvu provjeru znanja polažu samo završni dio ispita (II dio gradiva), dok studenti koji nisu položili prvu provjeru znanja zajedno sa završnim polažu i prvi parcijalni ispit (I dio gradiva). Ispit se polaže pismeno i usmeno. Navedena skala se usvaja prema Pravilima studiranja na Univerzitetu u Sarajevu. Napomena: Studenti su obavezni prisustvovati svim oblicima nastave minimalno 80 % od ukupnog fonda sati. 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.
Literatura:	Obavezna: 1. Bilješke i slajdovi s predavanja (moći će se preuzeti na WEB site-u Fakulteta). 2. BERKOVIĆ, M.: skripta predavanja, „Logistika u saobraćaju i komunikacijama, Fakultet za saobraćaj i komunikacije, 2024. godine. 3. KOSOVAC, A; Muharemović, E.: „Procesi logističkih sistem“, Fakultet za saobraćaj i komunikacije, 2022. godine. 4. ZELENIKA, R.: Logistički sustavi, Ekonomski fakultet u Rijeci, Rijeka 2005. 5. ZELENIKA, R.: Temelji logističke špedicije, Knjiga prva, Sveučilište u Rijeci 2005. Dopunska: 1. ZELENIKA, R.: Prometni sustavi, Tehnologija-organizacija-ekonomika-logistika-menadžment, Sveučilište u Rijeci 2001. 2. OBLAK, H.: Makrologistična politika,Ekonomsko-poslovna fakulteta Maribor, 1996. 3. VASILJEVIĆ, M. R.:“Logistika u saobraćaju“, Univerzitet u istočnom Sarajevu, Saobraćajni fakultet Doboj, Doboj 2015. 4. PERIŠIĆ R.: Sistem kvaliteta usluga logistika i informatika, Institut tehničkih nauka SANU, Beograd, 2002.

Šifra predmeta: 11ATCOS010203	**Naziv predmeta: PRIMIJENJENA MATEMATIKA I STATISTIKA**		
Ciklus: I	**Godina: II**	**Semestar: III**	**Broj ECTS kredita:** 6
Status: Obavezni predmet		**Ukupan broj kontakt sati: 90**	
Učesnici u nastavi	**Nastavnici i saradnici izabrani na oblast kojoj predmet pripada/predmet**		
Preduslov za upis:	Ne		
Cilj (ciljevi) predmeta:	Cilj predmeta je da studenti steknu znanja iz oblasti primjenjene matematike i opšte statistike koje su značajne u saobraćajnim i komunikacijskim naučnim/znanstvenim oblastima (teorije grešaka, osnova numeričke algebre i analize, vjerovatnoće i statistike, te primjena kombinatorike i teorije vjerovatnoće u statistici), kako bi bolje pratili i		

	savlađivali građu pojedinih stručnih predmeta koji obilnije koriste ove važne i sadržajne oblasti savremene matematike.
Tematske jedinice: *(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)*	• Uvod – osnove primijenjene matematike u inženjerstvu (saobraćaju i komunikacijama). Greške približnih vrijednosti brojeva i funkcija • Numeričko rješavanje linearnih jednačina i sistema linearnih jednačina, Gaussov algoritam • Rješavanje sistema nelinearnih transcendentnih jednačina. Lokalizacija nula polinoma. Određivanje minimuma funkcija • Metoda najmanjih kvadrata. Interpolacije i aproksimacije • Numeričko diferenciranje i integriranje • Zakoni velikih brojeva • Elementi kombinatorike • Uvod u teoriju vjerovatnoće - Osnove klasične teorije vjerovatnoće (tri klasična koncepta vjerovatnoće, osnovne teoreme ,formula totalne vjerovatnoće i Bajesova formula) • Opšta (aksiomatska) definicija pojma vjerovatnoće. Diskretni i nediskretni prostori vjerovatnoće • Analiza diskretne i kontinualne slučajne varijable. Funkcija/zakon (gustoće) vjerovatnoće i funkcija distribucije (raspodjele, teorijskog rasporeda) vjerovatnoće • Uvod u opštu i matematičku statistiku. Pojam, predmet i značaj statistike (posebno u tehničkim naukama/znanostima). • Statistički skup i statističke jedinice. Obilježja statističkih jedinica. Pojam statističkog istraživanja. Deskriptivna statistička analiza, obrada i analiza podataka i rezultata (grafičko prikazivanje statističkih serija, mjere varijacije/disperzije) • Metod statističkih uzoraka. Testiranje statističkih (parametarskih i neparametarskih) hipoteza • Pojam i predmet regresione analize: regresija i korelacija • Dinamička analiza u statistici
Ishodi učenja:	Znanje: Nakon završetka kursa, student bi trebao: • imati razvijen osjećaj za deduktivno rasuđivanje; • razumjeti osnovne pojmove iz oblasti teorije grešaka, numeričke matematike, teorije vjerovatnoće i statistike i tako biti upoznat kako se intuitivni koncepti prevode u precizan matematički jezik; • ovladati standardnim numeričkim, stohastičkim i statističkim metodama i njihovim primjenama ; • razumjeti ulogu koju proces linearizacije ima u matematičkom modeliranju konkretnih fizikalnih, saobraćajnih, komunikacijskih i drugih inženjerskih problema; • ovladati osnovnim tehnikama numeričke algebre, numeričke analize, klasične i savremene teorije vjerovatnoće i statistike; • produbiti razumijevanje osnovnih problema iz oblasti inženjerskih matematika 1 i 2. Vještine: potiče kreativnost, preciznost, sistematičnost, apstraktno

	mišljenje i kritičko razmišljanje koje pomaže pri uočavanju i rješavanju problema, a što je ključno za nastavak školovanja. Kompetencije: prikazivanje i komuniciranje matematičkim jezikom, logičko razmišljanje, argumentiranje i zaključivanje.
Cilj održivog razvoja (SDG):	SDG4 – Kvalitetno obrazovanje, SDG9 – Industrija, inovacije i infrstruktura
Metode izvođenja nastave:	Predavanja provodi nastavnik tokom kojih se predstavljaju teorijski aspekti uz rješavanje numeričkih problema i praktičnih primjera. Predavanje se odvijaju uz korištenje video i audio zapisa. Vježbe uključuju rješavanje numeričkih i praktičnih problema, a što uključuje i rješavanje problema sa prethodnih ispita s ciljem postizanja boljeg razumijevanja prezentiranih teorijskih tema.
Metode provjere znanja sa strukturom ocjene:	Kriterijum vrednovanja rada i ocjenjivanja studenta u toku nastave, vrši se na sljedeći način: Testovi tokom semestra (ili praktični zadatak) od 0 - 15 bodova; I parcijalni ispit/I test/ I provjera znanja/ od 0 - 35 bodova (uslov 50%). Ukupan broj bodova koji student prema navedenom praćenju u toku nastave može ostvariti iznosi maksimalno 50 bodova. Završni ispit se organizuje iz cjelokupnog pređenog gradiva u toku nastave i iznosi najviše 50 bodova, od čega je II parcijalni ispit od 0 - 25 bodova (uslov 50%) i završni - teorija i zadaci od 0 - 25 bodova, koji traje 60 min (studenti polažu teoriju i zadatke koje nisu radili na parcijalnim ispitima). Na završnom ispitu studenti mogu popravljati I parcijalni ispit, ako to ranije nisu zadovoljili. Isto vrijedi i za ispitni rok popravni završnog ispita i oba termina jesenjeg ispitnog roka. 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 85-94,9 bodova; c) 8 (C) - prosječan, sa primjetnim greškama, nosi 75-84,9 bodova; d) 7 (D) - općenito dobar, ali sa značajnijim nedostacima, nosi 65-74,9 bodova; e) 6 (E) - zadovoljava minimalne uslove, nosi 55-64,9 bodova; f) 5 (F, FX) - ne zadovoljava minimalne uslove, 0 – 54,9 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 (%) Aktivnost /Mini testovi/Zadaće/Seminarski rad .....15 bodova (%) I Parcijalni ispit/Test/Provjera znanja/.....35 bodova (%) Završni ispit (II Parcijalni + Teorija) .....50 bodova (%)
Literatura:	Obavezna: 1. Blažić, M. R., Opšta statistika - Osnovi i analiza, Savremena administracija, Beograd, 1982. 2. Carnahan, B. , H. A. Luther, H. A. , Wilkes, J. O., Applied Numerical Methods, John Wiley &Sons, 1969. 3. Elezović, N., Teorija vjerojatnosti, zbirka zadataka, Element, Zagreb, 1995. 4. Fatkić, H., Vjerovatnoća i statistika, I . dio, The Soros Foundations, FOD BiH, Sarajevo, 1997; Corons, Sarajevo, 2000. 5. Fatkić, H., Hasković, A., Čolaković, A., Avdagić, E., Primjenjena matematika i statistika, Predavanja i vježbe, Slajdovi i bilješke, Sarajevo, 2012, http://www.fsk.unsa.ba/ 6. Hadžć, O., Numeričke i statističke metode u obradi eksperimentalnih podataka,Institut za matematiku, Novi Sad, 1989. Dopunska: 1. Ivanšić, I., Numerička matematika, Element, Zagreb, 1998. 2. Johnson, R. A. , Bhattacharyya, G. K., Statistics: Principles and Methods, Wiley, New York, 5th edition, 2006. 3. Lučić, B., Statistika, Ekonomski fakultet, Sarajevo, 1996.

Šifra predmeta: 12ATCOS010203	**Naziv predmeta: SISTEMSKO INŽENJERSTVO**		
Ciklus: I	**Godina: II**	**Semestar: III**	**Broj ECTS kredita: 6**
Status: Obavezni predmet		**Ukupan broj sati: 90** Razrada distribucije sati po tipu: Predavanja: 60	

	Vježbe: 30 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, 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 – pojmovi i definicije 2. Sustavski pristup proučavanja prometa (Struktura prometnog sustava; Sustavsko modeliranje prometa) 3. Temeljni sustavski koncepti (Opće definicije i interpretacije pojma sustav; Klasifikacija sustava) 4. Analogija, homomorfija i izomorfija. Stanje I proctor stanja. Sustavska analiza. Sustavska arhitektura. Životni ciklus sustava. 5. Sustavski dijagrami i pomagala (Objektogram i funkciogram; ER dijagrami; DFD dijagrami; GPSS blok dijagrami; Petrijeva mreža) 6. Ponašanje otvorenih dinamičkih sustava (Vrste ponašanja sustava; Prijelazni procesi; Statička i dinamička karakteristika sustava) 7. Definiranje i razvoj sustava (Primarne faze sustavskog inženjerstva; Definiranje sustavskih zahtjeva) 8. Sustav i procesi cestovnog prometa (Sustavsko definiranje cestovnog prometa; Sustavsko dizajniranje cestovne mreže) 9. Tehnologija cestovnog prometa (Sustavski opis tehnologije prevoza putnika i tereta u cestovnom prometu) 10. Sustav i procesi željezničkog prometa (Definiranje i opisivanje sustava željeznčkog prometa; Sustavski pristup izboru željezničkih vozila) 11. Sustav i procesi zračnog prometa (Sustavsko definiranje zračnog prometa; Sustavski razvoj mrežne infrastrukture; Tehnologija zračnog prometa) 12. Sustavi i procesi telekomunikacijskog prometa (Sustavsko definiranje tk. Prometa; Sustavski razvoj tk.mreže) 13. Tehnološki procesi Inteligentne mreže 14. Sustav i procesi poštanskog prometa (Sustavsko definiranje poštanskog prometa; Razvoj poštanske mreže i tehnologija; Tehnologija poštanskog prometa)

	15. Razvoj inteligentnih transportnih sustava (Koncept i usluge ITS-a; Razvoj ITS-a)
Ishodi učenja:	Znanje:. Studenti kroz nastavni proces predavanja i auditornih vježbi, kao i kroz praktičan rad će ovladati predmetnom tematikom i steći teorijska i praktična znanja iz oblasti sistemskog inženjerstva Vještine: Sposobnost primjene teorijskih i praktičnih znanja iz oblasti sistemskog inženjerstva. Kompetencije: Sposobnosti praćenja tehnoloških procesa, a u cilju stvaranja kvalitetne strukture prometnog sustava koja za rezultat ima kvalitetnu, sigurnu, bez kašnjenja i ekološki prihvatljivu prometnu uslugu.
Ciljevi održivog razvoja (SDGs)	SDG9 – Industrija, inovacije i infrastruktura SDG11 – Održivi gradovi i zajednice SDG12 – Održiva potrošnja i proizvodnja SDG13 – Zaštita klime
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:	1. Čaušević S, Bošnjak I, SUSTAVSKO INŽENJERSTVO U TRANSPORTU I KOMUNIKACIJAMA, Univerzitet u Sarajevu, Fakultet za saobraćaj i komunikacije, Sarajevo, 2006.
	2. Bilješke i slajdovi s predavanja i vježbi

Šifra predmeta: 13ATCOS010203	**Naziv predmeta: Ekonomika u saobraćaju i komunikacijama**		
Ciklus: I	**Godina:** II	**Semestar: IV**	**Broj ECTS kredita:** 6
Status: Obavezni 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:	Sticanje elementarnih znanja iz područja ekonomike u saobraćaju i komunikacijama u funkciji ekonomski efikasnog i kvalitetnog saobraćajno-komunikacijskog sistema.		
Tematske jedinice: *(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)*	1. Pojam i značaj ekonomike saobraćajno-komunikacijskih modela 2. Uloga saobraćaja u društvenoj reprodukciji 3. Karakterstike proizvodnje saobraćajno-komunikacijskih usluga 4. Ponuda i potražnja kao tržišni elementi 5. Oblikovanje i utvrđivanje vrijednosti saobraćajno-komunikacijske usluge 6. Troškovi saobraćajno-komunikacijskog procesa 7. Analiza dinamike troškova 8. Remanentnost troškova i faktori remanentnosti u saobraćaju i komunikacijama 9. Cijene saobraćajno-komunikacijske usluge i faktori od kojih zavise 10. Tarife i tarifska politika 11. Principi ekonomije poslovanja u saobraćaju i komunikacijama 12. Investicije u saobraćaju i komunikacijama 13. Metode vrednovanja investicijskih projekata u SIK 14. Osnovna obilježja poreskog sistema i poreske politike u SIK 15. Faktori relevantni za vođenje ekonomike preduzeća u SIK		
Ishodi učenja:	*Znanje*: Studenti će steći znanja iz područja ekonomike u saobraćaju i komunikacijama u funkciji ekonomski efikasnog i kvalitetnog saobraćajno-komunikacijskog sistema *Vještine*: Razumijevanje ekonomskih zakonitosti i kvalitativno-kvalitativnih analiza ekonomskih procesa koji se pojavljuju u		

	saobraćajnom preduzeću i saobraćajnom tržištu *Kompetencije*: Aplikaciju stečenih znanja u konkretnim modelima.
Cilj održivog razvoja (SDG):	SDG 4: Osigurati inkluzivno i kvalitetno obrazovanje, te promovirati mogućnosti cjeloživotnog učenja za sve, SDG 8: Promicati održiv ekonomski rast kroz punu i produktivnu zaposlenost i dostojanstven rad za sve, SDG 9: Industrija, inovacije i infrastruktura - Izgraditi otporniju infrastrukturu, promovirati inkluzivnu i održivu industrializaciju te poticati inovacije, SDG 10: Smanjenje nejednakosti - Smanjiti nejednakosti unutar i među zemljama. 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 i seminarskih radova. Case Study, Workshop.
Metode provjere znanja sa strukturom ocjene:	Kriterijum vrednovanja rada i ocjenjivanja studenta u toku nastave, vrši se na sljedeći način: Domaća zadaća: od 0 do 5 bodova Seminarski rad / projektni zadatak): od 0 do 10 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 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 (%) Domaća zadaća .....5 bodova (%) Seminarski / Projektni zadatak:..... 10 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 55% (aktivnost, parcijalni ispit, završni ispit), tj. da bi student položio ispit mora ostvariti sljedeće uslove: - Domaća zadaća:3 boda - Aktivnost (seminarski rad / projektni zadatak): 6 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 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. Azra Ferizović, Aida Kalem, „Ekonomika u saobraćaju i komunikacijama (SKRIPTA I dio)," Fakultet za saobraćaj i komunikacije, Sarajevo, 2020. 2. Azra Ferizović, Aida Kalem „Ekonomika u saobraćaju i komunikacijama (SKRIPTA II dio)," Fakultet za saobraćaj i komunikacije, Sarajevo, 2020. 3. Čekić, Š., Ekonomika u transportu i komunikacijama, Univerzitet u Sarajevu, Fakultet za saobraćaj i komunikacije, Sarajevo, 2005. 4. Novaković, S., Ekonomija saobraćaja, Beograd, 5. Perić, T., Radačić, Ž., Šimulčik, D., Ekonomika prometnog sustava, Sveučilište u Zagrebu, Fakultet prometnih znanosti, Zagreb, 2000. 6. Perović, D., Teorija troškova, Beograd, 7. Samuelson, P., Nordhaus, D., Ekonomija, Mate, 1992. Dopunska: 1. J. Petrović-Vujačić: Osnovi ekonomije, Saobraćajni fakultet Beograd, 2010. 2. Šunjić-Beus, M. et al. (2009). Ekonomika preduzeća, elektronsko izdanje, Ekonomski fakultet u Sarajevu, Sarajevo 3. Martinović, D. (2013). Tačka pokrića kao instrument poslovnog odlučivanja, Ekonomski fakultet u Sarajevu 4. Thompson, A. Economics of the Firm, theory and practice, fifth Edition, New Jersey

	5. Tatić, K. (2008). Menadžerska ekonomija. Ekonomski fakutet u Sarajevu 6. Somun-Kapetnović, R., Arnaut-Berilo, A. Šehić, E & Kahvić, E. (2009). Kvantitativne metode u ekonomiji i menadžmentu, Sarajevo. Ekonomski fakultet u Sarajevu

Šifra predmeta: 14ATCOS010203	**Naziv predmeta: Informacioni sistemi u saobraćaju i komunikacijama**		
Ciklus: I	**Godina: II**	**Semestar: III**	**Broj ECTS kredita:** 6
Status: obavezni 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:	Sticanje znanja o informacijskim sistemima, njihovoj primjeni, komponentama, tehnologijama i principima razvoja, a u cilju osposobljavanja studentata za rješavanje zadataka i problema planiranja, razvoja i analize informacijskih sistema u saobraćaju i komunikacijama.		
Tematske jedinice:	– Pojam sistema i informacijskih sistema (IS) – Infrastruktura i arhitektura informacijskih sistema – Informacijske i komunikacijske tehnologije – Sistemi za upravljanje bazama podataka – Programska rješenja za razvoj IS – Komunikacijske tehnologije za razvoj IS – Životni ciklus razvoja informacijskih sistema (SDLC) – Organizacija razvoja informacijskih sistema – Primjena CASE alata za projektovanje IS – Planiranje razvoja informacijskih sistema – Modeliranje i reinženjering procesa: *Workflow, DFD, BPR* – Modeliranje strukture, baze podataka i ponašanja IS – Implementacija informacijskih sistema – Analiza informacijskih sistema – Sigurnost i kvalitet informacijskih sistema		
Ishodi učenja:	**Znanje**: Studenti će steći teorijska i praktična znanja o vrstama i komponentama informacijskih sistema, načinu njihovog projektovanja i mogućnostima primjene u saobraćaju i komunikacijama. **Vještine**: Studenti će ovladati vještinama i alatima koji se koriste kod projektovanja i razvoja informacijskih sistema kao što su CASE alati. **Kompetencije**: Studenti će biti osposobljeni da učestvuju u planiranju i razvoju informacijskih sistema, a posebno sistema koji su namjenjeni za oblasti saobraćaja i komunikacija.		
Ciljevi održivog razvoja (SDG):	SDG9 – Industrija, inovacije i infrastruktura		
Metode izvođenja nastave:	Nastava se realizira kroz izvođenje predavanja i vježbi. Predavanja se realizuju kroz usmeno izlaganje sa prezentacijom i prikazom primjera iz prakse. Tokom realizacije nastave se inicira diskusija o problemima		

	planiranja, analize, projektovanja i razvoja informacijskih sistema sa posebnim osvrtom na sisteme koji se primjenjuju u oblasti saobraćaja i komunikacija. U toku nastave se koriste različite metode koje uključuju: usmeno izlaganje, diskusije, demonstracije, individualni i grupni rad.
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/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 nije obuhvaćen parcijalnim ispitom) koji se vrednuje sa 50 bodova za studente koji su položili parcijalni ispit ili se sastoji od kompletnog gradiva koje se vrednuje sa 80 bodova za studente koji nisu položili parcijalni ispit. Aktivnost studenta se prati i ocijenjuje kroz učestvovanje u diskusijama na nastavi, izradu zadaća, seminarskih radova, projektnih zadataka ili polaganje kvizova. Završni / popravni ispit se organizuje kao pismeni i/ili usmeni ispit. 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/popravnog ispita. Prema kvalitetu stečenih znanja i vještina student može osvojiti maksimalno 100 bodova, a prema sljedećoj skali: Struktura bodovanja Bodovi (%) Zadaće / Aktivnost na nastavi:..... 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). Navedena skala ocjenjivanja se može korigovati prema Pravilima studiranja na Univerzitetu u Sarajevu (Član 49).
Literatura:	Obavezna literatura: – A. Čolaković, „*Informacioni sistemi u saobraćaju i komunikacijama (SKRIPTA),"* Fakultet za saobraćaj i komunikacije, Sarajevo, 2020. Dopunska literatura: – 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. – Richard T. Watson (editor), „*Information Systems*," Global Text Project (Creative Commons Attribution 3.0 License), 2017. – 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. – Anita Pickerden, „*Planning and Managing your Work Based Projects*," bookboon.com, 2015. – Terra Vanzant Stern, „*Lean and Agile Project Management*," Taylor & Francis Group, 2017. – Andrew Stellman & Jennifer Greene, „*Learning Agile*," O'Reilly Media, 2015. – Christos Kalloniatis: "*Modern Information Systems*," InTech Croatia, 2012. – Poliščuk Jaroslav: „*Projektovanje informacionih sistema*," Podgorica, 2007. – Kelly R. Jr, Efraim T.: „*Uvod u informacione sisteme*," Data Status, 2009. – Information Security Management Systems (ISMS) standards, ISO/IEC 27000 – ISO 9000 family of quality management systems (QMS) standards

Šifra predmeta: 15-1ATCES010203	**Naziv predmeta: Elementi transportnih sredstava i uređaja**		
Ciklus: I	**Godina: II**	**Semestar: III**	**Broj ECTS kredita:** 6
Status: IZBORNI PREDMET		**Ukupan broj kontakt sati: 90**	
Učesnici u nastavi	**Nastavnici i saradnici izabrani na oblast kojoj predmet pripada/predmet**		
Preduslov za upis:	Ne		
Cilj (ciljevi) predmeta:	Cilj predmeta je da student upozna sa racionalnim konstrukcionim oblicima, principima rada, osnovama proračuna i principima izbora materijala elemenata i uređaja transportnih i pretovarnih sredstava.		
Tematske jedinice: *(po potrebi plan izvođenja po sedmicama se utvrđuje*	– Uvod. Elementi za spajanje. Zavareni, lemljeni, lijepljeni spojevi. Spojevi sa zakovicama. – Spojevi sa vijcima. Spojevi sa klinovima. strujanje. Stoksova teorema		

uvažavajući specifičnosti organizacionih jedinica)	– Elastični spojevi. – Elementi za kružno kretanje . Vratilo i osovine. – Spojnice. Ležišta. – Elementi za prijenos snage. Frikcioni prenosnici. – Zupčasti prenosnici. – Remeni prenosnici. – Karakteristika prenosnika snage i njihova primjena na transpornim i pretovarnim sredstvima. – Elementi za provođenje tekućina (tečnosti) i gasova (cijevi, cijevni zatvarači i drugi). – Uvod. Prvi glavni zakon termodinamike – Kalorična svojstva gasova. Smjese gasova – Promjene stanja gasova. Kružni procesi. – Drugi glavni zakon termodinmike – Toplotne mašine. Kompresori. Motori SUS. Turbine
Ishodi učenja:	Znanje: Poznavanje racinalnih konstrukcionih oblika, principa rada, osnova proračuna i izbora materijala elemenata i uređaja transpornih i pretovarnih sredstava. Vještine: Primjena usvojenih znanja iz navedene oblasti će studentu omogućiti da u toku praktičnog rada maksimalno iskoristi eksploatacione karakteristike elemenata i uređaja koji su ugrađeni u transportna i pretovarna sredstva i izvrši pravilan izbor elemenata.Usvojeno znanja iz ovog predmeta je potrebno za lakše praćenje i razumjevanje drugih stručnih predmeta u nastavku studija. Kompetencije: Kroz nastavni proces predavanja, vježbi i izrade domaćih zadataka student će biti sposoban, na osnovu usvojenog znanja da: – shvati osnovne principe rada kompresora, motora sus i gasnih turbina. – analizira elemente i uređaje koji ulaze u sastav transportnih i pretovarnih sredstava te da izvrši pravilan izbor i zamjenu potrebnih elemenata. – postavi i definiše mehaničko- matematičke modele prenosa snage od pogonskog do radnog dijela transportnih i pretovarnih sistema i izvriši pravilan izbor potrebne opreme i snage pogonskog agregata.
Cilj održivog razvoja (SDG):	SDG12 – Održiva potrošnja i proizvodnja
Metode izvođenja nastave:	– Samostalno izlaganje – Diskusija – Analiza primjera iz prakse(zadaci,seminarski radovi)
Metode provjere znanja sa	Ocjena kreativnosti na nastavi i vježbama uz izradu samostalnih radova,

strukturom ocjene:	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 55 %. – I Parcijalni ispit/test/provjera znanja/35 bodova (%), položen je ako se osvoji preko 55 %. – Završni ispit (II Parcijalni) 50 bodova (%), položeno ako se osvoji preko 55 %. – Završni ispit (Integralni) 85 bodova (%), položeno ako se osvoji preko 55 %. 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, 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. 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.....80 (%) 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: – Perše,S., Višnjić,V.: Strojarstvo u prometu, Fakultet prometnih znanosti, Zagreb, 2000. – Decker,K.H.: Elementi strojeva ,Tehnička knjiga, Zagreb, 1975. – Vrhovski, D., Nikšić. M.: Osnove strojarstva –zbirka rješenih zadataka ,FPZ, Zagreb,1998. Dopunska: – Šelmić,R.: Elementi transportnih sredstava i uređaja, Saobraćajni fakultet, Beograd, 2005. – Šelmić,R, Mijailović,D., Perišić, D.: Elementi transportnih sredstava i uređaja-Praktikum Saobraćajni fakultet, Beograd, 2006. – Šelmić,R.:Tehnička termodinamika, Saobraćajni fakultet, Beograd, 2006.

Šifra predmeta: 15-2ATCES010203	**Naziv predmeta: Informacije i komunikacije**		
Ciklus: I	**Godina: II**	**Semestar: III**	**Broj ECTS kredita: 6**
Status: Izborni 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:	**Studenti stiču osnovna teorijska znanja potrebna za izučavanje savremenih digitalnih telekomunikacijskih sistema:** osnovna teorijska i djelomično praktična znanja iz oblasti teorije informacija i komunikacija u obimu koji odgovara početnom kursu iz ovih oblasti i osnove informacijskih i IP mreža.		
Tematske jedinice:	1. Informacija: Slučajni događaji. Definicija informacije, matematička interpretacija, svojstva informacije na sintatičkom,		

(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)	semantičkom i programskom nivou. Sadržaj informacije. Logika, sintaksa i semantika. Formalni sistemi, metode i tehnike. Izvori informacija i vrste. 2. Diskretni izvori informacije: količina informacije, entropija. Svojstva entropije. Entropija kontinualnog izvora. Uslovne entropije, uzajamna količina informacije. Izvori sa memorijom - izvori Markova, ergodični izvori. Entropija izvora Markova, izvori višeg reda. 3. Kodiranje izvora: osnovni pojmovi, prefiksni kodovi, Kraftova nejednakost. Statističko kodiranje. Optimalno statističko kodiranje, kodiranje proširenog izvora. Prvi Shannonov teorem. Shannon-Fano kod, Huffmanov kod. 4. Statistički model kanala: diskretni kanal, osnove zaštitnog kodiranja. Shannonov teorem o kodiranju. 5. Signali: pojam, podjela. Deterministički signali: obrada signala u frekvencijskom domenu. Fourierov red. Fourierova transformacija. 6. Slučajni procesi: Autokorelaciona fukcija. Spektralna gustina snage. Signali šumova. Gaussov šum. 7. Kontinualni kanal: pojam, kontinualni kanal sa aditivnim Gaussovim šumom, kapacitet kanala. 8. Analogno digitalna konverzija: Diskretni prikaz kontinualnog signala. Kvantiziranje po amplitudi. PCM. 9. Specifičnosti prenosa digitalnih signala: model telekomunikacijskog sitema, prenos u osnovnom opsegu učestanosti.. 10. Specifičnosti prenosa digitalnih signala u trensponovanom opsegu učestanosti: linearne digitalne modulacije: ASK. FSK. PSK. QAM. Višestruki pristup. 11. Mreže: Informacijska mreža. Telekomunikacijska mreža. Obilježja mreža. OSI i IP modeli mreža. 12. Internet mreže: IP protokol. Familija protokola TCP/IP. IP adresiranje. 13. Internet komunikacije: principi, napredne Internet aplikacije i tehnike komuniciranja, organizacija web-a. 14. Telekomunikacijske mreže: podjela, specifičnosti žičnih i bežičnih mreža. Kvalitet servisa u mrežama QoS. 15. Napredne telekomunikacijske tehnike i višestruki pristup: raširenispektar, sistemi sa više nosilaca.
Ishodi učenja:	Znanje: osnovna teorijska i djelomično praktična znanja iz oblasti teorije informacija i komunikacija u obimu koji odgovara početnom kursu iz ovih oblasti i osnove informacijskih i IP mreža. Vještine: Sposobnost primjene teorijskih i praktičnih znanja iz oblasti

	savremenih digitalnih telekomunikacijskih sistema. Kompetencije: Sposobnosti samostalnog analiziranja osnovnih parametara relevantnih za teoriju informacija, dizajniranje i analiziranje sistemske karakteristike diskretnog i kontinualnog kanala, sposobnost korištenja osnovnih analitičkih metode u analizi informacijskih i IP mreža.
Ciljevi održivog razvoja (SDGs)	SDG4 – Kvalitetno obrazovanje SDG5 – Rodna ravnopravnost SDG9 – Industrija, inovacije i infrastruktura SDG17 –Partnerstvom do ciljeva
Metode izvođenja nastave:	Nastava se realizira kroz izvođenje predavanja, vježbi i laboratorijskih vježbi. 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 princip uz prikaz opisnih primjera i rješavanje određenih zadataka. Dodatni primjeri se razmatraju i rješavaju kroz vježbe i laboratorijske vježbe, što omogućava kontinuiran rad i pripremu za samostalno rješavanje problema. Rad na domaćoj zadaći/seminarskom radu/ praktičnom radu ima za cilj razvijanje vještina individualnog i timskog rada, te organizacije i realizacije praktičnog projekta.
Metode provjere znanja sa strukturom ocjene:	Kriterijum praćenja rada i ocjenjivanja studenta vrši se na sljedeći načinu: – Zadaća: 0 do 15 bodova (%); – I parcijalni ispit: 0 do 35 bodova (%); – Završni ispit: II parcijalni (0 do 50 bodova (%)) i/ili popravni I parcijalni (0 do 35 bodova (%)); Završni ispit se organizuje kao pismeni i/ili 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 I parcijalnom i završnom (II parcijalnom) dijelu ispita, a dovoljan uslov je da suma ostvarenih bodova (zadaća/praktični rad + I

	parcijalni + II parcijalni) bude 55. Zadaća se realizira kroz izradu domaće zadaće i polaganje kvizova ili izradu praktičnog rada Postignuti bodovi na kvizovima i dostavljenoj zadaći nemaju mogućnost popravljanja. Za studente koji nisu uspješno okončali I 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.
Literatura:	Obavezna: 3. Bilješke i slajdovi s predavanja 4. K. Suruliz i M. Hadžialić, Statistička teorija telekomunika- cija, Elektrotehnički fakultet u Sarajevu, 2009, ISBN 978-9958-629-27-3. 5. B. P. Lathi, Modern Digital and Analog Communication Systems, Oxford University Press, New York 998. Dopunska: 1. V. Sinković, Informacijske mreže, Školska knjiga, Zagreb, 1994. 2. Bažant i dr, Osnovne arhitekture mreža, Element, 2004. 3. M. Schwartz, Telecommunications Network: Protocols, Modelling and Analysis, Adisson-3. Wesley PC, Reading, Massachusetts, 1987. 4. J. F. Kurose, K.W. Ross, Internet and Communication Networks, Mc Graw-Hill, 2003.

Šifra predmeta: 16CITOS010204	**Naziv predmeta: SOFTVERSKO INŽINJERSTVO I**		
Ciklus: I	**Godina: II**	**Semestar: IV**	**Broj ECTS kredita:** 6
Status: Obavezni		**Ukupan broj 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 predmeta je upoznati studente s najnovijim tehnologijama u području softverskog inžinjerstva i tehnikama razvoja softvera.
Tematske jedinice: *(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)*	1. Životni ciklus softvera. 2. Osnovni dijagrami (UML, ERD). 3. Uvod i principi programskih jezika 4. Proceduralni i objetno-orjentirani jezici. 5. Osnovne tehnike programiranja. 6. Uvod u programiranje u C++, U/I u C++ i druge specifičnosti C++ sintakse. 7. Struktura programa u C++. 8. Petlje i stringovi u C++ 9. Logički operatori. 10. Podaci u softver inžinjeringu (povezivanje formi i baza podataka). 11. Pregled. NET platforme i Visual Studio. NET razvojne okoline. 12. Stvaranje konzolnih aplikacija u VB.NET. 13. Oblikovanje grafičkog korisničkog interfejsa i rad sa Windows formama u VB.NET. 14. Pisanje i razumijevanje softverske dokumentacije. 15. Sigurnost i zaštita aplikacija.
Ishodi učenja:	**Znanje:** U predmetu Softversko inžinjerstvo I studenti trebaju da savladaju osnovne principe programiranja. **Vještine:** osnove programskih jezika C++ i VB.NET Kompetencije: sticanje predznanja za uspješno rješavati nekih od programerskih problema iz prakse. **Kompetencije:** Studenti će biti sposobni dizajnirati i optimizirati telekomunikacijske mreže. Također, moći će procijeniti sigurnosne rizike i primijeniti zaštitne mjere.
Cilj održivog razvoja (SDG):	SDG4 – Kvalitetno obrazovanje SDG9 – Industrija, inovacije i infrastruktura
Metode izvođenja nastave:	Teorijski dio nastave pripremljen iz referentne literature prezentuje se

	upotrebom savremenih multimedijskih sredstava, uz podsticanje interaktivnosti u nastavi. Vježbe i laboratorijske vježbe održavaju se uz upotrebu savremenih softverskih alata u kompjuterskim laboratorijama fakulteta, te rješavanje konkretnih problemskih i praktičnih zadataka. Laboratorijske vježbe / terenski rad / praksa omogućava kontinuiran rad i predstavljaju adekvatnu 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:	Kriterijum vrednovanja rada i ocjenjivanja studenta u toku nastave, vrši se na sljedeći način: Domaća zadaća/seminarski rad/projektni zadatak od 0 do 15 bodova (15%); Parcijalni ispit/ test/provjera znanja od 0 do 35 bodova (35%); Ukupan broj bodova koji student prema navedenom praćenju u toku nastave može ostvariti iznosi maksimalno 50 bodova (50%). Završni ispit od 0 do 50 bodova (50%). Da bi položio predmet student mora položiti (zadovoljiti) svaki od tri dijela zasebno (seminarski, parcijalni i završni ispit), te u ukupnom zbroju osvojiti minimalno 55 bodova (55%). 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 85-94,9 bodova; c) 8 (C) - prosječan, sa primjetnim greškama, nosi 75-84,9 bodova; d) 7 (D) - općenito dobar, ali sa značajnijim nedostacima, nosi 65-74,9 bodova; e) 6 (E) - zadovoljava minimalne uslove, nosi 55-64,9 bodova; f) 5 (F, FX) - ne zadovoljava minimalne uslove, 0 – 54,9 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 (%) Domaća zadaća/seminarski rad/projektni zadatak.....15 bodova (%) I Parcijalni ispit/Test/Provjera znanja/.....35 bodova (%) Završni ispit (II Parcijalni + Teorija) .....50 bodova (%)
Literatura:	Obavezna: Nastavni materijal dostupan na web stranici Fakulteta za saobraćaj i komunikacije. Dopunska: 1. Dragan M.: „Objektno orijentisano programiranje na jeziku C++“, Mikro Knjiga 1995. 2. Jesse L.: „C++ Naučite za 21 dan“, Kompjuter biblioteka“, 2003. 3. Walter Savitch: Problem Solving in C++, Pearson Publishing, 2006 4. T.Žuljević: “Uvod u programiranje – VB.NET”, Sveučilište u Splitu, Split 2005. 5. H. M. Deitel, P. J. Deitel, and T. R. Nieto: “ Visual Basic.NET How to Program”, Prentice Hall, 2002. 6. David I. Schneider: “An Introduction to Programming Using Visual Basic.NET”, Prentice Hall, 2003.

Šifra predmeta: 17CITOS010204	**Naziv predmeta:** Operativni sistemi		
Ciklus: I	**Godina:** II	**Semestar:** IV	**Broj ECTS kredita: 6** **ECTS Praksa:2**
Status: Obavezni		**Ukupan broj sati:** 90 Opciono razraditi distribuciju sati po tipu: Predavanja 45 Vježbe 30 Seminar/Terenski rad/Laboratorijske vježbe/Praksa:15	
Učesnici u nastavi	**Nastavnici i saradnici izabrani na oblast kojoj predmet pripada/predmet**		

Preduslov za upis:	NE
Cilj (ciljevi) predmeta:	Po uspješno završenom kursu, studenti će biti u stanju: Identificirati glavne komponente operativnog sistema i opisatinjihove funkcije. Diskutovati osobine operativnog sistema potrebne za pojedinuprimjenu. Razumjeti različite nivoe sistemskog i aplikativnog softvera. • Biti upoznat s glavnim uslugama operativnih sistema, poputdatotečnih sistema, upravljanja memorijum, upravljanja procesima,upravljanja uređajima i korisničkim interfejsom. Upotrijebiti i prilagođavati operativne sisteme.
Tematske jedinice: *(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)*	1.Uvod: Uloga, funkcionalnost i struktura operativnog sistema,historijski razvoj operativnih sistema: batch, multiprogramiranje,time-sharing 2.Struktura računarskog sistema: prekidi i upravljanje prekidima,ulazno izlazne operacije, dualni način rada procesora, sistemski pozivi servisi. 3.Struktura operativnog sistema: slojna struktura operativnog sistema,monolitni i mikrokernel, funkcionalna organizacija operativnih sistema Unix, Linux, Windows 4.Upravljanje resursima, I/O manager, metode za rad sa zastojem,bankarski algoritam 5.Upravljanje procesima: Koncept i stanja procesa, izmjena procesa,operacije nad procesima, predstavljanje procesa, thread-i i upravljanje thread-ovima, upravljanje procesima u Unix-u,međuprocesna komunikacija koristeći pipe i signale, posredstvomprosljeđivanja poruka: direktno, indirektno, baferovanje. 6.Dijeljena memorija, problem sinhronizacije procesa, kritična sekcija imeđusobno isključivanje, semafori i hardverke tehnike sinhronizacije: test_and_set. 7.Raspoređivanje procesora: Opšti koncepti i kriteriji raspoređivanja,dispečer, algoritmi raspoređivanja: FCFS, SJF, prioritetni, RoundRobin, MFQ, raspoređivanje na primjerima operativnog sistema UNIX-a i Windows-a 8.Upravljanje memorijom: Loaderi, opšti koncepti prevođenja adresa iz logičke u fizičku, alokacija memorije, kontinualna: sa jednom i više particija, statičke i dinamičke, i nekontinualna: straničenje i

	segmentiranje, virtuelna memorija, upravljanje memorije u Unix-u. 9.Upravljanje datotekama: Strukture datotečnog sistema, upravljanjeslobodnim prostorom, implementacija datoteke i direktorija, datotečnisistemi za Unix i Windows operativne sisteme: logička organizacija datoteka, upravljanje pristupom datotekama/direktorijima, zaštitadatoteka 10.Korisnički interfejs, tekstualni, grafički i mrežni 11.Arhitektura DOS, Windows i Linux sistema,
Ishodi učenja:	Znanje: Po uspješno završenom kursu, studenti će biti u stanju: Identificirati glavne komponente operativnog sistema i opisatinjihove funkcije. Diskutovati osobine operativnog sistema potrebne za pojedinuprimjenu. Razumjeti različite nivoe sistemskog i aplikativnog softvera. Biti upoznat s glavnim uslugama operativnih sistema, poput datotečnih sistema, upravljanja memorijum, upravljanja procesima,upravljanja uređajima i korisničkim interfejsom. Upotrijebiti i prilagođavati operativne sisteme. Vještine: Upotreba operativnih sistema iz komandne linije Kompetencije: U skladu sa kompetencijama zanimanja za koje se školuje
Ciljevi održivog razvoja (SDG):	SDG 9: Industrija, inovacije i infrastruktura
Metode izvođenja nastave:	Na predavanjima se obrađuju temeljni koncepti iz oblasti operativnih sistema.Studenti se upoznaju sa različitim podsistemima jezgra operativnog sistema, injihovim međusobnim odnosom. Auditorne vježbe uključuju kvantitativne primjere kojii lustruju uvedene koncepte i algoritme. Domaće zadaće mogu da uključuju dodatne primjere i probleme koji su blisko povezani sa predavanjima.
Metode provjere znanja sa strukturom ocjene:	Konačna ocjena se dobija na sljedeći način: 5 poena pohađanje i rad na predavanju i laboratorijskim 10 poena po problemski, programski zadaci i slučajevi ili grupni

	5 poena na dodatnu aktivnost ukoliko ukupni zbir ne prelazi 100. 35 poena parcijalni pismeni ispit, problemski zadaci i pitanja pri čemu se 18 poena smatra položenim ispitom Završni ispit za studente koji su položili parcijalni ispit: 30 poena pismeni dio ispita, 20 poena usmeni dio. Završni ispit za studente koji nisu položili parcijalni ispit: 45 poena pismeni dio ispita, 40 poena usmeni dio. Konačna ocjena: do 20 poena ponovo upisati kurs, 21-54 ocjena 5, 55-64ocjena 6, 65-74 ocjena 7, 75-84 ocjena 8, 85-94 ocjena 9, 95-100 ocjena 10.
Literatura:	Obavezna: Samir Ribić "Operativni sistemi", 2019 Univerzitet u Sarajevu Dopunska: Tanenbaum A., "Modern Operating Systems", 3rd Edition, Prentice Hall, 2008.

Šifra predmeta: 18CITOS010204	**Naziv predmeta: RAČUNARSKE MREŽE I PROTOKOLI**		
Ciklus: I	**Godina: II**	**Semestar: IV**	**Broj ECTS kredita:** 6
Status: **Obavezni predmet**		**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:	Sticanje znanja o vrstama računarskih mreža kao i načinu funkcionisanja istih. Upoznavanje sa osnovnim komponentama računarskih mreža i sticanje znanja o mogućnostima njihove implementacije što će poslužiti daljem razvoju vještina potrebnih za projektovanje i razvoj računarskih		

	mreža.
Tematske jedinice: *(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)*	1. Uvod – pojam mreže i vrste komunikacijskih mreža 2. Arhitekture računarskih mreža 3. Procesi u računarskim mrežama 4. OSI i TCP/IP modeli 5. TCP/IP stek protokola – aplikacijski i transportni sloj 6. TCP/IP stek protokola – mrežni i fizički sloj 7. LAN mreže i njihova protokolska arhitektura 8. Ethernet i Token Ring mrežna arhitektura 9. Aktivne komponente LAN mreža 10. Pasivne komponente LAN mreža 11. Projektovanje LAN mreža i strukturno kabliranje 12. Standardi WLAN mreža 13. Infrastruktura WLAN mreža 14. Procesi u WLAN mrežama 15. Sigurnost i zaštita računarskih mreža
Ishodi učenja:	Znanje: Studenti će steći teorijska i praktična znanja o vrstama i mogućnostima računarskih mreža kao i o opremi koja se koristi kod razvoja računarskih mreža. Studenti će se upoznati sa osnovnim protokolima koji se koriste i načinu funkcionisanja računarskih mreža. Vještine: Na osnovu stečenog znanja studenti će biti osposobljeni za primjenu opreme u razvoju i projektovanju računarskih mreža. Kompetencije: Studenti će naučiti koristiti određene alate za simulaciju rada računarskih mreža i analizu mrežnog saobraćaja i protokola.
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: <u>Obaveze studenta Bodovi (%)</u>

	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. TANENBAUM, D. WETHERALL: Računarske mreže, Prevod petog izdanja, Mikro knjiga, 2012. 2. Kurose, J.F., Ross, K.W.: Computer Networking: A Top-Down Approach, Sixth edition, Addison-Wesley, 2012. 3. Stallings, W.: Data and Computer Communications, Eight edition, Prentice Hall, 2007. 4. Engst, E., Fleishman, G.: Bežično umrežavanje, Komjuterska biblioteka, 2004. 5. William C Hardy: "An Architectural Framework for Support of Quality of Service in Packet Networks", IEEE Communications Magazine, June 2003. 6. Turčinhodžić Faruk: Lokalne računarske mreže, Univerzitetsko izdanje, Sarajevo, 2004.

Šifra predmeta: 19-20-1CITES010204	**Naziv predmeta:** **ARHITEKTURA RAČUNARA**		
Ciklus: I	**Godina: II**	**Semestar: IV**	**Broj ECTS kredita:** 6
Status: Izborni		**Ukupan broj sati: 90** Predavanja: 45 Vježbe: 45	
Učesnici u nastavi	**Nastavnici i saradnici izabrani na oblast kojoj predmet pripada/predmet**		
Preduslov za upis:	Ne		
Cilj (ciljevi) predmeta:	- Razviti temeljno razumijevanje arhitekture računara i njezinih osnovnih komponenti. - Osigurati duboko razumijevanje funkcija i uloge ključnih komponenti računarske arhitekture kao što su procesor, memorija i matična ploča. - Razviti sposobnost samostalnog istraživanja i učenja o naprednim konceptima u području arhitekture računara.		

	- Potaknuti razvoj komunikacijskih vještina kroz prezentaciju kompleksnih tehničkih informacija.
Tematske jedinice: *(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)*	1. Pojam arhitekture računara. 2. Modeli računara (personalni, server, super računari). 3. Osnovne komponente arhitekture računara. 4. Matična ploča (funkcija, struktura, PCI portovi, PCI Express, AGP). 5. Procesor (aritmetičko logička jedinica, upravljačka jedinica, radni registri, cache memorija, sabirnica unutar procesora). 6. Procesori sa više jezgra. 7. Sistemska sabirnica ili magistrala (magistrala podataka, magistrala instrukcija, upravljačka magistrala, 32bit, 64bit). 8. RAM memorija (vrste memorije ovisno o arhitekturi računara, dinamički i statički RAM, brzine, kapaciteti). 9. ROM memorija (vrste, funkcija). 10. Clock (sat). 11. Grafička karta (funkcija, brzine, portovi). 12. Hard Disk (HDD-dijelovi, funkcija, rad, kapacitet, brzina). 13. Ulazni i izlazni uređaji. 14. Asemblerski jezici i asemblersko programiranje (potprogram, makro, stek). 15. Kompajler.
	Znanje: - Prepoznavanje i opisivanje različitih modela računara. - Identifikacija i objašnjenje osnovnih komponenti arhitekture računara. - Razumijevanje funkcija procesora, aritmetičko-logičke jedinice, upravljačke jedinice, radnih registara, cache memorije i sabirnice unutar procesora. - Opisivanje sistemske sabirnice ili magistrale, njezine uloge te različitih tipova. - Razumijevanje pojedinih komponenti arhitekture računara. - Razumijevanje razlike između različitih struktura diskova.

Ishodi učenja:	Vještine: - Identificiranje komponenti računarske arhitekture. - Povezivanje komponenti računarske arhitekture sa njihovim funkcijama i ulogama. - Interpretiranje različitih tipova memorije i njihovih karakteristika. - Analiziranje komponenti računarske arhitekture u kontekstu njihove primjene i performansi. Kompetencije: - Primjena stečenog znanja o arhitekturi računara u praksi, kao što su identifikacija i rješavanje problema u hardverskim konfiguracijama. - Razvijanje sposobnosti analize i procjene performansi računarskih komponenti. - Sposobnost komunikacije i prezentiranja kompleksnih tehničkih informacija o računarskoj arhitekturi. - Integracija znanja iz područja računarske arhitekture u širem kontekstu informacijske tehnologije i računalnih znanosti.
Cilj održivog razvoja (SDG):	SDG4 – „Osigurati uključivo i kvalitetno obrazovanje te promovirati mogućnosti cjeloživotnog učenja“; SDG9 – “Izgraditi prilagodljivu infrastrukturu, promovirati uključivu i održivu industrijalizaciju i poticati inovativnost”; SDG12 - „Osigurati održive oblike potrošnje i proizvodnje“.
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: – Domaća zadaća/seminarski rad/praktični rad/ 15 bodova (%), uzimaju se u obzir bodovi ako se osvoji preko 50 % (predaja 7 bodova, a odbrana 8). – I Parcijalni ispit/test/provjera znanja/35 bodova (%), položen je ako se osvoji preko 50 %. – Završni ispit - pismeni 20 bodova (da bi se pristupilo usmenom ispitu, na pismenom se mora osvojiti minimalno 50%) – Završni ispit – usmeni 30 bodova – Završni ispit (Integralni) – pismeni - 40 bodova (da bi se pristupilo usmenom ispitu, na pismenom se mora osvojiti minimalno 50%), – Završni ispit (Integralni) – Usmeni - 45 bodova , **Da bi student položio ispit mora položiti usmeni dio ispita**. Ukupan broj bodova (%) koji student prema navedenom praćenju u toku nastave može ostvariti iznosi maksimalno 50 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 40+45 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. 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 – pismeni .....20 bodova Završni ispit – usmeni .....30 bodova Završni ispit (Integralni) –pismeni.....40 bodova Završni ispit (Integralni) - usmeni.....45 bodova
Literatura:	Obavezna: 1. Nastavni materijal dostupan na web stranici Fakulteta za saobraćaj i komunikacije u okviru moodle platforme - i na MS TEAMS u okviru predmeta) 2. Tanenbaum, A.S.: Arhitektura i organizacija računara, Prevod petog izdanja, Mikro knjiga, 2007 Organizacija i arhitektura računara: projekat u funkciji performansi, Prevod devetog izdanja. 3. William Stallings: CET, 2012.

Šifra predmeta: 19-20-2CITES010204	**Naziv predmeta: Digitalna obrada signala**		
Ciklus: I	**Godina: II**	**Semestar: IV**	**Broj ECTS kredita: 6** **ECTS Praksa:2**
Status: Izborni predmet		**Ukupan broj sati: 90** Razrada distribucije sati po tipu: Predavanja: 30 Vježbe: 30	

	Seminar 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 stiču osnovna teorijska znanja potrebna za izučavanje savremenih digitalnih telekomunikacijskih sistema sa aspekta razumjevanja osnova digitalne obrade signala do nivoa mogućnosti čitanja stručne literatura čiji je ona fundament. Omogućavanje primjene koncepata digitalne obrade signala za područje od interesa iz naprednijih oblasti i aplikacija.
Tematske jedinice: *(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)*	1. Reprezentacija signala i sistema. 2. Osnovne podjele i osnovni signali. 3. A/D i D/A konverzija 4. Analiza i obrada diskretnih signala u vremenskom domenu: LTI sistemi 5. Impulsni odziv. Konvolucija. Dekonvolucija. 6. Z - transformacija: direktna i inverzna 7. Primjena z - transformacija na LTI sisteme 8. Frekvencijska analiza vremenski kontinualnih signala. 9. Frekvencijska analiza vremenski diskretnih signala 10. Diskretna Fourier-ova transformacija (DFT) i brza Fourier-ova transformacija (FFT). 11. Osobine i primjena DFT 12. Digitalno filtriranje: sistemi s beskonačnim (IIR) impulsnim odzivom 13. Digitalno filtriranje: sistemi s konačnim (FIR) impulsnim odzivom. 14. Uzorkovanje pojasnih signala. 15. Rekonstrukcija signala
Ishodi učenja:	Znanje: osnovna teorijska i djelomično praktična znanja iz oblasti analize i obrade digitalnih signala. Vještine: Sposobnost primjene teorijskih i praktičnih znanja iz oblasti analize signala i digitalne obrade signala. Kompetencije: Studenti bi trebali biti u stanju da: – koriste osnovne alate i tehnike za analizu i digitalnu obradu signala; – razumiju procese konverzija analognog signala u digitalni oblik, sa aspekata uzorkovanja signala i kvantiziranja uzoraka;

	– analiziraju i procjenjuju vrijednost brzine uzorkovanja i preciznosti u procesu kvantizacije.
Ciljevi održivog razvoja (SDGs)	SDG4 – Kvalitetno obrazovanje SDG8 – Dostojanstven rad i ekonomski rast SDG9 – Industrija, inovacije i infrastruktura SDG11- Održivi gradovi i zajednice **SDG16 - Mir, pravda i snažne institucije** 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 kroz izradu zadaće/samostalnih radova/praktičnih radova, ocjena parcijalnog ispita u toku nastave kao i ocjena završnog/popravnog ispita. Kriterijum praćenja rada i ocjenjivanja studenta vrši se na sljedeći načinu: – Zadaća: 0 do 15 bodova (%); – I parcijalni ispit: 0 do 35 bodova (%); – Završni ispit: II parcijalni (0 do 50 bodova (%)) i/ili popravni I parcijalni (0 do 35 bodova (%)); Završni ispit se organizuje kao pismeni i/ili 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 I parcijalnom i završnom (II parcijalnom) dijelu ispita, a dovoljan uslov je da suma ostvarenih bodova (zadaća/praktični rad + I

	parcijalni + II parcijalni) bude 55. Zadaća se realizira kroz izradu domaće zadaće i polaganje kvizova ili izradu praktičnog rada Postignuti bodovi na kvizovima i dostavljenoj zadaći nemaju mogućnost popravljanja. Za studente koji nisu uspješno okončali I 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.
Literatura:	Obavezna: 1. Bilješke i slajdovi s predavanja 2. Oppenheim, Alan V., and Ronald W. Schafer: „Digital Signal Processing“, Prentice Hall, 1999. 3. J. G. Proakis, D. K. Manolakis: „Digital Signal Processing“, Prentice Hall, 2007. 4. S. K. Mitra: „Digital Signal Processing“, McGraw-Hill, 2005. Dopunska: 5. M. Ahić – Đokić, B. Berunčić, Analiza signala i sistema, Sarajevo 1999. 6. B. P. Lathi, Modern Digital and Analog Communication Systems, Oxford University Press, New York 998.

Šifra predmeta: 19-20-3CITES010204	**Naziv predmeta:** LINEARNO PROGRAMIRANJE		
Ciklus: I	**Godina: II**	**Semestar: IV**	**Broj ECTS kredita: 6**
Status: Izborni predmet		**Ukupan broj sati: 90** Opciono razraditi distribuciju sati po tipu:	

	Predavanja: 45 Vježbe: 20 Laboratorijske vježbe: 15
Učesnici u nastavi	**Nastavnici i saradnici izabrani na oblast kojoj predmet pripada/predmet**
Preduslov za upis:	NE
Cilj (ciljevi) predmeta:	Razvijanje osnovnih teorijskih znanja relevantnih za koncepte i metode rješavanja problema linearnog programiranja, sa naglaskom na rješavenje optimizacijskih problema u transportno komunikacijskim tehnologijama. Razvijanje osnovnih vještina korištenja simulacijskog okruženja za izbor optimalnog rješenja linearnog programiranja.
Tematske jedinice: *(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)*	Predavanja: - Uvodno u linearno programiranje - Matematsko modeliranje, uvod u optimizaciju - Klasična optimizacija bez ograničenja - Lagranžova metode i metoda KarushKuhn-Tacker-a . - Nelinearno programiranje I dio - Nelinearno programiranje II dio - Linearno programiranje I dio (Grafičko rješavanje) - Linearno programiranje II dio (Simpleks metod) - Linearno programiranje III dio (Dualnost) - Cjelobrojno linearno programiranje I - Cjelobrojno linearno programiranje II - Primjena linearnog programiranja u rješavanju transportnog problema Vježbe: - Primjena bezuslovne za rješavanje problema optimizacije - Uslovna optimizacija Lagrange-ovi multiplikatori i Karush-Kuhn-Tucker metoda - Gradijentne metode pretraživanja - Primjena metoda za jednodimenzionalno pretraživanje (Newton-Rapson-ova i metoda sekante) - Primjena metoda fibonačijevog pretraživanja i zlatnog sječenja za jednodimenzionalno pretraživanje - Linearno programiranje - Primjena grafičke metode za rješavanje problema linearnog programiranja - Tablični simpleks metod - Primjena linearnog programiranja za rješavanja dualnog problema

Ishodi učenja:	Znanje: Studenti će steći temeljno razumijevanje osnovnih pristupa i metoda optimizacije, s posebnim naglaskom na linearno programiranje. Naučit će identificirati i opisati probleme linearnog programiranja u stvarnim scenarijima, posebno u području saobraćaja i komunikacija. Razumijevanje primjene različitih metoda optimizacije uz pomoć računarskih alata i simulacijskih modela. Vještine: Sposobnost primjene različitih metoda optimizacije za rješavanje složenih problema, koristeći računar i odgovarajuće softverske alate. Vještina analize i rješavanja problema linearnog programiranja pomoću simulacijskih alata i donošenje odluka o prikladnim metodologijama za različite realne situacije. Sposobnost kritičkog razmišljanja i procjene primjerenosti različitih metoda optimizacije, uz uvažavanje etičkih normi u primjeni. Kompetencije: Studenti će biti kompetentni u prepoznavanju i rješavanju problema linearnog programiranja u različitim praktičnim situacijama. Moći će samostalno koristiti računar i simulacijske alate za pronalaženje optimalnih rješenja, kao i evaluaciju rezultata u kontekstu stvarnih problema iz saobraćaja i komunikacija. Razviti sposobnost donošenja odluka o primjerenoj metodologiji optimizacije, s naglaskom na odgovorno i etički svjesno upravljanje resursima.
Cilj održivog razvoja (SDG):	"SDG4 – Kvalitetno obrazovanje", SDG9-Industrija, inovacije i infrastruktura"
Metode izvođenja nastave:	Na predavanima se obrađuju teorijski koncepti i principi uz prikaz opisnih primjera i rješavanje određenih zadataka. Dodatni primjeri se razmatraju i rješavaju kroz vježbe, , što omogućava kontinuiran rad i pripremu za samostalno rješavanje problema. Materijal za vježbe – tutorijali se dostavljaju prije održavanja tematske cjeline, kako bi se student pripremio za iste.

	Na vježbama razvijat će se vještine potrebne za individualni i timski rad u cilju izvršavanja zadataka iz zadane oblasti. Zadaci za samostalni rad podrazumijevaju i zadaće u toku semestra, a koje uključuju zadatke poput onih na auditornim vježbama. Praktični rad podrazumijeva laboratorijske vježbekoje se realizuju uz korištenje softverskih simulacijskih rješenja (rad u Matlabu).
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 (%) 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. Nastavni materijal dostupan na web stranici Fakulteta za saobraćaj i komunikacije. 2. Hillier S.F., Lieberman G.J.: "Introduction to operations research". 7th Edition, McGrow Hill Book Co. 2001 3. S. Vukadinović: Transportni zadatak linearnog programiranja, Naučna knjiga, Beograd, 1979.

	Dopunska: 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.

Šifra predmeta: 21CITOS010305	**Naziv predmeta: Softversko inženjerstvo II**		
Ciklus: I	**Godina: III**	**Semestar: V**	**Broj ECTS kredita:** 6
Status: Obavezan predmet		**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 osnovnim konceptima i naprednim konceptima programskog jezika Java sa fokusom na principe objektno orijentisanog programiranja		
Tematske jedinice: *(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)*	1. Kako započeti programirati, ulaz/ispis, varijable i naredbe 2. Ponavljanje funkcionalnosti, petlje i funkcije 3. Otkrivanje grešaka, liste, nizovi i stringovi 4. Uvod u objektno-orijentisano programiranje 5. Složenije OOP, preopterećenje funkcija 6. Objekti i liste, kreiranje korisničkog interfejsa 7. Programske paradigme i algoritmi 8. Hash mapa, sličnost objekata i grupisanje podataka 9. Nasljeđivanje klasa, interfejsi i polimorfizam 10. Rukovanje kolekcijama kao tokovima, interfejs „Comparable“ i druge korisne tehnike 11. Dijagrami klasa, paketi, izuzeci i obrada fajlova 12. Parametri tipova, NizLista i hash tabela, slučajnost i višedimenzionalni podaci 13. Grafički korisnički interfejsi 14. Vizualizacija podataka, multimedija i Maven		
Ishodi učenja:	Znanje: Poznavanje osnovnih i naprednijih koncepata programskog jezika Java kao i principa i koncepata objektno-orijentisanog programiranja.		

	Vještine: Razvoj aplikacija poštujući principe objektno-orijentisanog programiranja korištenjem programskog jezika Java Kompetencije: Programiranje na osnovnom i srednjem nivou sa nekoliko naprednih koncepata u programskom jeziku Java.
Cilj održivog razvoja (SDG):	SDG9 – Industrija, inovacije i infrastruktura SDG11- Održivi gradovi i zajednice
Metode izvođenja nastave:	Teorijska predavanja na kojima se predstavljaju koncepti programskog jezika JAVA i objektno orijentisanog programiranja uključujući praktčne primjere.. 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. Java: A Beginner's Guide, Eighth Edition 8th Edition,Herbert Schildt 2. Head First Java: Your Brain on Java - A Learner's Guide 1st Edition Bert Bates 3. Java Coding Problems: Improve your Java Programming skills by solving real-world coding challenges Anghel Leonard

Šifra predmeta: 22CITOS010305	**Naziv predmeta: Baze podataka**		
Ciklus: I	**Godina: III**	**Semestar: V**	**Broj ECTS kredita:** 6
Status: Obavezan/izborni		**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:	Sticanje teorijskih i praktičnih znanja i vještina iz oblasti relacijskih baza podataka.
Tematske jedinice: *(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)*	1. Baze podataka i podatkovni modeli a. Osnovni pojmovi i. Baza podataka ii. Sistem za upravljanje bazama podataka b. Modeli podataka i. Hijerarhijski model podataka ii. Mrežni model podataka iii. Objektno orjentisani model podataka iv. Relacioni model podataka c. Životni ciklus baze podataka 2. Modeliranje podataka a. Modeliranje podataka b. Dijagram entiteta i njegovih odnosa (ER) 3. Relacioni model a. Osnove relacione algebre b. Očuvanje integriteta podataka c. Normalizacija (1NF, 2NF, 3NF) 4. SQL a. Uvod u SQL i. Standard SQL ii. Tipovi podataka b. Definicije modela podataka (Jezik za izmjenu definicije podataka (DDL)) iii. Kreiranje strukture baza podataka c. Upiti - dohvatanje podataka i. Select naredba, Select DISTINCT, SELECT TOP ii. Sortiranje,Filtriranje iii. Agregatne funkcije i grupisanje podataka iv. Podupiti d. Spajanje tabela i operacije sa skupovima e. Jezik za manipulaciju podacima (DML) - modifikacija podataka i. Dodavanje ii. Brisanje iii. Ažuriranje podataka f. Sistemske funkcije i. Funkcije za rad sa datumima ii. Matematicke funkcije iii. Funkcije za rad sa znakovima 5. Napredne mogućnosti SQL a. Pogledi b. Osnove funkcija i procedura c. Osnove transakcija

Ishodi učenja:	Znanje: Poznavanje relacionog modela podataka i principa funkcionisanja sistema za upravljanje relacionim bazama podataka. Vještine: Kreiranje modela baze podataka, izmjena modela, manipulacije podacima, poznavanje jezika SQL Kompetencije: Kreiranje relacionog modela baze podataka uz primjenu normalizacijskih normi, kreiranje modela u sistemu za upravljanje bazama podataka
Cilj održivog razvoja (SDG):	SDG9 – Industrija, inovacije i infrastruktura SDG11- Održivi gradovi i zajednice
Metode izvođenja nastave:	Teorijska predavanja na kojima se predstavljaju koncepti baza podataka. Predavanja su pored teorijskih koncepata su podržana i prikazivanjem i objašnjavanjem primjera. 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. Ramey Elmasri and Shamkant B. Navathe: Fundaments of Database Systems, 7th Edition, Pearson, 2015, ISBN-13: 978-0133970777 2. C.J. Date, Database in Depth: The Relational Model for Practitioners, O'Reilly, 2005 3. Database System Concepts, A. Silberschatz, H. Korth, S Sudarshan, McGraw Hill International Edition, 2005.

Šifra predmeta: 23CITOS010305	**Naziv predmeta: ADMINISTRACIJA RAČUNARSKIH SISTEMA I MREŽA**		
Ciklus: I	**Godina: III**	**Semestar: V**	**Broj ECTS kredita:** 6

Status: **Obavezni 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 predmeta je upoznavanje studenata sa osnovnim pojmovima i značajem administracije računarskih sistema i mreža, uz sticanje praktičnih znanja i sposobnosti potrebnih za administriranje računarskih mreža. Razmatraju se i analiziraju primjeri iz prakse, koji se odnose na konfigurisanje i upravljanje mrežnih uređaja, i definiraju se pojmovi i modeli vezani za administraciju sistema i mreža. Studenti se detaljno upoznaju sa tehnikama i alatima za nadzor i upravljanje rada mreže i praćenja mrežnih performansi.
Tematske jedinice: *(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)*	1. Pojam računarskog sistema, mreže računara i administracije računarskih sistema i mreža 2. Operativni sistemi, jezgro (kernel), procesi 3. Osnove Unix OS-a 4. Radno opterećenje, radna memorija, resursi 5. Rad sa diskovima, RAID polja 6. Clusteri i failover princip i primjena 7. TCP i UDP, connection oriented i connectionless protokoli 8. Implementacija IPv4 i IPv6 mrežne infrastrukture 9. VLAN 10. Dinamičko rutiranje 11. Instaliranje i konfigurisanje servera: windows servera 12. web server; http server, 13. DHCP i DNS 14. Aktivni direktorijum 15. Domene, stabla, šuma u AD-u 16. AD shema i Globalni katalog 17. Upravljanje objektima aktivnog direktorijuma 18. Lokalne i Globalne grupe u grupna politika 19. Administracija i automatizacija procesa u aktivnom direktorijumu
Ishodi učenja:	Znanje: omogućiti studentima da sagledaju ulogu sistemskog administratora i značaj i potrebu upravljanja mrežom; da definiraju odgovarajuće mrežne arhitekture i sisteme, koji su potrebni za optimalnu realizaciju sistemskih i mrežnih zahtjeva.

	Vještine: Konfigurisanje switcheva i routera, dizajniranje i implementacija VLAN-ova i segmentacija mreže su samo neke od tema koje se obrađuju i administratorske aktivnosti u vezi s tim. Kompetencije: Studenti će nakon odslušanog kursa moći da ocijene kako i u kojem slučaju implementirati pojedine ruting protokole, kako pratiti mrežne performanse, analizirati paketski saobraćaj i na osnovu toga vršiti trobleshutting.
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: <u>Obaveze studenta Bodovi (%)</u> 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: 7. Mark Burges, Principles of Network and System Administration, John Wiley & Sons, 2004. 8. V.Vasiljević, P.Gavrilović, Priručnik za administraciju računarskih mreža, 2006. 9. Craig Hunt, TCP/IP Network Administration (3rd Edition) , O'Reilly 2008.

<table>
<tr><td>Šifra predmeta: 24-25-1CITES010305</td><td colspan="3">Naziv predmeta: Bežični komunikacijski sistemi</td></tr>
<tr><td>Ciklus: I (prvi)</td><td>Godina: III (treća)</td><td>Semestar: VI (šesti)</td><td>Broj ECTS kredita: 6 (Šest)</td></tr>
<tr><td colspan="2">Status: Izborni predmet</td><td colspan="2">Ukupan broj kontakt sati: 3P + 2V + 1L
Predavanja: 3P
Vježbe: 2V
Laboratorijske vježbe: 1L</td></tr>
<tr><td>Učesnici u nastavi</td><td colspan="3">Nastavnici i saradnici izabrani na oblast kojoj predmet pripada/predmet</td></tr>
<tr><td>Preduslov za upis:</td><td colspan="3">NE</td></tr>
<tr><td>Cilj (ciljevi) predmeta:</td><td colspan="3">Sticanje znanja tokom realizacije programa iz bežičnih komunikacijskih sistema te praktične simulacije prijenosa informacija u mobilnim bežičnim mrežama, kao i analiza konkretnih standarda u primjeni za bežične komunikacijske sisteme i mreže. Fokus je na savremenim tehnologijama kao što su 4G, 5G, Wi-Fi 6, IoT i buduće tehnologije.</td></tr>
<tr><td>Tematske jedinice:
(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)</td><td colspan="3">Uvod u bežične komunikacijske sisteme - Sedmica 1

• Uvod u historiju i evoluciju bežičnih komunikacijskih sistema.
• Osnovni pojmovi i principi rada bežičnih mreža.
• Pregled aktuelnih tehnologija i standarda u bežičnim komunikacijama.
• Diskusija o trendovima i budućem razvoju bežičnih komunikacija.

Radio propagacija i karakteristike kanala - Sedmica 2

• Osnove radio propagacije: modeli širenja signala u bežičnim sistemima.
• Utjecaj okoline na širenje signala: refleksija, refrakcija, difrakcija.
• Interferencija i fading: problemi u prijenosu signala i metode izbjegavanja šuma.
• Praktične vježbe s analizom stvarnih radiofrekventnih okruženja.

Modulacijske i kodne tehnike u bežičnim komunikacijama -</td></tr>
</table>

	Sedmica 3 • Digitalne modulacijske tehnike (QPSK, QAM, OFDM) i njihove primjene. • Kodiranje kanala: osnovne tehnike za korekciju grešaka. • Primjena naprednih modulacijskih i kodnih tehnika u savremenim bežičnim mrežama. • Studija slučaja: Analiza spektralne efikasnosti u bežičnim sistemima. **Kapacitet bežičnog kanala, izračun slabljenja, Fresnelove zone za radio komunikacije - Sedmica 4** • Osnovni koncepti kapaciteta bežičnog kanala: Shannonova teorija, kapacitet kanala. • Fresnelove zone i njihov utjecaj na kvalitetu signala u bežičnim komunikacijama. • Specifičnosti DMR (Digital Mobile Radio) sistema: struktura kanala, optimizacija frekvencijskog spektra. • Praktične vježbe: analiza Fresnelovih zona i simulacija kapaciteta u DMR sistemima. **4G LTE mreže - Sedmica 5** • Arhitektura LTE mreža: osnovni blokovi i njihova funkcija. • Pregled osnovnih protokola i procedura u LTE mrežama. • Performanse LTE mreža: kapacitet, brzina prenosa, latencija. • Praktična implementacija i optimizacija LTE mreža u stvarnim uslovima. **5G mreže: Arhitektura i ključne tehnologije - Sedmica 6** • Pregled arhitekture 5G mreža: radijska pristupna mreža (RAN), jezgro mreže (Core). • Ključne tehnologije u 5G: mMIMO, beamforming, milimetarski talasi (mmWave). • Analiza novih servisa u 5G: eMBB, URLLC, mMTC. • Diskusija o izazovima implementacije i potencijalnim rješenjima. **5G usluge i primjene - Sedmica 7** • Detaljna analiza 5G servisa i njihovih aplikacija: industrija 4.0, autonomna vozila, pametni gradovi. • Uloga 5G u razvoju IoT ekosistema. • Izazovi u pružanju 5G usluga: sigurnost, latencija, kapacitet.

	• Studija slučaja: Implementacija 5G servisa u različitim industrijama. **Wi-Fi 6 (802.11ax) i budući Wi-Fi standardi - Sedmica 8** • Pregled evolucije Wi-Fi standarda do Wi-Fi 6. • Tehničke karakteristike Wi-Fi 6: OFDMA, MU-MIMO, Target Wake Time (TWT). • Uporedna analiza sa prethodnim generacijama Wi-Fi standarda. • Diskusija o budućim Wi-Fi standardima i njihovom utjecaju na bežičnu industriju. **Internet stvari (IoT) i LPWAN tehnologije - Sedmica 9** • Uvod u Internet stvari (IoT): osnovni koncepti i arhitektura. • Pregled LPWAN tehnologija: NB-IoT, LoRaWAN, Sigfox. • Implementacija IoT rješenja: dizajn mreže, sigurnosni izazovi, energetska efikasnost. • Praktična vježba: Dizajniranje IoT mreže koristeći LPWAN tehnologije. **MIMO i napredne antenske tehnologije - Sedmica 10** • Osnove MIMO (Multiple-Input Multiple-Output) tehnologije: koncept i primjene. • Prostorno multipleksiranje, diverzitet i beamforming. • Analiza naprednih antenskih sistema i njihove primjene u 5G i Wi-Fi 6 mrežama. • Praktična implementacija MIMO tehnologije u simulacijskom okruženju. **Milimetarski talasi i komunikacije visokih frekvencija - Sedmica 11** • Pregled milimetarskih talasa (mmWave): karakteristike i primjene. • Prednosti i izazovi u implementaciji komunikacija visokih frekvencija. • Uloga mmWave tehnologije u 5G mrežama i budućim komunikacijskim sistemima. • Diskusija o mogućnostima razvoja i širenja komunikacija visokih frekvencija. **Sigurnost u bežičnim komunikacijskim sistemima - Sedmica 12**

	• Potencijalne prijetnje i ranjivosti u bežičnim komunikacijama. • Pregled sigurnosnih protokola i mehanizama zaštite u bežičnim mrežama (WPA3, EAP). • Sigurnosni izazovi u 5G i IoT mrežama. • Studija slučaja: Sigurnosni incidenti u bežičnim mrežama i naučene lekcije. **Planiranje i optimizacija bežičnih mreža - Sedmica 13** • Proces planiranja i dizajniranja bežičnih mreža: osnovni koraci. • Alati i metodologije za optimizaciju performansi bežičnih mreža. • Upravljanje resursima u bežičnim mrežama: frekvencijski spektar, QoS. • Praktična vježba: Planiranje i optimizacija bežične mreže u simulacijskom okruženju. **Buduće tehnologije: 6G i dalje - Sedmica 14** • Predviđanja i istraživanja za 6G mreže: koncepti i tehnologije. • Potencijalne aplikacije i servisi u 6G mrežama. • Izazovi i prilike u razvoju budućih komunikacijskih tehnologija. • Diskusija o istraživačkim perspektivama i utjecaju 6G mreža na društvo. **Praktični projekti i studije slučaja - Sedmica 15** • Analiza realnih scenarija implementacije bežičnih komunikacijskih mreža. • Studije slučaja uspješnih implementacija 5G, IoT i Wi-Fi mreža. • Prezentacije studentskih projekata i grupne diskusije. • Zaključci i smjernice za budući razvoj karijere u bežičnim komunikacijama.
Ishodi učenja:	Znanje: Studenti stječu teorijska i praktična znanja iz savremenih bežičnih komunikacijskih sistema, uključujući 4G, 5G, Wi-Fi 6, IoT i buduće tehnologije kao što su 6G. Pored toga, studenti se upoznaju s izazovima sigurnost i planiranja bežičnih mreža. Vještine: Studenti razvijaju vještine potrebne za dizajn,

	implementaciju i optimizaciju modernih bežičnih mreža, uključujući korištenje naprednih antena, planiranje frekvencijskog spektra, te primjenu sigurnosnih protokola u bežičnim komunikacijskim sistemima. Kompetencije: Studenti stječu kompetencije za analizu i praktičnu primjenu stečenih znanja u industrijskim i komercijalnim okruženjima, pripremajući se za rad na naprednim bežičnim mrežama kao što su 5G, IoT i buduće 6G mreže.
Cilj održivog razvoja (SDG):	**SDG4 – Kvalitetno obrazovanje:** Kroz ovaj predmet, studenti stječu neophodna znanja i vještine za rad sa savremenim tehnologijama u bežičnim komunikacijama, čime se osigurava inkluzivno i kvalitetno obrazovanje u oblasti informacionih i komunikacijskih tehnologija. **SDG9 – Industrija, inovacije i infrastruktura:** Predmet obuhvata ključne aspekte moderne infrastrukture u oblasti bežičnih komunikacija, podržavajući inovacije i održivi razvoj industrije. **SDG11 – Održivi gradovi i zajednice:** Primjena bežičnih tehnologija, kao što su IoT i 5G, omogućava razvoj pametnih gradova i održivih zajednica kroz efikasno upravljanje resursima i poboljšanje kvaliteta života.
Metode izvođenja nastave:	**Predavanja:** • **Opis:** Klasična predavanja fokusirana na teorijske aspekte bežičnih komunikacijskih sistema, uz primjere iz prakse i analizu najnovijih istraživanja i tehnologija. Predavanja uključuju prezentacije, interaktivne diskusije, i primjere iz industrije. V**ježbe:** • **Opis:** Proračuni i simulacije slučajeva iz prakse. **Seminarski radovi:** • **Opis:** Studenti istražuju specifične teme iz oblasti bežičnih komunikacija i pripremaju seminarske radove koje prezentuju pred grupom. Fokus je na samostalnom istraživanju, analizi naučnih radova i prezentaciji nalaza. **Praktični projekti:**

	• **Opis:** Timovi studenata rade na praktičnim projektima vezanim za dizajn, implementaciju i optimizaciju bežičnih komunikacijskih sistema. Projekti mogu uključivati stvarne scenarije, simulacije, ili studije slučaja, a rezultati se prezentuju na kraju semestra.
Metode provjere znanja sa strukturom ocjene:	Prisustvo: 0-5% Testovi: 0-10% Projekti: 0-35% Završni ispit: 0-50% Konačna ocjena (Ukupno): 100%
Literatura:	Obavezna: Andreas F. Molisch - Wireless Communications, 3rd Edition, Wiley-IEEE Press, 2022. Harri Holma, Antti Toskala, Takehiro Nakamura - 5G Technology: 3GPP New Radio, John Wiley & Sons, 2020. David Tse, Pramod Viswanath - Fundamentals of Wireless Communication, Cambridge University Press, 2005. Jonathan Rodriguez - Fundamentals of 5G Mobile Networks, John Wiley & Sons, 2015. Martin Sauter - From GSM to LTE-Advanced Pro and 5G: An Introduction to Mobile Networks and Mobile Broadband, 3rd Edition, John Wiley & Sons, 2021. Dopunska: Stefano Buzzi, Osvaldo Simeone, Chong Han - Foundations of MIMO Communications, Cambridge University Press, 2023. Ian Poole - A Guide to the Wireless Engineering Body of Knowledge (WEBOK), 3rd Edition, Wiley-IEEE Press, 2021. Afif Osseiran, Jose F. Monserrat, Patrick Marsch - 5G Mobile and Wireless Communications Technology, Cambridge University Press, 2016. Erik Dahlman, Stefan Parkvall, Johan Skold - 5G NR: The Next Generation Wireless Access Technology, Academic Press, 2020. Klaus David, Nico Kourtis - 6G: The Road to the Future Wireless Technologies 2030, Wiley-IEEE Press, 2022.

Šifra predmeta: 24-25-2CITES010305	**Naziv predmeta: INTELIGENTNI TRANSPORTNI SISTEMI**		
Ciklus: I	**Godina: III**	**Semestar: V**	**Broj ECTS kredita:** 6
Status: izborni predmet		**Ukupan broj kontakt sati: 90** Opciono razraditi distribuciju sati po tipu: 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:	Sticanje znanja i vještina potrebnih u realizaciji programa iz područja inteligentnih transportnih sustava, analiza učinka ITS funkcionalnosti na promjene parametara stanja klasičnog prometnog sustava. Korištenje ITS funkcionlanosti u upravljanju prometnim procesima.		
Tematske jedinice: *(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)*	1.Definiranje osnovnih pojmova i uloge ITS-a 2. Znanstveno-tehnološki okvir razvoja ITS-a 3. Umjetna inteligencija u sustvu ITS-a 4. Mjerenje učinka i koristi ITS-a 5. Arhitektura ITS-a 6. Europska arhitektura ITS-a 7. Inteligentna vozila 8. Itteligentna transportna infrastruktura 9. Inteligentni terminali 10. Inteligentni teret i transportna oprema 11. Standardizacija Funkcionalnih područja ITS-a 12. Komunikacijske tehnologije u sustavu ITS-a 13. Digitalizacija transporta 14. Planiranje i upravljanje razvojem sustav ITS-a 15. Sigurnost i zaštita sustava ITS-a		
Ishodi učenja:	Znanje: Predmet Inteligentni transportni sustavi treba osigurati potreban nivo znanja o tehnologijama, funkcijama i učnicima ITS-a, metodama njihovog planiranja, razvoja i implementacije.		

	Vještine: Predmet ITS omogućava stjecanje vještina neophodnih za mjerenje, analizu i procjenu učinkovitosti, sigurnosti, utjecaja na okoliš i ekonomskih koristi od implementacije sevisa ITS-a. Kompetencije: Studenti kroz nastavni proces predavanja, vježbe, i seminarski rad trebaju steći odgovarajuće kompetencije za dizajniranje, razvoj i upravljanje inteligentnim transportnim sustavima.
Cilj održivog razvoja (SDG):	"SDG3 – Zdravlje i blagostanje"; "SDG 9 Industrija, inovacije i infrastruktura ", „SDG11- Održivi gradovi i zajednce", SDG 13-Zaštita klime"
Metode izvođenja nastave:	Predavanja, vježbe i seminarski rad.
Metode provjere znanja sa strukturom ocjene:	1. Prisustvo na na nastavi i semiraski rad 15 bodova 2. Prva provjera znanja 35 bodova 3. Završna provjera znanja 50 bodova
Literatura:	Obavezna: 1. Ezgeta,D.: Inteligentni transportni sustavi, Fakultet za saobraćaj i komunikacije univerziteta u Sarajevu, Sarajevo, 2018. 2. Bošnjak, I. : Inteligentni transportni sustavi, Sveučilište u Zagrebu, Fakultet prometnih znanosti , Zagreb, 2006. Dopunska: 1. Ghosh, S., Lee, T.: Inteligent Transportation Systems- New Principels and Architectures, CRC Press, London, 2000. 2. Miles, J. Chen, K.: ITS Handbook, 2nd edition, PIRAC, 2004. 3. Meng Lu:Evaluation of Intelligent Road Transport Systems – Methods and Results. Institution of Engineering and Technology, London.2016. 4. Meneguette , R.I., De Grande, R., Loureiro ,A. F.: Intelligent Transport System in Smart Cities, Springer, Ontario, 2018. 5. Sładkowski , A.: Wiesław Pamuła:Intelligent Transportation Systems – Problems and Perspectives, Springer, Katowice, 2016. 6. Perallos , A.:Intelligent transport systems – technologies and applications. Wiley & Sons, Bilbao,2016. 7. Chow, Y.J.:Informed urban transport systems, Elsever, Amaterdam, 2018. 8. Dimitrakopoulos , G., Uden,L.: The Future of Intelligent

	Transport Systems, Elsever, Amaterdam, 2020.

Šifra predmeta: 24-25-3CITES010305	**Naziv predmeta: WEB ARHITEKTURE**		
Ciklus: I	**Godina: III**	**Semestar: V**	**Broj ECTS kredita:** 6
Status: Izborni		**Ukupan broj 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:	Povezivanje znanja o programiranju, bazama podataka i mrežama računara. Omogućiti studentima temeljno poznavanje web arhitekture, tekućih tehnologija koje se koriste u izradi web stranica i kriterije za procjenu upotrebljivosti web stranice.		
Tematske jedinice: *(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)*	1. Koncepti web arhitekture. 2. Web standardi i usluge. 3. Web protokoli (Core Internet Protocols). 4. Web serveri i domene. 5. Web tehnologije i razvojna okruženja. 6. Osnove web dizajna. 7. Struktura i sintaksa HTML. 8. Primjena HTML sintakse. 9. Primjena CSS i povezivanje sa HTML. 10. Primjena i struktura XML. 11. Primjena JavaScript tehnologije. 12. Primjena AJAX tehnologije. 13. SEO optimizacija. 14. Internet marketing.		
Ishodi učenja:	**Znanje:** Teorijska i praktična znanja iz oblasti web arhitektura. Osnovni principi, pravila, metode i postupci u oblasti web arhitektura, analize arhitekture web sistema. **Vještine:** Sposobnost primjene teorijskih i praktičnih znanja iz oblasti web arhitektura u funkciji analize i sinteze sistema web arhitektura. **Kompetencije:** Sposobnosti samostalnog razumijevanja i korištenja		

	principa i RFC standarda, korištenja stručne literature, primjene metoda i postupaka, mjerenja i istraživanja, izrada analiza, procjena i praktičnih rješenja u funkciji upravljanja i kreiranja web arhitektura.
Cilj održivog razvoja (SDG):	SDG4 – Kvalitetno obrazovanje SDG9 – Industrija, inovacije i infrastruktura
Metode izvođenja nastave:	Teorijski dio nastave pripremljen iz referentne literature prezentuje se upotrebom savremenih multimedijskih sredstava, uz podsticanje interaktivnosti u nastavi. Vježbe i laboratorijske vježbe održavaju se uz upotrebu savremenih softverskih alata u kompjuterskim laboratorijama fakulteta, te rješavanje konkretnih problemskih i praktičnih zadataka. Laboratorijske vježbe / terenski rad / praksa omogućava kontinuiran rad i predstavljaju adekvatnu 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:	Kriterijum vrednovanja rada i ocjenjivanja studenta u toku nastave, vrši se na sljedeći način: Domaća zadaća/seminarski rad/projektni zadatak od 0 do 15 bodova (15%); Parcijalni ispit/ test/provjera znanja od 0 do 35 bodova (35%); Ukupan broj bodova koji student prema navedenom praćenju u toku nastave može ostvariti iznosi maksimalno 50 bodova (50%). Završni ispit od 0 do 50 bodova (50%). Da bi položio predmet student mora položiti (zadovoljiti) svaki od tri dijela zasebno (seminarski, parcijalni i završni ispit), te u ukupnom zbroju osvojiti minimalno 55 bodova (55%). 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 85-94,9 bodova; c) 8 (C) - prosječan, sa primjetnim greškama, nosi 75-84,9 bodova; d) 7 (D) - općenito dobar, ali sa značajnijim nedostacima, nosi 65-74,9 bodova; e) 6 (E) - zadovoljava minimalne uslove, nosi 55-64,9

	bodova; f) 5 (F, FX) - ne zadovoljava minimalne uslove, 0 – 54,9 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 (%) Domaća zadaća/seminarski rad/projektni zadatak.....15 bodova (%) I Parcijalni ispit/Test/Provjera znanja/.....35 bodova (%) Završni ispit (II Parcijalni + Teorija) .....50 bodova (%)
Literatura:	Obavezna: Nastavni materijal dostupan na web stranici Fakulteta za saobraćaj i komunikacije. Dopunska: 7. Creating Web Pages HTML & Dynamic HTML, Thomson Course Technology 2003 8. Web application Architecture: Principles, Protocols and Practices, Wiley; 2nd edition 2009 9. Patrick J. Lynch and Sarah Horton, „Web Style Guide“ Yale C/AIM 2002.

Šifra predmeta: 27CITOS010306	**Naziv predmeta: Razvoj web aplikacija**		
Ciklus: I	**Godina: III**	**Semestar: VI**	**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** **1 prof. (dr.sc.) + 1 asistent (v.a. ili a.)**		
Preduslov za upis:	n/a		
Cilj (ciljevi) predmeta:	Obezbjediti teorijsko i praktično znanje iz oblasti web baziranih aplikacija. Upoznati se sa arhitekturama web aplikacija. Osposobiti		

	studente za praktičan rad u razvoju web baziranih aplikacija. 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 junior full-stack developera.
Tematske jedinice: *(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)*	Front-end/back-end scripting, JavaScript, JavaScript razvojni okviri Napredne JS funkcionalnosti Promisses Back-end tehnologije .NET Core Entity framework Komunikacija sa bazom podataka Full-stack development Web bazirana aplikacija
Ishodi učenja:	Znanje: Znanje full stack development-a Vještine: Back-end i front-end development Kompetencije: Junior 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: • Nastavni materijal (bilješke i slajdovi) koji se može preuzeti sa web stranice fakulteta • Web application Architecture: Principles, Protocols and Practices, Wiley; 2nd edition 2009 • Luke Welling, Laura Thomson: "PHP and MySQL Web Development (5th ed.)", Addison-Wesley Professional (engleski)/Mikroknjiga (srpski, latinica, treće izdanje), 2016/2006 Dopunska:

	• Jeniffer Niederst Robbins: „Learn WEB Design“, O'Reilly (engleski) / Mikroknjiga (srpski, latinica), 2012/2008 Riješeni zadaci iz programskog jezika PHP, ETF Beograd; 2015

Šifra predmeta: 28CITOS010306	**Naziv predmeta: Razvoj aplikacija mobilnih uređaja**		
Ciklus: I	**Godina: III**	**Semestar: VI**	**Broj ECTS kredita: 6**
Status: Obavezni 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:	Teorijski i praktičnI aspekt osnovnih principa za razvoj aplikacija za mobilne uređaje, na Android operativnom sistemu. Upoznavanje sa razvojnim okruženjima koje se koriste za razvoj aplikacija za mobilne uređaje. Upoznavanje sa životnim ciklusom aplikacija, od planiranja, razvoja, testiranja a zatim i puštanja aplikacija u rad, te postavljanja na Google Play.		
Tematske jedinice: *(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)*	• Java za Android. • Uvod u Android i osnove izrade aplikacija. • Razvojna okruzenja za izradu mobilnih aplikacija (Eclipse, Android Studio). • Upravljanje zavisnostima Gradle. • Elementi grafickog interfejsa u Androidu, namjere. • Lokalno citanje i spremanje podataka u Androidu. • Usluge i asinhrono izvodjenje zadataka u pozadini. • Primjena Web servisa. • Testiranje i kontinuirana integracija. • Distribucija gotovih aplikacija. • Napredne teme: extend, Kotlin, Event driven programming		
Ishodi učenja:	Znanje: Teorijska i praktična znanja iz oblasti razvoja aplikacija mobilnih uređaja. Osnovni principi, pravila, metode i postupci u oblasti razvoja aplikacija mobilnih uređaja, analize arhitekture i programiranje aplikacija mobilnih uređaja. Vještine: Sposobnost primjene teorijskih i praktičnih znanja iz oblasti razvoja aplikacija mobilnih uređaja u funkciji analize, sinteze i programiranja sistema aplikacija mobilnih uređaja, baziranih na Andoid operativnom sistemu. Kompetencije: Studenti će samostalno izrađivati Android aplikaciju, korištenjem Android studio razvojne okoline ili Eclipse okruženja. Koristiti će najbolje prakse objektno orijentisanog programiranja na Android platformi te uspješno vladati svim gradivnim elementima Android aplikacija. Upoznati će se sa osnovama korištenja grafičkih elemenata te će se koristiti web servisima za dobijanje podataka. Dizajnirat će, oblikovati i implementirati baze podataka kroz MS SQL, SQLite i Transact SQL. Naučiti će način		

	postavljanja aplikacija na servis za prodaju i razmjenu aplikacija Google Play.
Ciljevi održivog razvoja (SDG):	SDG 9: Industrija, inovacije i infrastruktura
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. Usmeno iznošenje radi se sa prezentacijom i prikazom različitih sistema i procesa iz oblasti razvoja aplikacija mobilnih uređaja, uz korištenje video i audio zapisa, te samostalno izlaganje pojedinih konkretnih problema razvoja aplikacija mobilnih uređaja na konkretnom području istraživanja. Iniciranje rasprava i diskusija o problemima iz prakse, pojedinačnih zapažanja iz različitih okruženja, izrada samostalnih istraživanja i analiza iz oblasti razvoja aplikacija mobilnih uređaja. Na predavanima se obrađuju teorijski koncepti i principi uz demonstriranje 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: • Domaća zadaća/seminarski rad/praktični rad/prisustvo na predavanjima 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 %. • Završni ispit (Integralni) 85 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, 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. 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: • Nastavni materijal (bilješke i slajdovi) koji se može preuzeti sa web stranice fakulteta • Wei-Meng Lee: „Beginning Android Application Development“, WROX/Wiley(engleski)/Kompjuter biblioteka(srpski), 2011/2012. Dopunska: • Android Developers: http://developer.android.com

Šifra predmeta: 29CITOS010306	**Naziv predmeta: Sigurnost računarskih sistema i mreža**		
Ciklus: I	**Godina: III**	**Semestar: VI**	**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 računarskih sistema i mreža 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, društvenim inženjeringom, itd.		
Tematske jedinice:	• Uvod u sigurnost računarskih sistema i mreža • Istorija i budućnost cyber sigurnosti		

	• Osnovi sigurnosti informacija i informacijskih i komunikacijskih sistema • Vrste napada i prijetnji • Vrste zaštite • Kriptografija • Kriptografski protokoli • Sigurnost operativnih sistema • Sigurnost baza podataka • Sigurnost mreža i interneta • Sigurnost programskih jezika • Sigurnost mobilnih uređaja • Sigurnost društvenih mreža i društveni inženjering • Sigurnost kritpovaluta
Ishodi učenja:	Znanje: Studenti će steći teorijska i praktična znanja o sigurnosti računarskih sistema i mreža, te njihovoj primjeni u različitim poljima saobraćaja i komunikacija. Vještine: Očekuje se da studenti ovladaju vještinama i alatima koji se koriste u oblasti sigurnosti računarskih sistema i mreža. Kompetencije: Studenti će biti osposobljeni da učestvuju u aktivnostima u vezi sigurnosti računarskih sistema i mreža 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: 30-31-1CITES010306	**Naziv predmeta: Infrastruktura komunikacija**		
Ciklus: I	**Godina: III**	**Semestar: VI**	**Broj ECTS kredita:** 6
Status: izborni 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 infrastrukturnim komponentama komunikacijskih sistema i načinima planiranja, projektovanja i izgradnje telekomunikacijske kanalizacije.		
Tematske jedinice:	– Opći pojmovi o infrastrukturi komunikacijskih sistema – Struktura i komponente komunikacijskog sistema – Prenosni sistem u telekomunikacijama – Gradnja mjesne (pristupne) telekomunikacijske kanalizacije – Gradnja međumjesne telekomunikacijske kanalizacije – Gradnja zračne telekomunikacijske kanalizacije		

	– xDSL tehnologije i infrastruktura – Ethernet infrastruktura – Infrastruktura optičkih komunikacijskih sistema – Infrastruktura kablovskih distributivnih sistema (KDS) – Infrastruktura bežičnih komunikacijskih sistema – Prostorije za smještaj ICT opreme i podatkovni centri – Međusobni odnos tehnologije i infrastrukture – Tehnički propisi kod projektovanja komunikacijskih sistema – Projektovanje mreža i izrada tehničke dokumentacije
Ishodi učenja:	**Znanje**: Studenti kroz nastavni proces (predavanja, vježbe, laboratorijske vježbe, posjete kompanijama, praktičan rad) i zadaće / kvizove / seminarske radove / projektne zadatke će steći odgovarajuća znanja potrebna u procesima projektovanja, izgradnje i održavanja komunikacijskih mreža sa fokusom na optičke telekomunikacijske mreže i kablovsku kanalizaciju. **Vještine**: Nakon položenog ispita studenti studenti će znati primjenjivati određene softverske alate koji se koriste kod projektovanja telekomunikacijske infrastrukture. **Kompetencije**: Nakon stečenih znanja i vještine studenti će biti u stanju primjenjivati potrebna pravila, procedure i alate potrebne za planiranje telekomunikacijske infrastrukture.
Ciljevi održivog razvoja (SDG)	SDG9 – Industrija, inovacije i infrastruktura
Metode izvođenja nastave:	Kurs se izvodi putem predavanja, vježbi i praktičnih komponenti. Predavanja se održavaju kroz usmene prezentacije uz pomoć vizualnih primjera iz prakse. Pokreću se diskusije o pitanjima koja se tiču planiranja, modeliranja i analize informacionih sistema. Studenti su obavezni prisustvovati časovima i ispuniti određene obaveze tokom kursa (npr. kvizovi, priprema i prezentacija seminarskih radova i/ili projekata, itd.). U nastavi se koriste različite metode, uključujući usmene prezentacije i diskusije, demonstracije primjera, grafičke i video prezentacije, te grupni rad koristeći odgovarajuće metodološke pristupe. Kada je moguće, organizuju se posjete relevantnim kompanijama.
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, „*Infrastruktura komunikacija (SKRIPTA),"* Fakultet za saobraćaj i komunikacije, Sarajevo, 2023. – Fiber to the Home Council Europe, "FFTH Handbook", 2018. – Fiber to the Home Council Europe, "FFTH Handbook", 2021. Dopunska: – Dokumentacija objavljena od strane Regulatorne agencija za komunikacije Bosne i Hercegovine: www.rak.ba – Jason P. Jue, Vinod M. Vokkarane, "Optical WDM Networks," Springer, 2006. – Stephan Pachnicke , "Fiber-Optic Transmission Networks: Efficient Design and Dynamic Operation," Springer-Verlag Berlin Heidelberg, 2012.

	– Ioannis P. Chochliouros, George A. Heliotis, Ioannis P. Chochliouros, George A. Heliotis, "Optical access networks and advanced photonics: technologies and deployment strategies," Information Science Reference, 2010. – Chinlon Lin, "Broadband optical access networks and fiber-to-the-home: systems technologies and deployment strategies," Wiley, 2006. – James Booth, "Fiber Optic Telecommunications Networks: Lit Fiber Services," Independently published, 2019. – A. Stipetić: Kabelska kanalizacija, Fakultet prometnih znanosti Zagreb, 2000. – Sharon Evans, Sharon Evans, "Telecommunications Network Modelling, Planning and Design," Institution of Electrical Engineers, 2003.

Šifra predmeta: 30-31-2CITES010306	**Naziv predmeta: Simulacije u komunikacijama**		
Ciklus: I	**Godina: III**	**Semestar: VI**	**Broj ECTS kredita:** 6
Status: izborni predmet		**Ukupan broj kontakt sati: 90** Opciono razraditi distribuciju sati po tipu: Predavanja: 45 Vježbe: 30 Seminar: 0 Terenski rad: 0 Laboratorijske vježbe: 15 Praksa: 0 Koncertne aktivnosti: 0 …	
Učesnici u nastavi	**Nastavnici i saradnici izabrani na oblast kojoj predmet pripada/predmet**		
Preduslov za upis:	NE		
Cilj (ciljevi) predmeta:	Upoznavanje sa teorijskim i praktičnim aspektima simulacija u komunikacijama. Ovladavanje osnovama matematičkog modeliranja i simulacije komunikacijskih mreža. Sticanje vještina neophodnih za planiranje, konfiguriranje i ocjenjivanje		

	performansi komunikacijskih mreža. Upoznavanje sa simulacijskim alatima i načinu njihove primjene u simulaciji komunikacijskih mreža. Osposobljavanje za rad sa mrežnim simulatorom NS-3 (Network Simulator 3).
Tematske jedinice: *(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)*	1. Modeliranje i simulacija u komunikacijama. 2. Podjela i vrste simulacionih modela. 3. Klasifikacija i ocjena parametara simulacionih modela. 4. Validacija i verifikacija simulacionih modela. 5. Razvojni proces simulacije. 6. Simulacija diskretnih događaja. 7. Teorija vjerovatnosti u simulacijama. 8. Slučajni brojevi u simulacijama. 9. Teorija posluživanja u simulacijama. 10. Statističko testiranje u simulacijama. 11. Pristupi planiranju, izvršenju i ubrzavanju simulacije. 12. Dizajn i primjeri mrežnih simulatora. 13. Svojstva i način primjene mrežnog simulatora NS-3. 14. Gradivni blokovi mrežnog simulatora NS-3.
Ishodi učenja:	Znanje: Teorijska i praktična znanja iz područja simulacija u komunikacijama. Poznavanje metodologije modeliranja i simulacije komunikacijskih mreža. Razumijevanje osnovnih problema pri formiranju simulacijskog modela, planiranju i konfiguriranju simulacije komunikacijskih mreža, te obradi rezultata simulacije. Vještine: Primjena teorijskih i praktičnih znanja iz područja simulacija u komunikacijama. Planiranje, konfiguriranje i ocjenjivanje performansi komunikacijskih mreža. Rad u mrežnom simulatoru NS-3. Kompetencije: Sposobnosti razumijevanja problematike modeliranja i simulacije u komunikacijama, korištenja matematičkih alata za modeliranje komunikacijskih mreža, primjene simulacijskih alata za planiranje i konfiguriranje komunikacijskih mreža, te obradu rezultata simulacije.
Cilj održivog razvoja (SDG):	SDG4 – Kvalitetno obrazovanje SDG9 – Industrija, inovacije i infrastruktura
Metode izvođenja nastave:	Nastava se realizira kroz predavanja, vježbe i laboratorijske vježbe. Na predavanjima se obrađuju teorijski koncepti i princip uz prikaz opisnih primjera i rješavanje određenih zadataka. Dodatni primjeri se razmatraju kroz vježbe i laboratorijske vježbe, što omogućava kontinuiran rad i

	pripremu za samostalno rješavanje praktičnih problema. Izrada zadaće/seminarskog rada/praktičnog rada ima za cilj razvijanje sposobnosti individualnog i/ili timskog rada i praktičnih vještina.
Metode provjere znanja sa strukturom ocjene:	Kriteriji praćenja rada i ocjenjivanja studenta u toku nastave se vrši na sljedeći način: Zadaća/seminarski rad/praktični rad/ 15 bodova (%), položeno ako se osvoji preko 50 %. Parcijalni ispit/test/provjera znanja/35 bodova (%), položen je ako se osvoji preko 50 %. Završni ispit 50 bodova (%), položeno ako se osvoji preko 50 %. Završni ispit (Integralni) 85 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 ispitom čini 100 bodova (%). Za studente koji nisu položili parcijalni ispit, završni ispit (integralni) se organizira iz cjelokupnog pređenog gradiva u toku nastave i vježbi, i vrednuje se sa 85 bodova (%), što sa zadaćom/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) ocjena 10 ili A - izuzetan uspjeh u postizanju ishoda učenja bez grešaka ili sa neznatnim greškama (između 95-100 bodova); b) ocjena 9 ili B – uspjeh iznad prosjeka u postizanju ishoda učenja, sa ponekom greškom (između 85-94 bodova); c) ocjena 8 ili C – prosječan u postizanju ishoda učenja ali sa primjetnim greškama (između 75-84 bodova); d) ocjena 7 ili D - općenito dobar u postizanju ishoda učenja, ali sa značajnijim nedostacima (između 65-74 bodova); e) ocjena 6 ili E - zadovoljava minimalne uslove u postizanju ishoda učenja (između 55-64 bodova); f) ocjena 5 ili F - 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.....0 bodova (%) Zadaća/Seminarski/Praksa/.....15 bodova (%) I Parcijalni ispit/Test/Provjera znanja/.....35 bodova (%) Završni ispit .....50 bodova (%) Završni ispit (Integralni) .....85 bodova (%) Navedena skala se može korigovati prema Pravilima studiranja za prvi i drugi ciklus studija, integrisani, stručni i specijalistički studij na Univerzitetu u Sarajevu (Član 49).
Literatura:	Obavezna: 1. Nastavni materijal dostupan na Moodle stranici Fakulteta za saobraćaj i komunikacije 2. Jeruchim, M.C., Balaban, P., Shanmugan, K.S.: Simulation of Communication Systems – Modeling, Methodology and Techniques, Kluwer Academic Publishers, 2002. 3. Fujimoto, R.M., Perumalla, K.S., Riley, G.F.: Network Simulation, Synthesis Lectures on Communication Networks, 2007. 4. Rangisetti, A.K.: Advanced Network Simulations Simplified. Practical guide for wired, Wi-Fi (802.11n/ac/ax), and LTE networks using ns-3, Packt Publishing, 2023. Dopunska: 1. Law, M.A.: Simulation Modeling & Analysis, McGraw-Hill, 2007. 2. Le Boudec, J.Y.: Performance Evaluation of Computer and Communication Systems, EPFL, 2009. 3. Sokolowski J.A., Banks C.M.: Principles of Modeling and Simulation: A Multidisciplinary Approach, John Wiley and Sons, Ltd., 2009. 4. Guizani, M., Rayes, A., Khan, B., Al-Fuqaha, A.: Network Modeling and Simulation, John Wiley and Sons, Ltd., 2010.

Šifra predmeta: 30-31-3CITES010306	**Naziv predmeta: Tehnologija komunikacija**		
Ciklus: I	**Godina: III**	**Semestar: VI**	**Broj ECTS kredita:** 6
Status: izborni predmet		**Ukupan broj kontakt sati: 90**	
Učesnici u nastavi	**Nastavnici i saradnici izabrani na oblast kojoj predmet**		

	pripada/predmet
Preduslov za upis:	Ne
Cilj (ciljevi) predmeta:	Razvoj relevantnih znanja o osnovama i osnovnim tehnologijama telekomunikacionih mreža i tehnogijama pružanja telekomunikacionih usluga. Kroz praktične seminarske radove obrada realnih situacija inkorporiranja novih tehnologija u poslovne procese.
Tematske jedinice: *(po potrebi plan izvođenja po sedmicama se utvrđuje uvažavajući specifičnosti organizacionih jedinica)*	• Uvod – domeni izučavanja tehnologije telekomunikacija i osnovni zakoni tehnologije telekomunikacija; • Tehnologije mreža – referentni model, osnovne uloge i karkteristike mreža, podjela mreža; • PSTN mreže - tehnologije usmjeravanja, pristupa i prenosa;Tehnologije inteligentnih mreža i signalizacionih tehnika i mreža;Tehnologije mreža za prenos podataka: ISDN, X.25, Frame relay, ATM; • IP i Internet tehnologije, konvergentne i NGN mreže; • 5G, SDN i NFV tehnologije; • Tehnologije upravljanja podacima IoT, IoE, Big Data; • Tehnologije pružanja usluga – metode razvoja; telekomunikacionih usluga; • Teorija analize saobraćajnih tokova i saobraćajni modeli; • Metode dimenzionisanja telekomuniacionih mreža; • Tehnologije upravljanja telekomunikacionim i poslovnim sistemima OSS/BSS; • NGOSS arhitekture i radni okviri, životni ciklus i metodologije; • Tarifni modeli i tehnologije tarifiranja; • Tehnološki aspekt regulacije teleokomunikacija.
Ishodi učenja:	Znanje: Teorijska i praktična znanja iz oblasti tehnologija telekomunikacija. Studenti bi trebali nakon odslušanih predavanja i provedenih vježbi da razumiju filozofiju razvoja tehnologija te uticaj tehnologija na poslovanje. Vještine: Nakon uspješno provedenih predviđenih testova i seminarskih radova studenti bi trebali biti u stanju izvršiti izbor odgovarajuće tehnologije za dati poslovni model kao izvršiti izbor odgovarajuće telekomunikacione usluge za zadanu potrebu korisnika. Kompetencije: Studenti bi trebali razviti sposobnosti samostalnog razumijevanja i prihvatanja osobina novih tehnologija, korištenja stručne literature, istraživanja, izrade analiza, procjena i praktičnih rješenja u funkciji definisanja telekomunikacionih usluga.

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. Usmeno iznošenje je praćeno prezentacijom i prikazom različitih tehnologija iz oblasti tehnologija komunikacija uz korištenje video i audio zapisa, te samostalno izlaganje pojedinih konkretnih rješenja za zadanu uslugu. 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. Također se iniciraju rasprave i diskusije o problemima iz prakse, pojedinačnih zapažanja iz različitih okruženja, izrada samostalnih istraživanja i analiza iz oblasti tehnologije komunikacija. Na laboratorijskim vježbama / terenskom radu / praksi razvijaju 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 kroz izradu zadaće / samostalnih radova / praktičnih radova, ocjena parcijalnog ispita u toku nastave kao i ocjena završnog / popravnog ispita. Kriterijum praćenja rada i ocjenjivanja studenta vrši se na sljedeći 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 %; – Završni ispit (Integralni) - 85 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, 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 (%). Završni ispit se organizuje kao pismeni i/ili 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 I parcijalnom i završnom (II parcijalnom) dijelu ispita, a dovoljan uslov je da suma ostvarenih bodova (zadaća/praktični rad + I parcijalni + II parcijalni) bude 55. Zadaća se realizira kroz izradu domaće zadaće i polaganje kvizova ili izradu praktičnog rada Postignuti bodovi na kvizovima i dostavljenoj zadaći nemaju mogućnost popravljanja. Za studente koji nisu uspješno okončali I 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: 4. Bilješke i slajdovi s predavanja - materijali sa Web sajta kursa 5. Willliam A. SHAY, Savremene tehnologije i mreže, University of Wisconsin - Green Bay, ISBN: 86-7310-310-X, "Svetlost" Čačak, 2004 6. Andrew S. Tanenbaum, David J. Wetherall, Računarske mreže, prevod 5. izdanje, 2013 7. I. Bošnjak: Tehnologije telekomunikacijskog prometa II, Fakultet promentih znanosti, Zagreb, 1997. (prvo, treće i četvrto poglavlje) 8. W. Rahul, OSS/BSS for Converged Telecommunication networks, Xawy (2016) 9. ITU, Telecom Network Planning for evolving Network Architectures, 2007 10. ITU-T, 5G Basics, 2017 11. ITU, Telecommunications Regulation Handbook, 2011 12. Međunarodni standardi i preporuke Dopunska: 6. Villy B. Iversen, Teletraffic Engineering And Network Planning 7. Debashis De, Mobile Cloud Computing Architectures, Algorithms and Applications, West Bengal University of Technology Kolkata, India, CRC Press Taylor, 2016 8. C. X. Mavromoustakis, G. Mastorakis, J. M., Internet of Things (IoT) in 5G Mobile Technologies, Springer 2016

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

U nastavku su navedeni silabusi predmeta na Engleskom jeziku.

Course code: 01ATCOS010101	**Course title:** Mathematics for Engineers I		
Level: I	**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 (Exercises) 45
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 basic knowledge for continuing to follow higher-level mathematical disciplines that appear in the subjects: Mathematics for Engineering II and Applied Mathematics and Statistics, and in this way create prerequisites for applying mathematical tools in monitoring, understanding and studying phenomena that appear in professional subjects in the field traffic and communication.
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	1. Mathematical logic: Logical operations with statements. Relations, sets and mappings. 2. Sets of real and complex numbers: Natural numbers. Mathematical induction. Newton's binomial formula. Different forms of complex number 3. Linear algebra: Concept of matrix. Operations with matrices. The term determinant. Systems of linear equations: Gauss's method of elimination, Kramer's rule and Kronecker-Kapeli's theorem. 4. Linear algebra: Vector algebra. Operations with vectors. Scalar product. Vector product. Mixed product. 5. Analytical geometry of space: Plane in space. Rights in space. Distance of a point from a line. Mutual relationship of two lines in space. Interrelationship between line and plane. 6. Sequences and rows: Limes sequence. Convergence criterion. Monotonic sequences. An infinite queue. 7. Functions of a real variable: Properties of functions of one variable. Limit value of functions of one variable. 8. Differential calculus of functions of one variable: Continuity of functions. Elementary functions

	9. Differential calculus of functions of one variable: The concept of derivatives of functions of one variable. The geometric meaning of the derivative. The mechanical meaning of the derivative. 10. Differential calculus of functions of one variable: Differentiability and differential of functions. Derivatives and differentials of higher order. Differentiation rules. 11. Differential calculus of functions of one variable: Application of differential calculus. Rolle's, Cauchy's and Lagrange's theorems. L'Hospital's rule. Taylor's formula. Maclaurin's formula. 12. Examining the functions of a real variable: Monotonicity of functions. Determination of local extreme values. Convexity, concavity and inflection points of functions. Flow test. Graphing functions. 13. Indefinite integral: Primitive function and indefinite integral. Properties of the indefinite integral. Integration rules. Integration methods. 14. Definite integral: Properties of the definite integral. Newton – Leibniz formula. Improper integral 15. Application of the definite integral in geometry: Application of the definite integral to the calculation of the area of a plane figure, the length of the arc of a curve in a plane, the volume of a body and the area of revolving surfaces.
Learning outcomes:	Knowledge: • solve and apply systems of linear equations, • define and solve problems described by vectors, applying operations with vectors, • demonstrate an understanding of the basic concepts of analysis: limit values, differentiation and integration of real functions with one real variable, • apply differentiation procedures in solving the problem of extremes, • draw graphs of functions based on the application of the first and second derivative for its analysis, • define and calculate the indefinite integral using the substitution and partial integration methods,

	• understand and apply procedures for integration of rational functions, use integration to calculate area and volume. Skills: encourages creativity, precision, systematicity, abstract thinking and critical thinking, which helps in noticing and solving problems, which is essential for continuing education. Competences: presentation and communication in mathematical language, logical thinking, argumentation and reasoning
Sustainable Development Goal (SDG):	SDG 4 – Quality education SDG 9 – Industry, innovation and infrastructure
Teaching methods:	Theoretical lectures with the use of multimedia tools, active learning and discussion techniques, practical teaching - exercises, and independent presentation and solving of specific specific problems.
Assessment methods with grading structure:	The criterion for evaluating the work and evaluating the student during classes is as follows: Tests during the semester from 0 - 15 points; 1st partial exam/1st test/1st knowledge test/ from 0 - 35 points (passed if more than 50% is won). The total number of points that a student can achieve according to the above-mentioned monitoring during classes is a maximum of 50 points. The final exam is organized from the entire material covered during the course and amounts to a maximum of 50 points, of which there is the II partial exam of 0 - 25 points (passed if over 50%) and Theory and tasks of 0 - 25 points, which lasts 60 min (students pass the theory and tasks they did not do in the partial exams). At the final exam, students can correct the I partial exam, if they did not pass it earlier. The same applies to the remedial exam period of the final exam and both dates of the autumn exam period. 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 (A) - exceptional success without mistakes or with minor mistakes, carries 95-100 points; b) 9 (B) - above average, with some errors, carries 85-94.9 points; c) 8 (C) - average, with noticeable errors, carries 75-84.9 points; d) 7 (D) - generally good, but with significant shortcomings, carries 65-74.9 points; e) 6 (E) - meets the

	minimum requirements, carries 55-64.9 points; f) 5 (F, FX) - does not meet the minimum conditions, 0 – 54.9 points. 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 and passing the partial and final exam, and according to the quality of acquired knowledge and skills, and contains a maximum of 100 points, and is determined according to the following scale: Student obligations Points (%) Mini-tests during classes.....15 points (%) I Partial exam/Test/Knowledge check/.....35 points (%) Final exam (II Partial + Theory) .....50 points (%)
Literature:	Mandatory: 1. M. Uščumlić, P.Miličić, Zbirka zadataka iz više matematike I, Naučna knjiga, Beograd 2. Kostić, V. Hadžiabdić, M. Mehuljić, J. Bektešević, Matematika I – teorija sa urađenim zadacima, Mašinski fakultet Sarajevo, 2011. ISBN 978-9958-601-32-3. 3. Alma Omerspahić, Vahidin Hadžiabdić, Midhat Mehuljić, Jasmin Bektešević, Teorijske osnove i zbirka zadataka iz integralnog računa, Mašinski fakultet Sarajevo, 2012. Supplementary: 1. P. JAVOR: Matematička analiza I, Element, Zagreb,1996. 2. S. KUREPA: Matematička analiza 1 i 2, Tehnička knjiga, Zagreb, 1972.

Course code:	**Course title: Engineering graphics**		
Level: I (first)	**Year: I (first)**	**Semester: I (first)**	**Number of ECTS credits:** 6
Status: Mandatory		**Total number of contact hours: 90** 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):	Training students for universal engineering communication, communicating with drawings, introducing students to the basics of technical drawing and design geometry, as well as the content and application of standards in the field of graphic communications and technical documentation. Training students to read and understand technical drawings and various technical situations, with special reference to traffic situations. Training students to create technical drawings using computer tools.
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	- Introduction – significance and application of graphic communications in technology. - Practical examples of drawings in the field of traffic and communications. - Computer programs and CAD systems in the field of traffic and communications. - Standardization in graphic communications. - Technical drawings, types of drawings, methods of their formation, drawing formats, headers and components. - Technical fonts and technical freehand sketching. - Types of lines and their use. - Construction of curved lines and circular arcs. - Scale. - Drawings of parts and situations on drawings with the basics of drawing geometry. - Projecting. Types of projections, axonometric projection, isometry, dimetry and oblique projection. - Orthogonal projection. - Sections, types of sections and hatching. - Dimensioning. - Drawing of basic standard elements in the field of traffic and communications. - Computer-aided creation of 3D models and technical documentation of products and situations. - Use and introduction of CAD systems in engineering practice. - Historical development of the CAD systems. - Basics of CAD system. - Principles of CAD system operation. - The difference between 2D and 3D CAD systems. - Basics of application of GIS (geographical information system) systems in the field of traffic and communications.
Learning outcomes:	**Knowledge:** Developing the ability to independently set up and solve simpler problems in the aforementioned areas. Adopts an engineering

	approach to problem solving. **Skills:** Ability to apply theoretical and practical knowledge in the field of engineering graphics. **Competencies:** Through the curriculum and examples from real situations, students should be able to present ideas graphically, as well as a universal, unambiguous understanding of technical documentation with the application of standard elements of graphic communication.
Sustainable Development Goal (SDG):	GOAL 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. GOAL 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
Teaching methods:	Oral presentation with presentations and display of various problems with the use of certain didactic tools. Independent work of students on concrete problems in the field of engineering graphics.
Assessment methods with grading structure:	Criterion of student's progress and evaluation during classes and through partial, final and remedial exams. According to the following method: - Regular attendance at lectures and exercises ….. 10 points, - Project assignments ……. 25 points, - I Partial exam/test/knowledge check/ …… 30 points, - II Partial exam/test/knowledge check/ …….. 35 points. The total number of points that a student can achieve according to the above-mentioned monitoring during classes is a maximum of 100 points (%). Student is passed if he/she collects a minimum of 55 points according to the above criteria. The final and remedial exam is organized for students who have not passed first, second or both knowledge tests. A maximum of 60 points can be scored on the final and remedial exam, which with project assignments and points based on class attendance makes a total of 100 points.

	The final success of the student, after all the foreseen forms of knowledge testing, is evaluated and graded by the grading system as follows: a) 10 (A) - exceptional success without errors or with minor errors, 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 errors, 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. 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 and passing the partial and final exam, and according to the quality of acquired knowledge and skills, and contains a maximum of 100 points, and is determined according to the following scale: Student obligations Points Attendance at lectures and exercises... ..... 10 points (minimum 80% attendance in all forms of classes is mandatory and this is a condition for certification/signature of regular attendance) Project tasks ....……. 25 points I Partial exam/Test/Knowledge check/..... 30 points II Partial exam/Test/Knowledge check/..... 35 points Final exam (I and/or II partial) ..... 60 points Remedial exam (I and/or II partial) ..... 60 points
Literature:	Mandatory: 1. Milan Kljajin and Milan Opalić: Engineering graphics, Faculty of Mechanical Engineering in Slavonski Brod, 2020. Additional: 1. Samir Lemeš: Computer graphics and geometric modeling, Zenica, 2017.

Course code: 03ATCOS010101	**Course title:** **BASICS OF TRAFFIC AND COMMUNICATION SYSTEMS**		
Level: I	**Year: I**	**Semester: I**	**Number of ECTS credits:** 6
Status: mandatory		**Total number of contact hours: 90** Optional breakdown of hours by type: 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 and skills necessary for understanding the structure and functions of transport, traffic and communication systems. Acquisition of basic knowledge about transport, traffic and communication processes, their development and management.		
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	1. Concept and significance of traffic and communication system 2. Basic characteristics of the transport substrate 3. Transport devices 4. Manipulation means and transport equipment 5. Man as a component of traffic and transport system 6. Basic concept and functions of transport modes 7. Capacity and service level of the transport system 8. Basic characteristics and challenges of mobility 9. Mode of road transport 10. Mode of rail transport 11. Mode of air transport 12. Mode of water transport 13. Mode of pipeline transport 14. Postal and communication technologies 15. Information and communication technologies in transport		
Learning outcomes:	Knowledge: The subject Basics of traffic and communication systems		

	should provide the necessary level of knowledge about the basic components and functions of transport, traffic and communication systems and the specific characteristics of individual modes of transport and the way transport and communication processes unfold. Skills: The course Basics of traffic and communication systems enables the acquisition of skills necessary for measuring, analyzing and evaluating the efficiency, safety, environmental impact and economic benefits of the transport system and individual modes of transport. Competences: Through the teaching process of lectures, exercises, and seminar work, students should acquire appropriate competencies for analyzing the functions and characteristics of components of the transport and communication system and the possibility of using different modes of transport in order to take advantage of the advantages of each mode of transport.
Sustainable Development Goal (SDG):	"SDG3 - Health and well-being"; "SDG 9 Industry, innovation and infrastructure", "SDG11- Sustainable cities and communities", SDG 13- Climate protection"
Teaching methods:	Lectures, exercises and seminar work.
Assessment methods with grading structure:	1. Attendance at classes and semester work 15 points 2. First knowledge test 35 points 3. Final knowledge test 50 points
Literature:	Mandatory: -Teaching material available on the online platform for study of the Faculty of Traffic and Communications Supplementary: - Bert van Wee, Jan Anne Annema: The Transport System and Transport Policy, Edward Elgar, Massachusett s, 2013. - Milan Janić : Advanced Transport Systems, Springer, London, 2014. - Mehrdad Ehsani, Fei-Yue Wang: Transportation Technologies for Sustainability, Springer, London, 2012.

Course code:	**Course title: Computer Science and Informatics**

04ATCOS010101			
Level: I	**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 Computer Science and Informatics course is to acquire knowledge and master skills that contribute to the development of information literacy necessary for further study. Students should familiarize themselves with the basic characteristics of computers, the way they work and their capabilities, i.e. achieve an understanding of the architecture of computer systems, operating systems and application software.		
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	- Introduction to computing and informatics - Basic terms in computer science and computer science and computer development - Number systems and codes in computing - Computer architecture and components - Data storage devices - Operating systems - Application software - Computer networks and services - Wireless and mobile networks - Network multimedia services - Tools for creating web pages - Programming languages for software development - Databases - Cryptocurrencies - Artificial intelligence - Security in computing and informatics - The future in computing and informatics		

Learning outcomes:	Knowledge: Students will acquire theoretical and practical knowledge about computing and informatics, and will be provided with a basic level of knowledge about hardware and software, as well as their application in various fields of traffic and communications. Skills: Students are expected to master the skills and tools used in computing and informatics. Competencies: Students will be trained to participate in activities related to computing and informatics 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: - Milosavljević, M., Veinović, M., Grubor, G.: „Informatika“, Univerzitet Singidunum, Beograd, 2009. - Kozić, M.: „Uvod u informatiku i računarstvo“, Mostar, 2006. - Baraković, S., Baraković Husić, J.: „Osnove modelovanja prijetnji u oblasti informaciono-komunikacijskih sistema“, Dobra knjiga, 2022. Supplementary: – Plazibat, B., Jerčić, S.: „Informatika“, Veleučilište u Splitu, Split, 2005. – Tanenbaum, A.S.: "Structured Computer Organization", 4 izdanje, Prentice Hall, 1999. – Mark Burel, „Fundamentals of Computer Architecture“, Palgrave Macmillan, 2003. – Hennessy J. L., Patterson D. J.: "Computer Architecture: A Quantitative Approach", Morgan Kaufman. – Tanenbaum, A.S.: „Računarske mreže“, prevod četvrtog izdanja, Mikro knjiga, 2005.

Course code: 05ATCOS010101	**Course title: ELECTRICAL ENGINEERING SYSTEMS IN TRAFFIC AND COMMUNICATIONS**		
Level: I	**Year:** I	**Semester: I**	**Number of ECTS credites:** 6
Status: MANDATORY COURSE		**Total number of contact hours: 90** Optional breakdown of hours by type: Lectures 45 Tutorials 30 Laboratory tutorials 15	
Course participants:	Academic staff and associates selected in the field to which the course belongs/course		
Prerequisite for enrollment:	No		
Course goal (goals):	The course aims to present students with the fundamental concepts of electrical systems in transport and communications, and their treatment through mathematical terms. Basic concepts of phenomena in electrical engineering, essential for the foundational		

	training of future transport and communications engineers, will be covered. Students are expected to acquire knowledge related to scientific methodology and natural laws, allowing them to approach phenomena in electrical engineering from both qualitative and quantitative perspectives.
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	1. Electric Charge and Matter: Coulomb's law of force, distribution of electric charges. Electric field: definition, calculation examples. Gauss's theorem for the electric field in integral form. Electric potential: work of electric field forces, conservative nature of the electric field. Potential and potential difference, principle of superposition when calculating potential. Electric capacitance: system of charged conductors, isolated conductor. Definition of electric capacitance, calculation examples of capacitance. Capacitor connections. Electrostatic energy. Behavior and application of capacitors in direct and alternating current circuits. Dielectrics and material polarization. 2. Direct Current Electrical Circuits: Definition of electrical conductivity and steady electric currents, Ohm's law, electrical conductivity, electrical resistance, specific electrical resistance, series and parallel resistors. Joule's law. Energy exchange in an electric circuit. Kirchhoff's laws. The law of energy conservation in an electrical circuit. Methods of analysis for direct current electrical circuits. 3. Magnetic Field: Magnetic interaction, electricity and magnetism. Magnetic force on a moving electric charge, magnetic force on a current-carrying conductor. Sources of the magnetic field, Ampere’s law in its basic form, magnetic properties of materials: magnetic field generated by current, Biot–Savart law, electrodynamic force, magnetic properties of materials. Time-varying electric and magnetic fields: characteristics of the electromagnetic field, Faraday's law of electromagnetic induction, Lenz's principle, induced electromotive force. Application of Faraday's law: alternating current generators, electric motors. Self-induction, inductive electric circuit. 4. Electrical Circuits with Time-Varying Currents and Lumped Parameters: Basic electrical quantities: voltage, current, power. Kirchhoff's laws. Two-pole elements: resistor, current and voltage sources, short circuit and open circuit. Series and parallel connections. Basic dynamic circuits: inductors and capacitors: energy and initial conditions. First-order circuits (RC and RL) connected to direct current voltage.

	5. Circuits in Steady-State Sinusoidal Operation: Periodic signals and effective value. Relationship between sinusoidal signals and phasors. Kirchhoff's laws in phasor representation. Impedance, admittance, reactance, and susceptance of two-pole elements in sinusoidal operation. Analysis of dynamic circuits in sinusoidal operation (RC, RL, and RLC). Active, reactive, and apparent power. 6. Three-Phase Systems: Delta and star connections, symmetric and asymmetric operation. Three-phase rotating field, principle of electric motor operation. 7. Transformers: Principle of operation, linear transformer. Basics of operation of commutator and asynchronous electric machines: principles and energy balance of electromechanical energy conversion. 8. Basic Measurements of Electrical Quantities: Basics of measurement techniques and error calculation. Basic measuring equipment. Analog and digital measuring instruments. Methods for measuring electrical quantities. 9. Analog Electronics: Electrical properties of semiconductors, electrons and holes. Donors and acceptors. Characteristics of the p-n junction: Open p-n junction. Diode (p-n junction) as a rectifier. Forward-biased p-n junction. Reverse-biased p-n junction. Static characteristic of the diode. Application of the diode's linear model. Principle of transistor operation. Transistor currents. Common-emitter configuration. Transistor operating regions. 10. Fundamentals of Digital Technology: Boolean algebra. Basic logic gates. Basic connections of AD and DA converters.
Learning outcomes: (Knowledge; Skills; Competencies)	Knowledge: Theoretical and practical knowledge in the field of electrical systems in transport and communications. Fundamental principles of electrical engineering and electronics, and their application in engineering. Skills: Upon successful completion of the course, the student will be able to apply the basic principles of electrical systems in their further studies. Competencies: The student will be capable of analyzing and proposing potential models and methods for solving problems in electrical systems.
Sustainable Development Goal (SDG):	SDG 4 – Quality Education; SDG 12 – Sustainable Consumption and Production
Teaching methods:	The course content is delivered through three activities:

	1. Lectures: Conducted in the classroom for all students by the instructor, where theoretical aspects are presented along with the solving of numerical problems and practical examples. The lectures are supported by the use of video and audio recordings. 2. Exercises: These sessions involve solving additional numerical and practical problems, including solving past exam problems to enhance the understanding of the theoretical topics presented. 3. Laboratory Exercises: Students are introduced to practical measurements and the use of measurement equipment to demonstrate specific principles in the field of electrical engineering. Students are therefore expected to regularly participate in all forms of instruction and engage in continuous independent study.

Assessment methods with grading structure:	Criteria for Monitoring and Grading Student Performance During the Course are structured as follows:
	• Homework/Seminar Paper: 15 points (15%), passing with more than 50% of the points.
	• First Midterm Exam/Knowledge Check: 35 points (35%), passing with more than 50% of the points.
	• Final Exam: 50 points (50%), consisting of two parts:
	  o Second Midterm Exam/Knowledge Check: 35 points (35%), passing with more than 50% of the points.
	  o Oral Exam: 15 points (15%), with no minimum point threshold.
	
	The total number of points a student can earn during the course is a maximum of 50 points (50%), combined with the Final Exam to reach 100 points (100%).
	
	For students who did not pass the First Midterm Exam, the Final Exam (Comprehensive) covers the entire content taught during lectures and exercises and is worth 85 points (85%), which, combined with the seminar paper/practical work, makes up 100 points (100%).
	
	The final grade is determined based on the total number of points obtained through all forms of assessment, using the following grading scale:

	• A (10) – Outstanding performance with no or minimal errors, 95-100 points; • B (9) – Above average, with minor 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) – Satisfactory, meets minimum criteria, 55-64 points; • F/FX (5) – Fails to meet minimum criteria, fewer than 55 points. Total evaluation of all student obligations during the semester and the final exam is based on the total points (%) obtained through fulfilling pre-exam obligations and passing the midterm and final exams, with a maximum of 100 points. The evaluation is determined according to the following scale: Student Obligations — Points (%) Homework/Seminar Paper — 15 points (%) First Midterm Exam/Knowledge Check — 35 points (%) Final Exam (Second Midterm/Oral Exam) — 50 points (%) Final Exam (Comprehensive) — 85 points (%)
Literature:	Required: 4. I. Turković: Bilješke i slajdovi sa predavanja i vježbi 5. E. Hot: Osnovi elektrotehnike, knjiga prva, Sarajevo, 1996. 6. E. Hot: Osnovi elektrotehnike, knjiga druga, Sarajevo, 1996. 7. D Milatović: Osnovi elektronike, Svjetlost, Sarajevo 1995.

Course code: 06ATCOS010102	**Course title:** Mathematics for Engineers II		
Level: I	**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 Exercises 45	
Course participants:	**Academic staff and associates selected in the field to which the course belongs/course**		
Prerequisite for	No		

enrollment:	
Course goal (goals):	Students upgrade basic knowledge with mathematical thematic units of a higher level of understanding. In this way, students become trained to recognize the application of this general knowledge to concrete practical problems (which arise from the field of professional subjects), and to independently define and solve them.
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	1. Functions of several variables: Basic terms. Limit value and continuity 2. Differential calculus of functions of several variables: Differentiation. Tangent plane and normal to the spatial surface. Higher order pracial derivative. Higher order differential. Taylor's formula for functions of two variables 3. Differential calculus of functions of several variables: Extreme values of functions of several variables. Conditional extremum of a function of several variables. 4. Integral calculus of functions of several variables: Calculation of the double integral. Calculation of the triple integral. 5. Differential equations: Differential equations of the first order: Differential equation with a separated variable. Homogeneous equation. Linear differential equation. Bernoulli's equation. Riccati's equation. Kler's equation. Lagrange's equation. 6. Differential equations: Differential equations of a higher order that allow lowering of the order. Higher order linear differential equations. 7. Differential equations. Systems of differential equations. 8. Line integrals: Line integrals of type I and II (definition, properties, calculation). Independence of the line integral from the path. Green's formula in the plane. 9. Surface integrals: Surface integrals of type I and II (definition, properties, calculation). Gauss-Ostrogradsky formula. Stokes formula. 10. Elements of field theory and vector analysis: Scalar field and its basic characteristics. Vector field and its basic characteristics. Vector lines. 11. Elements of field theory and vector analysis: Divergence of a vector field. Green – Gauss-Ostrogradski theorem. Circulation of the vector

	field. Vector field rotor. Stokes theorem in vector form. Potential field, solidoid field, Laplace field. 12. Theory of queues: Number queues. Rows with positive members. Queues with complex members. 13. Series theory: Series and series of functions. Uniform convergence of the order. Degree order. 14. Series theory: Laurent's series. Fourier's order. 15. Laplace transformation.
Learning outcomes:	Knowledge: - Students master the differential calculus of functions of several variables, - set up and solve differential equations and apply them to specific problems, - solve and apply systems of differential equations, - apply differentiation procedures in solving the problem of extrema of multi-variable functions, - define and calculate double, triple, line and surface integrals with the possibility of recognizing their application to specific problems, - demonstrate an understanding of the basic concepts of vector analysis Skills: encourages creativity, precision, systematicity, abstract thinking and critical thinking, which helps in noticing and solving problems, which is essential for continuing education. Competences: presentation and communication in mathematical language, logical thinking, argumentation and reasoning.
Sustainable Development Goal (SDG):	SDG 4 – Quality education SDR 9 – Industry, innovation and infrastructure
Teaching methods:	Theoretical lectures with the use of multimedia tools, active learning and discussion techniques, practical teaching - exercises, and independent presentation and solving of specific specific problems.
Assessment methods with grading structure:	The criterion for evaluating the work and evaluating the student during classes is as follows: Tests during the semester 0 - 15 points; 1st partial exam/1st test/1st knowledge test/ from 0 - 35 points (passed if more than 50% is won). The total number of points that a student can achieve

	according to the above-mentioned monitoring during classes is a maximum of 50 points. The final exam is organized from the entire material covered during the course and amounts to a maximum of 50 points, of which there is the II partial exam of 0 - 25 points (passed if over 50%) and Theory and tasks of 0 - 25 points, which lasts 60 minutes (students pass the theory and tasks they did not do in the partial exams). At the final exam, students can correct the I partial exam, if they did not pass it earlier. The same applies to the remedial exam period of the final exam and both dates of the autumn exam period. 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 (A) - exceptional success without mistakes or with minor mistakes, carries 95-100 points; b) 9 (B) - above average, with some errors, carries 85-94.9 points; c) 8 (C) - average, with noticeable errors, carries 75-84.9 points; d) 7 (D) - generally good, but with significant shortcomings, carries 65-74.9 points; e) 6 (E) - meets the minimum requirements, carries 55-64.9 points; f) 5 (F, FX) - does not meet the minimum conditions, 0 – 54.9 points. 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 and passing the partial and final exam, and according to the quality of acquired knowledge and skills, and contains a maximum of 100 points, and is determined according to the following scale: Student obligations Points (%) Mini-tests during classes.....15 points (%) I Partial exam/Test/Knowledge check/.....35 points (%) Final exam (II Partial + Theory) .....50 points (%)
Literature:	Mandatory:

	7. J. Bektešević, V. Hadžiabdić, M. Mehuljić, E. Pilav Teorijske osnove i zbirka riješenih zadataka iz višestrukih, krivolinijskih i površinskih integrala, PMF, Sarajevo 2018. 8. P. Miličić, M. Uščumlić, Zbirka zadataka iz više matematike II, Nauka, Beograd, 1998 9. A.Omerspahić, V.Hadžiabdić, M.Mehuljić, J.Bektešević, Teorijske osnove i zbirka zadataka iz integralnog računa, Mašinski fakultet Sarajevo, Sarajevo 2012. 10. D. Mihailović, D. Đ. Tošić, Elementi matematičke analize II, (Funkcije više promjenljivih, 11. vektorska analiza, višestruki integrali i teorija polja), Naučna knjiga, Beograd, 1976; 1988; 1991. 12. B.P. Demidovič: Zadaci I riješeni primjeri iz više matematike s primjenom na tehničke nauke, Tehnička knjiga, Zagreb, 1963 Supplementary: 3. S. Kurepa: Matematička analiza 2 i 3, Tehnička knjiga, Zagreb, 1976. 4. A.Omerspahić, Matematika 3, Mašinski fakultet Sarajevo, Sarajevo 2012.

Course code: 07ATCOS010102	**Course title: Technical Mechanics**		
Level: I	**Year: I**	**Semester: II**	**Number of ECTS credits:** 6
Status: MANDATORY		**Total number of contact hours: 90** Lectures 45 Exercises 45	
Course participants:	**Academic staff and associates selected in the field to which the course belongs/course**		
Prerequisite for enrollment:	No		
Course goal (goals):	Adoption of basic concepts and laws: Statics of rigid and solid bodies, Kinematics and Dynamics with the aim of training for successful monitoring and acquisition of knowledge from other professional subjects. Understanding of mechanical processes and application of acquired knowledge when solving problems related to the equilibrium conditions of rigid bodies, stress analysis and dimensioning of solid bodies, solving problems related to the geometry and kinematic characteristics of motion		

	as well as problems that consider the causes of motion. Developing the ability to independently set up and solve simpler problems in the aforementioned areas. Adopts an engineering approach to problem-solving.
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	– Introduction. Statics of rigid bodies. Connections and Connection Reactions. – Systems of interface forces. A static moment of force for a point. Coupling of forces – Reduction of force to a point. An arbitrary system of forces in a plane. – Beam supports in a plane – Friction. Center of gravity – Introduction to material resistance. External forces. Strain. Deformations – The relationship between stress and strain. Axial stress. – Shearing. Geometric characteristics of plane sections. – Bending. Twisting. – Introduction to kinematics. Kinematics of a particle. Straight-line harmonic oscillatory clipping. – Rigid body kinematics. Translational movement. – Rotation of the body around a fixed axis. Analysis of mechanisms – Introduction to dynamics. Laws of dynamics. Differential equations of motion of a point and their integration. – General laws of point dynamics Work and power – Forced motion of a point and Dalamber's principle, Impact theory
Learning outcomes:	Knowledge: Knowledge of basic terms and laws, such as statics of rigid and solid bodies, Kinematics and Dynamics. Skills: Ability to recognize problems related to equilibrium conditions of rigid bodies, stress analysis and dimensioning of solid bodies, solving problems related to geometry and kinematic characteristics of motion as well as problems that censider the causes of motion. Ability recognition basic characteristic scientific research and transmission conclusions and reasons which are up to them brought. Competencies: Through educational process lectures and exercises, the student will be able, at basis adopt knowledge that: – Understands and points out the causes that lead to changes in the state of rest and mechanical movement of the body in nature, to determine the kinematic and dynamic characteristics of movement.

	– Follows and acquires knowledge from other professional subjects. – Uses technical literature, manuals and tables from this field. – Independently set and solve simple problems in the mentioned areas
Sustainable Development Goal (SDG):	SGD4 – Quality educations; SDG12 – Responsible consumption and production
Teaching methods:	– Independent presentation – Discussion – Analysis of examples from practice (assignments, seminar papers)
Assessment methods with grading structure:	Assessment of creativity in classes and exercises with the creation of independent works, assessment of the partial test during the class as well as the assessment of the final exam. Criterion monitoring the work and evaluating the student during classes, according to the following method: – Homework/seminar work/practical work/ 15 points (%), passed if over 55% is won. – I Partial exam/test/knowledge check/35 points (%), passed if more than 55% is won. – Final exam (II Partial) 50 points (%), passed if over 55% is won. – Final exam (Integral) 85 points (%), passed if more than 55% is won. The total number of points (%) that a student can achieve according to the mentioned monitoring during classes is a maximum of 50 points (%), which with the Final (II partial) 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 testing, is evaluated and graded by the grading system as follows: a) 10 (A) - exceptional success without errors or with minor errors, 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. 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 pre-exam obligations and passing the partial and final exam, and according to the quality of acquired knowledge and skills, and contains a maximum of 100 points, and is determined according to the following scale: Student obligations _____Points (%) Attendance at lectures and exercises.....80 (%) Assignment/Seminar/Practice/.....15 points (%) I Partial exam/Test/Knowledge check/.....35 points (%) Final exam (II Partial) .....50 points (%) Final exam (Integral) .....85 points (%)
Literature:	Mandatory: – Dacić, S.: Mechanics in Traffic Engineering, Faculty of Traffic and Communications, Sarajevo, 2021. – Dacić, S.: Fundamentals of Mechanical Engineering, Faculty of Traffic and Communications, Sarajevo, 2007. – Dacić, S.: Selected chapters from the statics of rigid and solid bodies, kinematics and dynamics - script, Faculty of Traffic and Communications, Sarajevo, 2013. – Jurum-Kipke, J.: Mechanics in Traffic Engineering, Faculty of Traffic Sciences, Zagreb, 2001. – Kuzmanović, D., Kastratović, G., Vidanović, N.: Mechanics 1, University of Belgrade, Faculty of Communication, 2012. – Kuzmanović, D., Kastratović, G., Vidanović, N.: Mechanics 2, University of Belgrade, Faculty of Civil Engineering, 2012. Supplementary: – Rusov, L. Mechanics - Statics, Scientific book, Belgrade, 1992. – Rusov, L. Mechanics - Kinematics, Scientific book, Belgrade, 1992 – Rusov, L. Mechanics - Dynamics, Scientific book, Belgrade, 1992 – Beer, F., E. Russell, L., J. Kornwell. P., Vector Mechanics for Engineers, McGraw Hill, 2010. – Kuzmanović, D., Kastratović, G., Vidanović, N.: Collection of tasks from Mechanics 1, University of Belgrade, Faculty of Civil Engineering, 2012.

<table>
<tr><td>Course code:
08ATCOS010102</td><td colspan="3">Course title: Traffic and Traffic Space</td></tr>
<tr><td>Level: I</td><td>Year: I</td><td>Semester: II</td><td>Number of ECTS credits: 6</td></tr>
<tr><td colspan="2">Status: Mandatory course</td><td colspan="2">Total number of contact hours: 90

Optional breakdown of hours by type:
Lectures: 45
Tutorials: 30
Seminars: 15
Fieldwork:
Laboratory Tutorials:
Practice</td></tr>
<tr><td colspan="2">Course participants:</td><td colspan="2">Academic staff and associates selected in the field to which the course belongs/course</td></tr>
<tr><td colspan="2">Prerequisite for enrollment:</td><td colspan="2">No</td></tr>
<tr><td colspan="2">Course goal (goals):</td><td colspan="2">Acquisition of educational knowledge in the field of traffic planning and practical analysis of urban, regional, and environmental traffic planning. Gaining knowledge in planning management, land use, spatial protection, setting long-term goals and measures for spatial development in line with the planned overall economic, social, and historical development of the area being addressed.</td></tr>
<tr><td colspan="2">Topics covered (Units of study):
(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)</td><td colspan="2">1. Introduction – Basics of Spatial Planning
2. Key Characteristics of Environmental Issues
3. Measuring Levels of Social Development
4. Spatial Organization
5. Development of Spatial Planning and Spatial Organization in BiH
6. Environmental Impact Assessment
7. Legal Framework for Spatial Planning
8. Development Trends and New Approaches in Spatial Planning
9. Work Marketing
10. Elements of Sustainable Development
11. Spatial Models
12. Local Initiatives and Strategic Plans at the Local Level
13. New Dimensions of European Policy in Spatial Planning
14. Spatial Results Significant for Europe
15. Digital Technology in Spatial Planning</td></tr>
</table>

Learning outcomes:	Knowledge: Theoretical and practical knowledge in the field of spatial traffic planning. Basic regulations, rules, methods, and procedures in spatial planning within the context of traffic planning, as well as the analysis of traffic spatial plans. Skills: The ability to apply theoretical and practical knowledge in the field of spatial traffic planning. Competencies: The ability to independently understand and use regulations, utilize professional literature, apply methods and procedures, conduct measurements and research, prepare analyses, evaluations, and practical solutions for the realization and further improvement in spatial traffic planning.
Sustainable Development Goal (SDG):	"SDG3 – Good Health and Well-being"; "SDG9 – Industry, Innovation, and Infrastructure"; "SDG11 – Sustainable Cities and Communities"; "SDG13 – Climate Action"
Teaching methods:	Presentation with the demonstration of various systems and processes in the field of spatial traffic planning using video and audio recordings, and independent presentation of specific problems in a particular research area. Initiating discussions and debates on practical issues, individual observations from different environments, and the preparation of independent research and analysis of existing traffic spatial plans for the selected area.
Assessment methods with grading structure:	Evaluation of activities in lectures and exercises, along with the preparation of independent work, assessment of the mid-term test during the course, and the final exam. The criteria for monitoring and assessing student performance during the course are as follows: – Seminar/Fieldwork/Lab Exercises/Practice (written and oral assessment) – 15 points (%), passed if over 50% is achieved. – Mid-term exam/test/knowledge check (written assessment) – 35 points (%), passed if over 50% is achieved. – Final exam (Second Mid-term) (written assessment) – 50 points (%), passed if over 50% is achieved. – Final exam (Comprehensive) (written assessment) – 85 points (%), passed if over 50% is achieved. The total number of points (%) a student can achieve through this monitoring system during the course is a maximum of 50 points (%), which combined with the Final (Second Mid-term) totals 100 points (%).

	For students who did not pass the First Mid-term exam, the Final (Comprehensive) exam is organized covering all the material taught during lectures and exercises and is worth 85 points (%), combined with the seminar/practical work to make a total of 100 points (%). To pass the course, students must pass each of the following parts: the seminar paper, the first mid-term exam (test), and the final exam (second mid-term or comprehensive). The evaluation of the seminar paper and the first mid-term exam (test) is conducted during the course. Students who pass the first mid-term exam only take the second mid-term exam in the final exam, while those who do not pass the first mid-term exam will take the comprehensive final exam, which consists of both the first and second mid-term exams. Students who did not pass the exam in the previous academic year but fulfilled certain obligations and earned points can carry them over to the current academic year. Students who wish to carry over points must inform the course instructor at the start of the semester, by the end of the first week of lectures. Points may be carried over only once. The final student grade after all forms of knowledge assessment will be evaluated and graded according to the following system: a) 10 (A) – exceptional performance with no or minimal 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 minimum requirements, 55-64 points; f) 5 (F, FX) – does not meet minimum requirements, less than 55 points. The total assessment of all student obligations during the semester, i.e., the exam grade, is based on the total number of points (%) the student has achieved by fulfilling pre-exam obligations and passing the mid-term and final exams. This totals a maximum of 100 points, and is determined according to the following scale: Student Obligations Points (%) Attendance in lectures and exercises ……..... 0 points

	Minimum 80% attendance at all forms of classes is mandatory, and this is a condition for course certification/signing off on proper attendance. Seminar Paper/Fieldwork/Lab Exercises/Practice (written and oral assessment).....15 points (%) First Mid-term Exam (written).....35 points (%) Final Exam (Second Mid-term) (written).....50 points (%) Final Exam (Comprehensive) (written).....85 points (%)
Literature:	Mandatory: 1. Bublin, M., Traffic and Road Planning , Sarajevo, 2007. 2. Bublin, M., Spatial Planning and Environmental Protection, University Book, Sarajevo, 2010. 3. Bublin, M., Traffic and Traffic Space, University Book, Sarajevo, 2000. Supplementary: 1. Appleyard, D., Kerin, L., Majer, R., The View from the Road, Harvard. 2. Čekić, Š., Basics of Methodology and Technology of Scientific and Professional Work, Faculty of Traffic and Communications, Sarajevo, 1996. 3. Framework Traffic Strategy of Bosnia and Herzegovina, Sarajevo, 2016. 4. The Study on the Transport Master Plan in Bosnia and Herzegovina, 2001. 5. Zelenika, R., Livio, J., Modern Transport Systems, Faculty of Economics Rijeka, Rijeka, 1995.

Course code:	**Course title: INDUSTRIAL TRANSPORT**		
Level: I	**Year:** II	**Semester: IV**	**Number of ECTS credites:** 6
Status: MANDATORY COURSE		**Total number of 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):	Acquistion of educational forms for implementing programs in		

	industrial flow design and management.
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	1. **Introduction – Basics of Industrial Transport** 2. Classification and Basic Characteristics of Transport Mechanization 3. Accessories and Auxiliary Devices 4. Basics of Hydraulic Systems 5. Continuous Transport Equipment 6. Discontinuous Transport Equipment 7. Handling Equipment in Industrial Transport 8. Graders, Elevators, Conveyors 9. Cable Cars 10. Curved, Vibrating, and Roller Conveyors 11. Dumpers and Tip Trucks 12. Belt Conveyors and Belt Conveyor Calculations 13. Pneumatic Transport 14. Hydraulic Transport 15. Labor Costs and Optimization of Industrial Transport
Learning outcomes: (Knowledge; Skills; Competencies)	Through the teaching process, including lectures, exercises, and practical work, students should acquire the necessary knowledge and experience for practical application in the field of design, selection, management, and maintenance of internal transport equipment. This course provides the knowledge needed for optimizing industrial flows.
Sustainable Development Goal (SDG):	Sustainable Development Goals (SDGs) and Targets that can be linked are: Goal 8: Promote Inclusive and Sustainable Economic Growth, Employment, and Decent Work for All Goal 9: Build Resilient Infrastructure, Promote Inclusive and Sustainable Industrialization, and Foster Innovation
Teaching methods:	Lectures, tutorials and preparation of seminars with a practical focus.
Assessment methods with grading structure:	Evaluation and grading of students during the course are carried out as follows: • Attendance at lectures and exercises: 0 – 10 points (%) • Homework/seminar papers/practical work: 0 – 10 points (%) • First partial exam/test/knowledge check: 0 – 15 points (%)

	• Second partial exam/test/knowledge check: 0 – 20 points (%) The total number of points (%) that a student can achieve based on the above criteria during the course is a maximum of 55 points (%). The final exam is worth up to 45 points or 45 (%). The final exam covers the entire material studied during the course.
Literature:	Required: 8. Ahmić, A., Pretovarna i transportna mehanizacija, Univerzitetska knjiga, Sarajevo, 1996. 9. Marvin I., Prekrcajna mehanizacija, Zagreb, 1997. 10. Dedijer S., Osnovi transportnih uređaja, Građevinska knjiga, Beograd, 1989.

Course code: 10ATCOS010102	**Course title: Logistics in Traffic and Communications**		
Level: I	**Year: I**	**Semester: II**	**Number of ECTS credits: 6**
Status: mandatory		**Total number of contact hours: 90** **Lectures: 60** **Exercises: 30**	
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 goal of the course "Logistics in Transportation and Communications" is to acquire knowledge about logistics as a philosophy of service quality, technological changes in transportation and communications, requirements in logistics development, structure, and needs for the development of modern logistics centers.		
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of*	– Concept, definition, and development of logistics as a scientific discipline used in logistics – Division and content of logistics according to areas of application – Concept, structure, and processes of logistics systems – Logistics operators – Warehousing – Warehousing processes – Transport chain in logistics systems, supply, and supply chain – Warehousing process in the supply chain		

organizational units)	– Inventory and types of inventory – Reverse logistics – Information and communication technologies in logistics – Logistics strategy – Determining the quality of logistics services – Quality management in logistics – Modern concepts of logistics center development and the logistics center as a strategically significant factor in improving service quality
Learning outcomes:	**Knowledge:** The course should ensure a level of competence and knowledge necessary to solve specific problems in the field of logistics, providing theoretical and practical knowledge related to logistics in transportation and communications. **Skills:** Developed abilities to apply theoretical and practical knowledge in the area of logistics processes in transportation and communications. **Competencies:** Developed abilities for independent understanding and use of knowledge required to solve specific problems in logistics and logistics processes.
Sustainable Development Goal (SDG):	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.
Teaching methods:	Teaching is conducted through oral presentations (ex-cathedra) and demonstrations of various systems and processes in the field of logistics in transportation and communications, using video and audio recordings, as well as individual presentations of specific problems in the area of logistics processes based on specific research areas. Initiating discussions and debates with students about practical issues, individual observations from various environments, conducting independent research and analyses in logistics and logistics systems.
Assessment methods with grading structure:	Criteria for monitoring and evaluating student performance during

	classes are as follows: 1. Homework/Seminar work/Practical work - max 15 points (%), passed if more than 50% is achieved. 2. First Partial Exam/Test/Knowledge Check - max 35 points (%), passed if more than 50% is achieved. 3. Final Exam - written - 20 points 4. Final Exam - oral - 30 points 5. Final Exam (Integral) - written - 40 points 6. Final Exam (Integral) - oral - 45 points To pass, a student must pass the oral part of the exam. The total number of points (%) that a student can achieve according to the monitoring during classes is a maximum of 50 points (%), which combined with the final (second partial) exam makes 100 points (%). For students who did not pass the first partial exam, the final exam (integral) is organized covering all material covered during classes and exercises, valued at 85 points (%), which combined with seminar/practical work makes 100 points (%). Final student performance is evaluated based on the total number of points (%) earned from fulfilling pre-exam obligations and passing the partial and final exams, according to the quality of knowledge and skills acquired, and contains a maximum of 100 points, evaluated as follows: a) 10 (A) - exceptional success with no errors or only minor errors, worth 95-100 points; b) 9 (B) - above average, with some errors, worth 85-94 points; c) 8 (C) - average, with noticeable errors, worth 75-84 points; d) 7 (D) - generally good, but with significant shortcomings, worth 65-74 points; e) 6 (E) - meets minimum conditions, worth 55-64 points; f) 5 (F, FX) - does not meet minimum conditions, less than 55 points. 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 and passing the partial and final exams, according to the quality of knowledge and skills, with a maximum of 100 points, determined according to the following scale: Student Obligations _____points Attendance at lectures and exercises - attendance records are mandatory. Attendance in classes and exercises is not graded. Homework/Seminar/Practical work.....max 15 points First Partial Exam/Test/Knowledge Check.....max 35 points Final Exam - written.....max 20 points Final Exam - oral.....max 30 points Final Exam (Integral) - written.....max 40 points Final Exam (Integral) - oral.....max 45 points The final exam is organized so that students who passed the first knowledge check take only the final part of the exam (second part of the material), while students who did not pass the first knowledge check take both the final and the first partial exam (first part of the material). The exam is taken both in writing and orally. This grading scale is adopted according to the Study Regulations at the University of Sarajevo. **Note:** Students are required to attend all forms of teaching for at least 80% of the total hours. A student may, in justified cases (illness), be absent from classes, for which they must provide a medical excuse. Seminar and homework will be graded only if submitted by the defined deadlines. Late submissions will not be graded.
Literature:	**Mandatory:** 1. Lecture notes and slides (available for download on the Faculty's website). 2. BERKOVIĆ, M.: Lecture script, "Logistics in Transportation and Communications," Faculty of Transportation and Communications, 2024.

	3. KOSOVAC, A.; Muharemović, E.: "Processes of Logistics Systems," Faculty of Transportation and Communications, 2022. 4. ZELENIKA, R.: Logistics Systems, Faculty of Economics in Rijeka, Rijeka 2005. 5. ZELENIKA, R.: Foundations of Logistics Forwarding, Book One, University of Rijeka 2005. **Supplementary:** 1. ZELENIKA, R.: Transport Systems, Technology-Organization-Economics-Logistics-Management, University of Rijeka 2001. 2. OBLAC, H.: Macro-logistics Policy, Faculty of Economics and Business Maribor, 1996. 3. VASILJEVIĆ, M. R.: "Logistics in Transportation," University of East Sarajevo, Faculty of Traffic Engineering Doboj, Doboj 2015. 4. PERIŠIĆ, R.: Quality Systems of Services, Logistics, and Informatics, Institute of Technical Sciences SANU, Belgrade, 2002.

Course code: 11ATCOS010203	**Course title: APPLIED MATHEMATICS AND STATISTICS**		
Level: I	**Year: II**	**Semester: III**	**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):	The goal of the course is for students to acquire knowledge in the field of applied mathematics and general statistics that are significant in traffic and communication scientific/scientific fields (error theory, basics of numerical algebra and analysis, probability and statistics, and the application of combinatorics and probability theory in statistics), as would better follow and master the structure of individual professional subjects that make more extensive use of these important and meaningful		

	areas of modern mathematics.
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	• Introduction – basics of applied mathematics in engineering (traffic and communications). Errors of approximate values of numbers and functions • Numerical solution of linear equations and systems of linear equations, Gaussian algorithm • Solving systems of nonlinear transcendental equations. Localization of zeros of polynomials. Determining the minimum of functions • Method of least squares. Interpolations and approximations • Numerical differentiation and integration • Laws of large numbers • Elements of combinatorics • Introduction to probability theory - Basics of classical probability theory (three classical concepts of probability, basic theorems, formula of total probability and Bayesian formula) • General (axiomatic) definition of the concept of probability. Discrete and non-discrete probability spaces • Analysis of discrete and continuous random variables. Probability (density) function/law and probability distribution (distribution, theoretical distribution) function • Introduction to general and mathematical statistics. Concept, subject and significance of statistics (especially in technical sciences/sciences). • Statistical set and statistical units. Characteristics of statistical units. The concept of statistical research. Descriptive statistical analysis, processing and analysis of data and results (graphical presentation of statistical series, measures of variation/dispersion) • Method of statistical samples. Statistical (parametric and non-parametric) hypothesis testing • Concept and subject of regression analysis: regression and correlation • Dynamic analysis in statistics
Learning outcomes:	Knowledge: After completing the course, the student should: • have a developed sense of deductive reasoning; • understand basic concepts from the field of error theory, numerical mathematics, probability theory and statistics and thus be familiar with how intuitive concepts are translated into precise mathematical language; • master standard numerical, stochastic and statistical methods and their applications; • understand the role that the linearization process plays in the mathematical modeling of specific physical, traffic, communication and other engineering problems; • master the basic techniques of numerical algebra, numerical analysis, classic and contemporary probability theory and statistics;

	• deepen the understanding of basic problems in the field of engineering mathematics 1 and 2. Skills: it encourages creativity, precision, systematicity, abstract thinking and critical thinking, which helps in noticing and solving problems, which is essential for continuing education. Competencies: showing and communicating in mathematical language, logical thinking, argumentation and reasoning.
Sustainable Development Goal (SDG):	SDG4 – Quality Education, SDG9 - Industry, innovation and infrastructure
Teaching methods:	Lectures are conducted by the teacher during which theoretical aspects are presented along with solving numerical problems and practical examples. Lectures take place with the use of video and audio recordings. The exercises include solving numerical and practical problems, which also includes solving problems from previous exams with the aim of achieving a better understanding of the presented theoretical topics.
Assessment methods with grading structure:	The criteria for evaluating the student's work and evaluation during classes is as follows: Tests during the semester (or practical task) from 0 - 15 points; 1st partial exam/1st test/1st knowledge test/ from 0 - 35 points (requirement 50%). The total number of points that a student can achieve according to the above-mentioned monitoring during classes is a maximum of 50 points. The final exam is organized from the entire material covered during the course and amounts to a maximum of 50 points, of which there is the II partial exam of 0 - 25 points (requirement 50%) and the final - theory and tasks of 0 - 25 points, which lasts 60 minutes (students pass the theory and tasks they did not do in the partial exams). At the final exam, students can correct the I partial exam, if they did not pass it earlier. The same applies to the exam period for the remedial final exam and both dates of the autumn exam period. 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 85-94.9 points; c) 8 (C) - average, with

	noticeable errors, carries 75-84.9 points; d) 7 (D) - generally good, but with significant shortcomings, carries 65-74.9 points; e) 6 (E) - meets the minimum requirements, carries 55-64.9 points; f) 5 (F, FX) - does not meet the minimum conditions, 0 – 54.9 points. 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 and passing the partial and final exam, and according to the quality of acquired knowledge and skills, and contains a maximum of 100 points, and is determined according to the following scale: Student obligations _ Points (%) Activity / Mini tests / Tasks / Seminar paper .....15 points (%) I Partial exam/Test/Knowledge check/.....35 points (%) Final exam (II Partial + Theory) .....50 points (%)
Literature:	Mandatory: 7. Blažić, M. R., Opšta statistika - Osnovi i analiza, Savremena administracija, Beograd, 1982. 8. Carnahan, B. , H. A. Luther, H. A. , Wilkes, J. O., Applied Numerical Methods, John Wiley &Sons, 1969. 9. Elezović, N., Teorija vjerojatnosti, zbirka zadataka, Element, Zagreb, 1995. 10. Fatkić, H., Vjerovatnoća i statistika, I . dio, The Soros Foundations, FOD BiH, Sarajevo, 1997; Corons, Sarajevo, 2000. 11. Fatkić, H., Hasković, A., Čolaković, A., Avdagić, E., Primjenjena matematika i statistika, Predavanja i vježbe, Slajdovi i bilješke, Sarajevo, 2012, http://www.fsk.unsa.ba/ 12. Hadžć, O., Numeričke i statističke metode u obradi eksperimentalnih podataka,Institut za matematiku, Novi Sad, 1989. Supplementary: 1. Ivanšić, I., Numerička matematika, Element, Zagreb, 1998. 2. Johnson, R. A. , Bhattacharyya, G. K., Statistics: Principles and Methods, Wiley, New York, 5th edition, 2006. 3. Lučić, B., Statistika, Ekonomski fakultet, Sarajevo, 1996.

Course code: 12ATCOS010203	**Course title: System Engineering**		
Level: I	**Year: II**	**Semester: III**	**Number of ECTS credits: 6**

Status: Mandatory course	**Total number of contact hours: 90** Optional breakdown of hours by type: Lectures: 30 Tutorials: 30 Seminars: 10 Fieldwork: 10 Laboratory Tutorials: 10 Practice
Course participants:	**Academic staff and associates selected in the field to which the course belongs/course**
Prerequisite for enrollment:	No
Course goal (goals):	The aim of the course is to master traffic processes and establish common traffic parameters that enable better integration into a unified traffic network. By achieving adequate interaction between the components of the traffic system throughout its life cycle, an overview of individual phases of technological processes in transportation and communications will be provided.
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	1. Introduction – terms and definitions 2. Systems approach to studying traffic (Structure of the traffic system; System modeling of traffic) 3. Fundamental system concepts (General definitions and interpretations of the term system; System classification) 4. Analogy, homomorphy, and isomorphy. State and state space. Systems analysis. Systems architecture. Life cycle of the system. 5. System diagrams and tools (Objectogram and funciogram; ER diagrams; DFD diagrams; GPSS block diagrams; Petri net) 6. Behavior of open dynamic systems (Types of system behavior; Transient processes; Static and dynamic characteristics of systems) 7. System definition and development (Primary phases of systems engineering; Defining system requirements) 8. Systems and processes of road traffic (System definition of road traffic; System design of the road network) 9. Road traffic technology (System description of passenger and freight transport technology in road traffic)

	10. Systems and processes of railway traffic (Defining and describing railway systems; Systems approach to choosing railway vehicles) 11. Systems and processes of air traffic (System definition of air traffic; System development of network infrastructure; Air traffic technology) 12. Systems and processes of telecommunications traffic (System definition of telecommunications traffic; System development of telecommunications networks) 13. Technological processes of Intelligent Networks 14. Systems and processes of postal traffic (System definition of postal traffic; Development of postal networks and technology; Postal traffic technology) 15. Development of intelligent transport systems (ITS concept and services; ITS development)
Learning outcomes:	**Knowledge**: Through lectures and exercises, as well as through practical work, students will master the course material and gain theoretical and practical knowledge in the field of systems engineering. **Skills**: The ability to apply theoretical and practical knowledge in the field of system engineering. **Competencies**: The ability to monitor technological processes with the aim of creating a quality traffic system structure that results in quality, safe, timely, and environmentally friendly traffic services.
Sustainable Development Goal (SDG):	SDG 9 – Industry, Innovation, and Infrastructure SDG 11 – Sustainable Cities and Communities SDG 12 – Responsible Consumption and Production SDG 13 – Climate Action
Teaching methods:	Oral presentation method, discussion method, demonstration method, group work method.
Assessment methods with grading structure:	Evaluation of creativity during lectures and exercises through independent work, assessment of partial tests during the course, as well as evaluation of the final exam. The criteria for monitoring student work and evaluation during the course are as follows: • Homework/seminar paper/practical work: 15 points (%), passed if at least 55% is achieved. • First partial exam/test/knowledge assessment: 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 can take the exam on the material they have not successfully completed during the semester. A successful exam result requires at least 55% of the points from the maximum number of points on the partial and final exams, and it is sufficient if the total sum of points (from: homework, attendance, partial and final exams) is 55. Homework is organized through writing assignments and projects. Homework cannot be corrected. For students who have not successfully completed the partial exam, the final exam consists of the entire material covered during the course. The retake exam is organized in the same way as the final exam. The student's final success after all the prescribed forms of knowledge assessment is evaluated and graded according to the following grading system: a) 10 (A) – Excellent without or with minor mistakes, 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 minimum requirements, 55-64 points; f) 5 (F, FX) – Does not meet minimum requirements, less than 55 points. The total evaluation of all student obligations during the semester, or the grade on the exam, is based on the total number of points (%) the student has earned by fulfilling pre-exam obligations and passing the partial and final exams, and is determined according to the following scale: **Student Obligations | Points (%)** Attendance at lectures and exercises... | - Homework/Seminar/Practice/… | 15 points (%) First partial exam/Test/Knowledge assessment… | 35 points (%)

	Final exam (Second Partial) | 50 points (%) Final exam (Comprehensive) | 85 points (%)
Literature:	Mandatory: Čaušević S, Bošnjak I, **System Engineering in Transport and Communications**, University of Sarajevo, Faculty of Transport and Communications, Sarajevo, 2006. Lecture notes and slides.

Course code: 13ATCOS010203	**Course title: Economics in Traffic and Communications**		
Level: I	**Year: II**	**Semester: III**	**Number of ECTS credits:** 6
Status: mandatory subject		**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):	Acquisition of basic knowledge in the field of economics in transportation and communications, aimed at creating an economically efficient and high-quality transportation and communication system.		
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	1. The concept and significance of economics in transportation and communication models 2. The role of transportation in social reproduction 3. Characteristics of production of transportation and communication services 4. Supply and demand as market elements 5. Shaping and determining the value of transportation and communication services 6. Costs of transportation and communication processes 7. Analysis of cost dynamics 8. Cost residuals and factors of residual costs in transportation and communications 9. Prices of transportation and communication services and the factors they depend on 10. Tariffs and tariff policy		

	11. Principles of business economics in transportation and communications 12. Investments in transportation and communications 13. Methods for evaluating investment projects in transportation and communication systems 14. Basic features of the tax system and tax policy in transportation and communication systems 15. Factors relevant to managing business economics in transportation and communication systems
Learning outcomes:	Knowledge: Students will acquire knowledge in the field of economics in transportation and communications aimed at creating an economically efficient and high-quality transportation and communication system. Skills: Understanding economic principles and qualitative-quantitative analysis of economic processes that occur in transportation enterprises and the transportation market. Competencies: Application of acquired knowledge in specific models.
Sustainable Development Goal (SDG):	SDG 4: Ensure inclusive and quality education and promote lifelong learning opportunities for all. SDG 8: Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all. SDG 9: Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation. SDG 10: Reduce inequality within and among countries. SDG 12: Ensure sustainable consumption and production patterns.
Teaching methods:	During the course delivery, the instructor presents individual thematic units (ex cathedra), provides students with access to educational videos (DVDs, video presentations) related to the subject matter, and organizes discussions on assigned topics (interactive teaching). In practical sessions, examples and tasks are analyzed and solved according to theoretical topics, students are assisted in independently solving tasks, and in preparing programs and seminar papers. Case Study, Workshop.
Assessment methods with grading structure:	Criteria for evaluation and grading of student work during the course: Homework: 0 to 5 points Seminar Paper / Project Assignment: 0 to 10 points

	First Test / Knowledge Check / First Partial Exam: 0 to 35 points The total number of points a student can earn during the course is up to 50 points. The final exam covers the material that the student did not pass in the partial exam, meaning it includes the second part of the material (Second Partial Exam), worth 50 points, or it consists of the entire material, i.e., both the First and Second Partial Exams. The overall assessment of all student responsibilities during the semester, and the exam grade, is based on the total number of points (%) the student has earned by completing pre-exam obligations, passing the partial exam, and the final exam. Students can earn up to 100 points based on the following scale: Grading Structure Points (%) Homework: 5 points (%) Seminar Paper / Project Assignment: 10 points (%) First Test / Knowledge Check (First Partial Exam): 35 points (%) Final Exam (Second Partial Exam): 50 points (%) Requirements for Passing the Exam: Total score of 55 points, with at least 55% in each part of the exam (activity, partial exam, final exam). To pass the exam, students must achieve the following minimum scores: Homework: 3 points Activity (Seminar Paper / Project Assignment): 6 points First Test / Knowledge Check / Partial Exam: 19 points Final Exam (Second Partial Exam): 27 points Students who have passed the partial exam will only take the second part

	of the material (not covered in the partial exam) in the final exam. Students who have not passed the partial exam will take the entire material, with the grading criteria remaining the same. The final exam may be organized as a written and/or oral exam. Activity can be monitored through homework, seminar papers, project assignments, or quizzes. Note: Students are required to attend all forms of teaching at least 80% of the total hours, and attendance is a condition for confirming regular attendance. Students may be absent due to justified reasons (e.g., illness), for which they must provide a medical excuse. Seminar papers and homework will only be graded if submitted by the specified deadlines. Late submissions will not be graded. Final Evaluation and Grading Scale: a) 10 - Outstanding performance with no 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 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:** 1. Ferizović, A., Kalem, A., *Economics in Transportation and Communications (Script I part)*, Faculty of Traffic and Communications, Sarajevo, 2020. 2. Ferizović, A., Kalem, A., *Economics in Transportation and Communications (Script II part)*, Faculty of Traffic and Communications, Sarajevo, 2020. 3. Čekić, Š., *Economics in Transport and Communications*, University of Sarajevo, Faculty of Traffic and Communications, Sarajevo, 2005. 4. Novaković, S., *Traffic Economics*, Belgrade. 5. Perić, T., Radačić, Ž., Šimulčik, D., *Economics of the Traffic System*, University of Zagreb, Faculty of Traffic Sciences, Zagreb, 2000. 6. Perović, D., *Cost Theory*, Belgrade. 7. Samuelson, P., Nordhaus, D., *Economics*, Mate, 1992.

	Supplementary: 1. Petrović-Vujačić, J., *Fundamentals of Economics*, Traffic Faculty, Belgrade, 2010. 2. Šunjić-Beus, M. et al., *Business Economics*, electronic edition, Faculty of Economics, Sarajevo, 2009. 3. Martinović, D., *Break-Even Point as a Business Decision Tool*, Faculty of Economics, Sarajevo, 2013. 4. Thompson, A., *Economics of the Firm: Theory and Practice*, Fifth Edition, New Jersey. 5. Tatić, K., *Managerial Economics*, Faculty of Economics, Sarajevo, 2008. 6. Somun-Kapetnović, R., Arnaut-Berilo, A., Šehić, E., Kahvić, E., *Quantitative Methods in Economics and Management*, Faculty of Economics, Sarajevo, 2009.

Course code: 14ATCOS010203	**Course title: Traffic Information Systems**		
Level: I	**Year: II**	**Semester: III**	**Number of ECTS credits:** 6
Status: mandatory		**Total number of contact hours: 90** Lectures: 45; Exercises: 30; Seminar: 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 information systems, their applications, components, technologies, and development principles, with the aim of equipping students to address tasks and problems related to the planning, development, and analysis of information systems in transportation and communications.		
Topics covered (Units of study):	• The concept of systems and information systems (IS) • Infrastructure and architecture of information systems • Information and communication technologies • Database management systems • Software solutions for IS development • Communication technologies for IS development • The life cycle of information systems development (SDLC) • Organization of information systems development • Application of CASE tools for IS design • Planning of information systems development • Process modeling and reengineering: Workflow, DFD, BPR • Modeling of structure, database, and behavior of IS		

	• Implementation of information systems • Analysis of information systems • Security and quality of information systems
Learning outcomes:	Knowledge: Students will acquire theoretical and practical knowledge about the types and components of information systems, their design methods, and their application possibilities in transportation and communications. Skills: Students will master the skills and tools used in the design and development of information systems, such as CASE tools. Competencies: Students will be equipped to participate in the planning and development of information systems, particularly those intended for the fields of transportation and communications.
Sustainable Development Goal (SDG):	SDG 9 – Industry, Innovation, and Infrastructure
Teaching methods:	The course is delivered through lectures and practical exercises. Lectures are conducted through oral presentations with slides and practical examples. During the course, discussions are initiated on issues related to the planning, analysis, design, and development of information systems, with a special focus on systems used in transportation and communications. Various methods are used, including: oral presentations, discussions, demonstrations, individual and group work.
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/or seminar papers and/or project tasks, as well as a partial exam. The final/exam includes material not covered in the partial exam, which means it includes the second part of the material (not covered in the partial exam) and is worth 50 points for students who have passed the partial exam, or it covers the entire material worth 80 points for students who did not pass the partial exam. Student activity is monitored and assessed through participation in class discussions, completion of assignments, seminar papers, project tasks, or quizzes. The final/exam can be conducted as a written and/or oral test.

	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**: • Assignments/Class Participation: 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 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 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, "Traffic Information Systems (LECTURE NOTES)," Faculty of Traffic and Communications, Sarajevo, 2023. Supplementary: – 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. – Richard T. Watson (editor), „*Information Systems*," Global Text Project (Creative Commons Attribution 3.0 License), 2017. – 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. – Anita Pickerden, „*Planning and Managing your Work Based Projects*," bookboon.com, 2015. – Terra Vanzant Stern, „*Lean and Agile Project Management*," Taylor & Francis Group, 2017. – Andrew Stellman & Jennifer Greene, „*Learning Agile*," O'Reilly Media, 2015. – Christos Kalloniatis: "*Modern Information Systems*," InTech Croatia, 2012. – Poliščuk Jaroslav: „*Projektovanje informacionih sistema*," Podgorica, 2007. – Kelly R. Jr, Efraim T.: „*Uvod u informacione sisteme*," Data Status, 2009. – Information Security Management Systems (ISMS) standards, ISO/IEC 27000 – ISO 9000 family of quality management systems (QMS) standards

Course code: 15-1ATCES010203	**Course title: Elements of Transport Vehicles and Devices**		
Level: I	**Year: II**	**Semester: III**	**Number of ECTS credits:** 6
Status: ELECTIVE SUBJECT		**Total number of contact hours: 90** Lectures 45 Exercises 30 Seminar 15	
Course participants:	**Academic staff and associates selected in the field to which the course belongs/course**		
Prerequisite for enrollment:	No		
Course goal (goals):	The aim of the course is to acquaint the student with rational structural forms, work principles, calculation bases and principles of material selection, elements and devices of transport and handling devices.		

Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	– Introduction. Connecting elements. Welded, soldered, glued joints. Joints with rivets. – Bolted joints. Joints with studs. streaming. Stokes theorem – Elastic joints. – Elements for circular movement. Shaft and axles. – Couplings. Bearings. – Power transmission elements. Friction gears. – Gear transmissions. – Transmission belts. – Characteristics of power transmissions and their application on transport and handling vehicles. – Elements for conducting fluids (liquids) and gases (pipes, pipe closures and others). – Introduction. The first main law of thermodynamics – Calorific properties of gases. Mixtures of gases – Changes in the state of gases. Circular processes. – The second main law of thermodynamics – Heat engines. Compressors. Motors SUS. Turbines
Learning outcomes:	Knowledge: Knowledge of basic structural forms, principles of operation, basis of calculations and selection of materials for elements and devices of transport and handling equipment. Skills: The application of acquired knowledge from the above-mentioned field will enable the student to make the most of the exploitation characteristics of elements and devices that are built into transport and handling vehicles during practical work and make the correct selection of elements. Acquired knowledge from this subject is necessary for easier monitoring and understanding of other professional subjects in the continuation of studies. Competencies: Through the teaching process of lectures, exercises and doing homework, the student will be able, based on the acquired knowledge, to: – understand the basic principles of operation of compressors, sus engines and gas turbines. – analyzes the elements and devices that are included in the composition of transport and transshipment means and to make the correct selection and replacement of the necessary elements. – set up and define mechanical-mathematical models of power transmission from the drive to the working part of transport and transshipment systems and make a proper selection of the necessary equipment and the power of the power unit.
Sustainable Development Goal (SDG):	SDG12 – Responsible consumption and production

Teaching methods:	– Independent presentation – Discussion – Analysis of examples from practice (assignments, seminar papers)
Assessment methods with grading structure:	Assessment of creativity in classes and exercises with the creation of independent works, assessment of the partial test during the class as well as the assessment of the final exam. Criterion monitoring the work and evaluating the student during classes, according to the following method: – Homework/seminar work/practical work/ 15 points (%), passed if over 55% is won. – I Partial exam/test/knowledge check/35 points (%), passed if more than 55% is won. – Final exam (II Partial) 50 points (%), passed if over 55% is won. – Final exam (Integral) 85 points (%), passed if more than 55% is won. The total number of points (%) that a student can achieve according to the mentioned monitoring during classes is a maximum of 50 points (%), which with the Final (II partial) 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 testing, is evaluated and graded by the grading system as follows: a) 10 (A) - exceptional success without errors or with minor errors, 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. 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 pre-exam obligations and passing the

	partial and final exam, and according to the quality of acquired knowledge and skills, and contains a maximum of 100 points, and is determined according to the following scale: Student obligations _____Points (%) Attendance at lectures and exercises.....80 (%) Assignment/Seminar/Practice/.....15 points (%) I Partial exam/Test/Knowledge check/.....35 points (%) Final exam (II Partial) .....50 points (%) Final exam (Integral) .....85 points (%)
Literature:	Mandatory: – Perše, S., Višnjić, V.: Traffic Engineering, Faculty of Traffic Sciences, Zagreb, 2000. – Decker, KH: Elements of machines, Technical book, Zagreb, 1975. – Vrhovski, D., Nikšić. M.: Fundamentals of mechanical engineering - a collection of solved problems, FPZ, Zagreb, 1998. Supplementary: – Šelmić, R.: Elements of transport means and devices, Faculty of Transport, Belgrade, 2005. – Šelmić, R, Mijailović, D., Perišić, D.: Elements of transport means and devices - Praktikum Saobračajni fakultet, Belgrade, 2006. – Šelmić, R.: Technical thermodynamics, Faculty of Transportation, Belgrade, 2006.

Course code: 15-2ATCES010203	**Course title: Information and Communications**		
Level: I	**Year: II**	**Semester: III**	**Number of ECTS credits: 6**
Status: Elective Course		**Total number of contact hours: 90** Optional breakdown of hours by type: Lectures: 45 Tutorials: 30 Seminars Fieldwork:	

	Laboratory Tutorials: 15 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):	Students acquire basic theoretical knowledge necessary for studying modern digital telecommunications systems: basic theoretical and partially practical knowledge in the field of information theory and communications, in a scope corresponding to an introductory course in these areas, and the basics of information and IP networks.
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	**Information:** Random events. Definition of information, mathematical interpretation, properties of information at the syntactic, semantic, and programmatic levels. Content of information. Logic, syntax, and semantics. Formal systems, methods, and techniques. Information sources and types. **Discrete Information Sources:** Amount of information, entropy. Properties of entropy. Entropy of continuous sources. Conditional entropies, mutual information. Sources with memory - Markov sources, ergodic sources. Entropy of Markov sources, higher-order sources. **Source Coding:** Basic concepts, prefix codes, Kraft inequality. Statistical coding. Optimal statistical coding, extended source coding. The first Shannon theorem. Shannon-Fano code, Huffman code. **Statistical Channel Model:** Discrete channel, basics of error-correcting coding. Shannon's coding theorem. **Signals:** Concept, classification. Deterministic signals: signal processing in the frequency domain. Fourier series. Fourier transform. **Random Processes:** Autocorrelation function. Power spectral density. Noise signals. Gaussian noise. **Continuous Channel:** Concept, continuous channel with additive Gaussian noise, channel capacity.

	Analog-to-Digital Conversion: Discrete representation of a continuous signal. Amplitude quantization. PCM. **Specificities of Digital Signal Transmission:** Telecommunication system model, baseband transmission. **Specificities of Digital Signal Transmission in Transposed Band:** Linear digital modulation: ASK, FSK, PSK, QAM. Multiple access. **Networks:** Information network. Telecommunications network. Network characteristics. OSI and IP network models. **Internet Networks:** IP protocol. TCP/IP protocol family. IP addressing. **Internet Communications:** Principles, advanced Internet applications, and communication techniques, web organization. **Telecommunication Networks:** Division, specifics of wired and wireless networks. Quality of service in networks (QoS). **Advanced Telecommunication Techniques and Multiple Access:** Spread spectrum, multicarrier systems.
Learning outcomes:	**Knowledge**: Basic theoretical and partially practical knowledge in the field of information theory and communications in a scope corresponding to an introductory course in these areas and the basics of information and IP networks. **Skills**: Ability to apply theoretical and practical knowledge in the field of modern digital telecommunications systems. **Competencies**: Ability to independently analyze basic parameters relevant to information theory, design and analyze system characteristics of discrete and continuous channels, ability to use basic analytical methods in the analysis of information and IP networks.
Sustainable Development Goal (SDG):	• SDG4 – Quality Education • SDG5 – Gender Equality • SDG9 – Industry, Innovation, and Infrastructure • SDG17 – Partnerships for the Goals
Teaching methods:	The teaching is conducted through lectures, exercises, and laboratory exercises. The following methods are used: oral presentation method, discussion method, demonstration method, graphical works method,

	drawing method, and group work method. During lectures, theoretical concepts and principles are covered with descriptive examples and the solving of certain tasks. Additional examples are considered and solved through exercises and laboratory exercises, enabling continuous work and preparation for independent problem solving. Homework/seminar/practical work aims to develop skills for individual and team work, as well as the organization and realization of practical projects.
Assessment methods with grading structure:	The criteria for monitoring the work and evaluation of the student are carried out as follows: • Homework: 0 to 15 points (%); • First Partial Exam: 0 to 35 points (%); • Final Exam: Second Partial (0 to 50 points (%)) and/or remedial First Partial (0 to 35 points (%)); • The final exam is organized as written and/or oral. The student may take the exam material that was not covered and/or successfully completed during the semester. The required condition for successfully passing the exam is achieving at least 55% of the maximum number of points in the first partial and the final (second partial) part of the exam, and the sufficient condition is that the sum of achieved points (homework/practical work + first partial + second partial) is 55. • Homework is realized through doing homework assignments and quizzes or practical work. Points achieved on quizzes and submitted homework cannot be improved. • For students who did not successfully complete the first partial exam, the final exam consists of the entire covered material during the teaching period. The remedial exam is organized in the same way as the final exam. The final success of the student after all the provided forms of knowledge assessment is evaluated and graded using the following grading system: a) 10 (A) - outstanding performance with no or minor errors 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 minimum criteria carries 55-64 points;

	f) 5 (F FX) - does not meet minimum criteria less than 55 points.
Literature:	**Mandatory**: 1. Lecture notes and slides 2. K. Suruliz i M. Hadžialić, Statistička teorija telekomunika- cija, Elektrotehnički fakultet u Sarajevu, 2009, ISBN 978-9958-629-27-3. 3. B. P. Lathi, Modern Digital and Analog Communication Systems, Oxford University Press, New York 998. **Supplementary**: 5. V. Sinković, Informacijske mreže, Školska knjiga, Zagreb, 1994. 6. Bažant i dr, Osnovne arhitekture mreža, Element, 2004. 7. M. Schwartz, Telecommunications Network: Protocols, Modelling and Analysis, Adisson-3. Wesley PC, Reading, Massachusetts, 1987. 8. J. F. Kurose, K.W. Ross, Internet and Communication Networks, Mc Graw-Hill, 2003.

Course code: 16CITOS010204	**Course title: SOFTWARE ENGINEERING I**		
Level: I	**Year: II**	**Semester: IV**	**Number of ECTS credits:** 6
Status: Mandatory		**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 latest technologies in the field of software engineering and software development techniques.		
Topics covered (Units of study): *(if necessary, the weekly*	1. Software lifecycle 2. Basic diagrams (UML, ERD) 3. Introduction and principles of programming languages 4. Procedural and object-oriented languages		

implementation plan is established taking into account the specificities of organizational units)	5. Basic programming techniques 6. Introduction to C++ programming 7. Input/output in C++ and other specific C++ syntax features 8. Program structure in C++ 9. Loops and strings in C++ 10. Logical operators 11. Data in software engineering (connecting forms and databases) 12. Overview of the .NET platform and Visual Studio .NET development environment 13. Creating console applications in VB.NET 14. Designing graphical user interfaces and working with Windows forms in VB.NET 15. Writing and understanding software documentation 16. Application security and protection
Learning outcomes:	**Knowledge:** In the course "Software Engineering I," students will master the basic principles of programming. **Skills:** Students will acquire basic skills in C++ and VB.NET programming languages. **Competencies:** Students will gain foundational knowledge for solving practical programming problems.
Sustainable Development Goal (SDG):	SDG4 – Quality Education SDG9 – Industry, Innovation, and Infrastructure
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: • Dragan M.: Object-Oriented Programming in C++, Mikro Knjiga, 1995 • Jesse L.: Learn C++ in 21 Days, Kompjuter biblioteka, 2003 • Walter Savitch: Problem Solving in C++, Pearson Publishing, 2006 • T. Žuljević: Introduction to Programming – VB.NET, University of Split, 2005

	• H. M. Deitel, P. J. Deitel, T. R. Nieto: Visual Basic.NET How to Program, Prentice Hall, 2002 • David I. Schneider: An Introduction to Programming Using Visual Basic.NET, Prentice Hall, 2003

Course code: 17CITOS010204	**Course title: Operating Systems**		
Level: I	**Year: II**	**Semester: IV**	**Number of ECTS credits:** 6
Status: mandatory		**Total number of contact hours: 90** Optional breakdown of hours by type: Lectures 45 Exercises 30 Seminars/Fieldwork/Laboratory/Practice: 15	
Course participants:	**Academic staff and associates selected in the field to which the course belongs/course**		
Prerequisite for enrollment:	No		
Course goal (goals):	Upon successful completion of this course, students will be able to: • Identify the main components of the operating system and describe their functions. • Discuss operating system properties required for specific applications. • Understand the different levels of system and application software. • Become familiar with key operating system services such as file systems, memory management, process management, device management, and user interface. • Use and adapt operating systems.		
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	1. Introduction: The role, functionality, and structure of operating systems, historical development: batch, multiprogramming, time-sharing. 2. Structure of a computer system: Interrupts and interrupt management, input/output operations, dual processor operation modes, system calls, services. 3. Structure of an operating system: Layered structure, monolithic and microkernel, functional organization in Unix, Linux, Windows.		

	4. Resource management: I/O manager, methods for handling deadlocks, Banker's algorithm. 5. Process management: Concept and process states, process swapping, process operations, threads and thread management, process management in Unix, inter-process communication using pipes and signals, message passing (direct, indirect, buffered). 6. Shared memory, synchronization problems, critical sections, mutual exclusion, semaphores, and hardware techniques: test_and_set. 7. CPU Scheduling: General concepts and scheduling criteria, dispatcher, scheduling algorithms (FCFS, SJF, Priority, Round Robin, MFQ), UNIX and Windows examples. 8. Memory management: Loaders, address translation from logical to physical addresses, memory allocation (continuous: single/multiple partitions, static and dynamic), non-contiguous memory (paging, segmentation), virtual memory, memory management in Unix. 9. File system management: File system structure, free space management, file and directory implementation, file systems in Unix and Windows, logical file organization, access control, file protection. 10. User interface: Text-based, graphical, and network interfaces. 11. Architecture of DOS, Windows, and Linux systems.
Learning outcomes:	**Knowledge**: Identify the main components of an operating system and describe their functions. Discuss the characteristics of the operating system needed for a particular application. Understand different levels of system and application software. Be familiar with the main services of operating systems, such as file systems, memory management, process management, device management and user interface. **Skills**: Use operating systems from the command line. **Competencies**: Aligned with the competencies for the profession being studied.
Sustainable Development Goal (SDG):	SDG 9: Industry, Innovation, and Infrastructure
Teaching methods:	Lectures cover fundamental concepts of operating systems. Students are introduced to various subsystems of the operating system kernel and their interrelationships. Theoretical exercises include quantitative examples that illustrate the introduced concepts and algorithms.

	Homework may include additional examples and problems closely related to lectures.
Assessment methods with grading structure:	Final grade: 5 points for attendance and work in lectures and labs. 10 points for programming tasks or group projects. 5 points for additional activity if the total does not exceed 100. 35 points partial written exam, problem tasks and questions, where 18 points are considered a passed exam Final exam for students who passed the partial exam: 30 points written part of the exam, 20 points oral part. Final exam for students who did not pass the partial exam: 45 points for the written part of the exam, 40 points for the oral part. **Final Grade Distribution:** 21-54 points: grade 5 , 55-64 points: grade 6, 65-74 points: grade 7, 75-84 points: grade 8, 85-94 points: grade 9, 95-100 points: grade 10
Literature:	Mandatory: Samir Ribić "Operativni sistemi", 2019 Univerzitet u Sarajevu Supplementary: Tanenbaum A., "Modern Operating Systems", 3rd Edition, Prentice Hall, 2008.

Course code: 18CITOS010204	**Course title: COMPUTER NETWORKS AND PROTOCOLS**		
Level: I	**Year: II**	**Semester: IV**	**Number of ECTS credits:** 6
Status: Mandatory		**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	None		

enrollment:	
Course goal (goals):	To provide knowledge about different types of computer networks and their functioning. Students will learn about the basic components of computer networks and gain knowledge on how to implement them, which will further develop the skills required for designing and developing computer networks.
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	1. Introduction – concept of networks and types of communication networks 2. Computer network architectures 3. Processes in computer networks 4. OSI and TCP/IP models 5. TCP/IP protocol stack – application and transport layers 6. TCP/IP protocol stack – network and physical layers 7. LAN networks and their protocol architecture 8. Ethernet and Token Ring network architecture 9. Active components of LAN networks 10. Passive components of LAN networks 11. LAN network design and structured cabling 12. WLAN network standards 13. WLAN network infrastructure 14. Processes in WLAN networks 15. Security and protection of computer networks
Learning outcomes:	**Knowledge:** Students will acquire theoretical and practical knowledge of different types of computer networks and the equipment used in network development. They will also learn about the basic protocols used and how computer networks function. **Skills:** Based on the acquired knowledge, students will be capable of using equipment for developing and designing computer networks. **Competencies:** Students will learn how to use specific tools for simulating network operations and analyzing network traffic and protocols.
Sustainable Development Goal (SDG):	SDG4 – Quality Education SDG9 – Industry, Innovation, and Infrastructure
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: g) 10 (A) - exceptional success without mistakes or with minor mistakes, 95-100 points h) 9 (B) - above average, with some mistakes, 85-94 points i) 8 (C) - average, with noticeable mistakes, 75-84 points j) 7 (D) - generally good, but with significant shortcomings, 65-74 points k) 6 (E) - meets the minimum requirements, 55-64 points l) 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. Tanenbaum, D. Wetherall, Computer Networks (5th edition), Mikro knjiga, 2012 • J.F. Kurose, K.W. Ross, Computer Networking: A Top-Down Approach (6th edition), Addison-Wesley, 2012 • W. Stallings, Data and Computer Communications (8th edition), Prentice Hall, 2007 • E. Engst, G. Fleishman, Wireless Networking, Kompjuterska biblioteka, 2004 • William C. Hardy, "An Architectural Framework for Support of Quality of Service in Packet Networks," IEEE Communications Magazine, June 2003 • Faruk Turčinhodžić, Local Area Networks, University Edition, Sarajevo, 2004

Course code: 19-20-1CITES010204	**Course title: COMPUTER ARCHITECTURE**		
Level: I	**Year: II**	**Semester: IV**	**Number of ECTS credits:** 6
Status: elective		**Total number of hours: 90** Lectures: 45 hours Exercises: 45 hours	
Course participants:	**Academic staff and associates selected in the field to which the course belongs/course**		
Prerequisite for enrollment:	No		
Course goal (goals):	- Develop a fundamental understanding of computer architecture and its basic components. - Ensure a deep understanding of the functions and roles of key components of computer architecture, such as the processor, memory, and motherboard. - Develop the ability for independent research and learning about advanced concepts in the field of computer architecture.		

	- Encourage the development of communication skills through the presentation of complex technical information.
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	1. The concept of computer architecture. 2. Computer models (personal, server, supercomputers). 3. Basic components of computer architecture. 4. Motherboard (function, structure, PCI ports, PCI Express, AGP). 5. Processor (arithmetic logic unit, control unit, working registers, cache memory, bus within the processor). 6. Multi-core processors. 7. System bus (data bus, instruction bus, control bus, 32-bit, 64-bit). 8. RAM memory (types of memory depending on computer architecture, dynamic and static RAM, speeds, capacities). 9. ROM memory (types, function). 10. Clock. 11. Graphics card (function, speeds, ports). 12. Hard Disk (HDD - components, function, operation, capacity, speed). 13. Input and output devices. 14. Assembly languages and assembly programming (subroutines, macros, stack). 15. Compiler.
Learning outcomes:	Knowledge: - Recognizing and describing different computer models. - Identifying and explaining the basic components of computer architecture. - Understanding the functions of the processor, arithmetic logic unit, control unit, working registers, cache memory, and the bus within the processor. - Describing the system bus and its role, including various types of buses. - Understanding the individual components of computer architecture.

	- Understanding the differences between different disk structures. Skills: - Identifying the components of computer architecture. - Relating the components of computer architecture to their functions and roles. - Interpreting different types of memory and their characteristics. - Analyzing computer architecture components in the context of their applications and performance. Competencies: - Applying acquired knowledge of computer architecture in practice, such as identifying and solving problems in hardware configurations. - Developing the ability to analyze and assess the performance of computer components. - Communicating and presenting complex technical information about computer architecture. - Integrating knowledge of computer architecture into the broader context of information technology and computer science.
Sustainable Development Goal (SDG):	SDG4 – "Ensure inclusive and quality education and promote lifelong learning opportunities for all"; SDG9 – "Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation"; SDG12 – "Ensure sustainable consumption and production patterns".
Teaching methods:	Classes are conducted through lectures, exercises, laboratory work/fieldwork/practical work. The following methods are employed: oral presentation method, discussion method, demonstration method, graphic work method, drawing method, and group work method. During lectures, theoretical concepts and principles are covered, accompanied by descriptive examples and the solving of specific problems. Additional examples are discussed and solved through exercises, laboratory work/fieldwork/practical work, which facilitates

	continuous work and preparation for independent problem-solving. In laboratory work/fieldwork/practical work, skills required for both individual and teamwork will be developed, aiming to complete tasks within the given area of study.
Assessment methods with grading structure:	Creativity in class and exercises is evaluated through the creation of independent work, partial test assessments during the course, and the final exam evaluation. The criteria for monitoring student work and grading throughout the course are as follows: - Homework/Seminar Paper/Practical Work – 15 points (%). Points are considered if more than 50% is achieved (submission 7 points, defense 8 points). - First Partial Exam/Test/Knowledge Check – 35 points (%). It is passed if more than 50% is achieved. - Final Exam - Written – 20 points (to take the oral exam, a minimum of 50% must be achieved in the written part). - Final Exam - Oral – 30 points. - Final Exam (Integral) – Written - 40 points (to take the oral exam, a minimum of 50% must be achieved in the written part). - Final Exam (Integral) – Oral - 45 points. **The student must pass the oral part of the exam to pass the course.** The total number of points (%) that a student can achieve during the course monitoring amounts to a maximum of 50 points (%), which, along with the Final Exam, totals 100 points (%). For students who did not pass the first partial exam, the Final Exam (Integral) is organized from the entire curriculum covered in lectures and exercises and is evaluated with 40+45 points, which, along with the seminar paper/practical work, totals 100 points. The student's final grade after all forms of knowledge assessment is evaluated using the following grading system: - a) 10 (A) – Exceptional success without errors or with negligible 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 total evaluation of all student obligations throughout the semester, i.e., the exam grade, is based on the total number of points (%) achieved by fulfilling pre-exam obligations, passing the partial and final exams, and according to the quality of acquired knowledge and skills. The maximum is 100 points and is determined according to the following scale: **Student Obligations** — **Points** Attendance at lectures and exercises – Homework/Seminar/Practice 15 points First Partial Exam/Test/Knowledge Check 35 points Final Exam - Written 20 points Final Exam - Oral 30 points Final Exam (Integral) - Written 40 points Final Exam (Integral) - Oral 45 points
Literature:	Mandatory: 1. Nastavni materijal dostupan na web stranici Fakulteta za saobraćaj i komunikacije u okviru moodle platforme - i na MS TEAMS u okviru predmeta) 2. Tanenbaum, A.S.: Arhitektura i organizacija računara, Prevod petog izdanja, Mikro knjiga, 2007 Organizacija i arhitektura računara: projekat u funkciji performansi, Prevod devetog izdanja. 3. William Stallings: CET, 2012.

Course code: 19-20-2CITES010204	**Course title: Digital Signal Processing**		
Level: I	**Year: II**	**Semester: III**	**Number of ECTS credits: 6**
Status: Elective Course		**Total number of contact hours: 90** Optional breakdown of hours by type: Lectures: 30	

	Tutorials: 30 Seminars Fieldwork: Laboratory Tutorials: 30 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):	Students acquire basic theoretical knowledge necessary for studying modern digital telecommunications systems, understanding the fundamentals of digital signal processing to the level that enables reading specialized literature for which this is the foundation. The course also aims to enable the application of digital signal processing concepts in advanced fields and applications of interest.
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	1. Representation of signals and systems. 2. Basic classifications and fundamental signals. 3. A/D and D/A conversion 4. Analysis and processing of discrete signals in the time domain: LTI systems 5. Impulse response. Convolution. Deconvolution. 6. Z-transform: direct and inverse 7. Application of Z-transforms to LTI systems 8. Frequency analysis of continuous-time signals. 9. Frequency analysis of discrete-time signals 10. Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT). 11. Properties and applications of DFT 12. Digital filtering: Infinite Impulse Response (IIR) systems 13. Digital filtering: Finite Impulse Response (FIR) systems.

	14. Sampling of bandpass signals. 15. Signal reconstruction
Learning outcomes:	**Knowledge**: Basic theoretical and partially practical knowledge in the field of digital signal analysis and processing. **Skills**: Ability to apply theoretical and practical knowledge in the field of signal analysis and digital signal processing. **Competencies**: Students should be able to: • Use basic tools and techniques for signal analysis and digital signal processing; • Understand the processes of converting an analog signal to a digital form, including aspects of signal sampling and sample quantization; • Analyze and assess the value of sampling rate and precision in the quantization process.
Sustainable Development Goal (SDG):	• SDG4 – Quality Education • SDG 8 - Decent Work and Economic Growth • SDG9 – Industry, Innovation, and Infrastructure • SDG 11- Sustainable Cities and Communities • SDG 16: Peace, Justice, and Strong Institutions • SDG17 – Partnerships for the Goals
Teaching methods:	Teaching is conducted through lectures, exercises, laboratory exercises/field work/practice. The following methods are used: oral presentation, discussion method, demonstration method, graphical work method, drawing method, and group work method. During lectures, theoretical concepts and principles are covered with descriptive examples and solving specific tasks. Additional examples are considered and solved through exercises, laboratory exercises/field work/practice, enabling continuous work and preparation for independent problem-solving. In laboratory exercises/field work/practice, skills necessary for individual and team work will be developed to accomplish tasks in the given field.
Assessment methods with grading structure:	Assessment of creativity in teaching and exercises through homework/independent work/practical work, assessment of partial exams during teaching, as well as assessment of the final/remedial exam.

	The criteria for monitoring the work and evaluation of the student are carried out as follows: • Homework: 0 to 15 points (%); • First Partial Exam: 0 to 35 points (%); • Final Exam: Second Partial (0 to 50 points (%)) and/or remedial First Partial (0 to 35 points (%)); The final exam is organized as written and/or oral. The student may take the exam material that was not covered and/or successfully completed during the semester. The required condition for successfully passing the exam is achieving at least 55% of the maximum number of points in the first partial and the final (second partial) part of the exam, and the sufficient condition is that the sum of achieved points (homework/practical work + first partial + second partial) is 55. Homework is realized through homework assignments and quizzes or practical work. Points achieved on quizzes and submitted homework cannot be improved. For students who did not successfully complete the first partial exam, the final exam consists of the entire covered material during the teaching period. The remedial exam is organized in the same way as the final exam. The final success of the student after all the provided forms of knowledge assessment is evaluated and graded using the following grading system: g) 10 (A) - outstanding performance with no or minor errors carries 95-100 points; h) 9 (B) - above average with some errors carries 85-94 points; i) 8 (C) - average with noticeable errors carries 75-84 points; j) 7 (D) - generally good but with significant shortcomings carries 65-74 points; k) 6 (E) - meets minimum criteria carries 55-64 points; l) 5 (F FX) - does not meet minimum criteria less than 55 points.
Literature:	**Mandatory**: 4. Lecture notes and slides 5. Oppenheim, Alan V., and Ronald W. Schafer: “Digital Signal Processing,” Prentice Hall, 1999.

	6. J. G. Proakis, D. K. Manolakis: "Digital Signal Processing," Prentice Hall, 2007. 7. S. K. Mitra: "Digital Signal Processing," McGraw-Hill, 2005. **Supplementary**: 8. M. Ahić – Đokić, B. Berunčić, Signal and Systems Analysis, Sarajevo, 1999. 9. B. P. Lathi, Modern Digital and Analog Communication Systems, Oxford University Press, New York, 1998. J. F. Kurose, K.W. Ross, Internet and Communication Networks, McGraw-Hill, 2003.

Course code: 19-20-3CITES010204	**Course title:** Linear Programming		
Level: II	**Year: II**	**Semester: III**	**Number of ECTS credits:** 6
Status: Elective		Total Hours: 90 Lectures: 45 Exercises: 20 Laboratory Exercises: 15	
Course participants:	**Academic staff and associates selected in the field to which the course belongs/course**		
Prerequisite for enrollment:	None		
Course goal (goals):	Developing basic theoretical knowledge relevant to the concepts and methods for solving linear programming problems, with an emphasis on solving optimization problems in transport and communication technologies. Developing basic skills in using simulation environments to select the optimal solution for linear programming.		
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	Lectures: • Introduction to Linear Programming • Mathematical Modeling, Introduction to Optimization • Classical Optimization without Constraints • Lagrange Methods and the Karush-Kuhn-Tucker Method • Nonlinear Programming Part I • Nonlinear Programming Part II • Linear Programming Part I (Graphical Solution) • Linear Programming Part II (Simplex Method) • Linear Programming Part III (Duality)		

	• Integer Linear Programming Part I • Integer Linear Programming Part II • Application of Linear Programming in Solving the Transportation Problem Exercises: • Application of Unconstrained Optimization Problem Solving • Constrained Optimization, Lagrange Multipliers, and Karush-Kuhn-Tucker Method • Gradient Search Methods • Application of One-Dimensional Search Methods (Newton-Raphson and Secant Method) • Application of Fibonacci Search and Golden Section Methods for One-Dimensional Search • Linear Programming • Application of the Graphical Method for Solving Linear Programming Problems • Tabular Simplex Method • Application of Linear Programming for Solving the Dual Problem
Learning outcomes:	**Knowledge:** Students will acquire a fundamental understanding of basic approaches and optimization methods, with a particular focus on linear programming. They will learn to identify and describe linear programming problems in real-world scenarios, especially in the fields of transportation and communications. Understanding the application of various optimization methods using computer tools and simulation models is also a key component. **Skills:** Students will develop the ability to apply different optimization methods to solve complex problems using computers and appropriate software tools. They will gain skills in analyzing and solving linear programming problems using simulation tools and in making decisions about suitable methodologies for various real-life situations. The ability to think critically and assess the appropriateness of different optimization methods, while considering ethical norms in application, will also be cultivated. **Competencies:** Students will be competent in identifying and solving linear programming problems in various practical situations. They will

	be able to independently use computers and simulation tools to find optimal solutions and evaluate results in the context of real-world problems in transportation and communications. They will develop the ability to make decisions about the appropriate optimization methodology, with an emphasis on responsible and ethically aware resource management.
Sustainable Development Goal (SDG):	"SDG4 – Quality Education," "SDG9 – Industry, Innovation, and Infrastructure"
Teaching methods:	During lectures, theoretical concepts and principles are covered with descriptive examples and the solving of specific tasks. Additional examples are discussed and solved through exercises, which allow for continuous work and preparation for independent problem-solving. Materials for exercises—tutorials—are provided before each thematic unit, enabling students to prepare in advance. In the exercises, skills necessary for both individual and team work are developed to complete tasks in the given area. Independent work tasks include assignments throughout the semester, similar to those in the classroom exercises. Practical work involves laboratory exercises, which are conducted using software simulation solutions (work in MATLAB).
Assessment methods with grading structure:	**Student Obligations Points (%)** • Attendance at lectures and exercises: Recorded without points • Assignments during the course: 15 points (%) • First Partial Exam/Test/Knowledge Assessment: 20 points + 15 points for theory (%) • Second Partial Exam/Test/Knowledge Assessment: 20 points + 15 points for theory (%) • Oral Exam: 20 points (%) **The final success of the student after all forms of knowledge assessment is evaluated and graded according to the following grading system:** a) 10 (A) - exceptional 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, 0-55 points
Literature:	Mandatory: 1. Teaching materials available on the website of the Faculty of Traffic and Communications. 2. Hillier, S.F., Lieberman, G.J.: "Introduction to Operations Research," 7th Edition, McGraw Hill Book Co., 2001. 3. S. Vukadinović: "Transport Problem of Linear Programming," Naučna knjiga, Belgrade, 1979. Supplementary: 1. Husein Pašagić, "Mathematical Modeling and Graph Theory," FPZ, Zagreb, 1998. 2. D. Lipovac, D. Letić, "Methods of Operations Research," University of Novi Sad, Zrenjanin, 1999.

Course code: 21CITOS010305	**Course title: Software Engineering II**		
Level: I	**Year: III**	**Semester: V**	**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 the basic and advanced concepts of the Java programming language with a focus on the principles of object-oriented programming		
Topics covered (Units of	1. How to start programming, input/output, variables, and commands		

study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	2. Repetition of functionality, loops, and functions 3. Debugging, lists, arrays, and strings 4. Introduction to object-oriented programming 5. More advanced OOP, function overloading 6. Objects and lists, creating a user interface 7. Programming paradigms and algorithms 8. Hash maps, object similarity, and data grouping 9. Class inheritance, interfaces, and polymorphism 10. Handling collections as streams, the "Comparable" interface, and other useful techniques 11. Class diagrams, packages, exceptions, and file handling 12. Type parameters, ArrayList and hash table, randomness, and multidimensional data 13. Graphical user interfaces 14. Data visualization, multimedia, and Maven
Learning outcomes:	**Knowledge:** Understanding of basic and more advanced concepts of the Java programming language, as well as the principles and concepts of object-oriented programming. **Skills:** Application development adhering to object-oriented programming principles using the Java programming language. **Competencies:** Programming at a basic and intermediate level with several advanced concepts in the Java programming language.
Sustainable Development Goal (SDG):	"SDG4 – Quality Education," "SDG9 – Industry, Innovation, and Infrastructure"
Teaching methods:	Theoretical lectures presenting the concepts of the Java programming language and object-oriented programming, including practical examples. 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:	4. Java: A Beginner's Guide, Eighth Edition 8th Edition,Herbert Schildt 5. Head First Java: Your Brain on Java - A Learner's Guide 1st Edition Bert Bates 6. Java Coding Problems: Improve your Java Programming skills by solving real-world coding challenges Anghel Leonard

Course code: 22CITOS010305	**Course title: Databases**		
Level: I	**Year: III**	**Semester: V**	**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):	Acquisition of theoretical and practical knowledge and skills in the field of relational databases.		
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	**1. Databases and Data Models** a. **Basic Concepts** i. Database ii. Database Management System b. **Data Models** i. Hierarchical Data Model ii. Network Data Model iii. Object-Oriented Data Model iv. Relational Data Model c. **Database Life Cycle** **2. Data Modeling** a. Data Modeling b. Entity-Relationship (ER) Diagram **3. Relational Model** a. Basics of Relational Algebra b. Data Integrity Preservation c. Normalization (1NF, 2NF, 3NF) **4. SQL** a. Introduction to SQL i. SQL Standard ii. Data Types b. Data Definition Language (DDL) iii. Creating Database Structures c. Queries - Data Retrieval		

	i. SELECT Statement, SELECT DISTINCT, SELECT TOP ii. Sorting, Filtering iii. Aggregate Functions and Data Grouping iv. Subqueries d. Table Joins and Set Operations e. Data Manipulation Language (DML) - Data Modification i. Insertion ii. Deletion iii. Data Update f. System Functions i. Date Functions ii. Mathematical Functions iii. String Functions **5. Advanced SQL Features** a. Views b. Basics of Functions and Procedures c. Basics of Transactions
Learning outcomes:	Knowledge: Understanding of the relational data model and the principles of functioning of relational database management systems. Skills: Creating database models, modifying models, data manipulation, knowledge of SQL language. Competencies: Creating a relational database model with the application of normalization standards, creating models in a database management system.
Sustainable Development Goal (SDG):	"SDG4 – Quality Education," "SDG9 – Industry, Innovation, and Infrastructure"
Teaching methods:	Theoretical lectures presenting the concepts of databases. In addition to theoretical concepts, the lectures are supported by examples that are demonstrated and explained. 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:	1. Ramey Elmasri and Shamkant B. Navathe: Fundaments of Database Systems, 7th Edition, Pearson, 2015, ISBN-13: 978-0133970777 2. C.J. Date, Database in Depth: The Relational Model for Practitioners, O'Reilly, 2005 3. Database System Concepts, A. Silberschatz, H. Korth, S Sudarshan, McGraw Hill International Edition, 2005.

Course code: 23CITOS010305	**Course title: COMPUTER SYSTEMS AND NETWORKS ADMINISTRATION**		
Level: I	**Year: III**	**Semester: V**	**Number of ECTS credits:** 6
Status: Mandatory course		**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 basic concepts and the importance of system and network administration, providing them with practical skills for managing computer networks. The course includes real-world examples of network configuration and device management, as well as models for system and network administration. Students will become familiar with tools and techniques for monitoring network performance and managing network operations.		
Topics covered (Units of study): *(if necessary, the weekly implementation plan is*	1. Concepts of computer systems, computer networks, and administration 2. Operating systems (kernel, processes) 3. Basics of Unix OS 4. Workload, memory management, resources 5. Disk management and RAID arrays		

established taking into account the specificities of organizational units)	6. Clusters and failover principles and applications 7. TCP and UDP protocols 8. Implementation of IPv4 and IPv6 network infrastructure 9. VLANs and dynamic routing 10. Installing and configuring servers (Windows servers, web servers, HTTP servers) 11. DHCP and DNS 12. Active Directory (domains, forests, AD schema, and Global Catalog) 13. Active Directory object management 14. Local and Global groups, Group Policy 15. Administration and automation of processes in Active Directory
Learning outcomes:	**Knowledge:** Students will understand the role of system administrators and the need for network management. They will be able to define appropriate network architectures and systems to meet specific requirements. **Skills:** Students will gain experience in configuring switches and routers, designing VLANs, and network segmentation. **Competencies:** After completing the course, students will be able to implement routing protocols, monitor network performance, analyze network traffic, and troubleshoot issues.
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: • Mark Burges, Principles of Network and System Administration, John Wiley & Sons, 2004. • V. Vasiljević, P. Gavrilović, Handbook for Computer Network Administration, 2006.

	• Craig Hunt, TCP/IP Network Administration (3rd Edition), O'Reilly, 2008.

Course code: 24-25-1CITES010305	**Course title: Wireless Communication System**		
Level: I	**Year: III**	**Semester: VI**	**Number of ECTS credits: 6**
Status: Elective course		**Total number of contact hours: 3 + 2 + 1** Lectures: 3 Tutorials: 2 Laboratory Tutorials: 1	
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 through the implementation of the program in wireless communication systems and practical simulations of information transmission in mobile wireless networks, as well as the analysis of specific standards applied to wireless communication systems and networks. The focus is on modern technologies such as 4G, 5G, Wi-Fi 6, IoT, and future technologies		
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	Week 1: Introduction to Wireless Communication Systems Introduction to the history and evolution of wireless communication systems. Basic concepts and principles of wireless networks operation. Overview of current technologies and standards in wireless communications. Discussion on trends and future development of wireless communications. Week 2: Radio Propagation and Channel Characteristics Basics of radio propagation: signal propagation models in wireless systems.		

	Environmental impact on signal propagation: reflection, refraction, diffraction. Interference and fading: signal transmission issues and noise avoidance methods. Practical exercises with the analysis of real radiofrequency environments. Week 3: Modulation and Coding Techniques in Wireless Communications Digital modulation techniques (QPSK, QAM, OFDM) and their applications. Channel coding: basic error correction techniques. Application of advanced modulation and coding techniques in modern wireless networks. Case study: Spectral efficiency analysis in wireless systems. Week 4: Wireless Channel Capacity and Fresnel Zone Attenuation for Radio Communications Basic concepts of wireless channel capacity: Shannon's channel capacity theory. Fresnel zones and their impact on signal quality in wireless communications. Specificities of DMR (Digital Mobile Radio) systems: channel structure, frequency spectrum optimization. Practical exercises: Fresnel zone analysis and capacity simulation in DMR systems. Week 5: 4G LTE Networks LTE network architecture: basic blocks and their functions. Overview of basic protocols and procedures in LTE networks. LTE network performance: capacity, transmission speed, latency. Practical implementation and optimization of LTE networks in real conditions.

	Week 6: 5G Networks: Architecture and Key Technologies Overview of 5G network architecture: Radio Access Network (RAN), Core network. Key technologies in 5G: mMIMO, beamforming, millimeter waves (mmWave). Analysis of new services in 5G: eMBB, URLLC, mMTC. Discussion on implementation challenges and potential solutions. Week 7: 5G Services and Applications Detailed analysis of 5G services and their applications: Industry 4.0, autonomous vehicles, smart cities. The role of 5G in the development of the IoT ecosystem. Challenges in providing 5G services: security, latency, capacity. Case study: Implementation of 5G services in various industries. Week 8: Wi-Fi 6 (802.11ax) and Future Wi-Fi Standards Overview of Wi-Fi standard evolution up to Wi-Fi 6. Technical characteristics of Wi-Fi 6: OFDMA, MU-MIMO, Target Wake Time (TWT). Comparative analysis with previous generations of Wi-Fi standards. Discussion on future Wi-Fi standards and their impact on the wireless industry. Week 9: Internet of Things (IoT) and LPWAN Technologies Introduction to the Internet of Things (IoT): basic concepts and architecture. Overview of LPWAN technologies: NB-IoT, LoRaWAN, Sigfox. Implementation of IoT solutions: network design, security challenges, energy efficiency. Practical exercise: Designing an IoT network using LPWAN technologies.

	Week 10: MIMO and Advanced Antenna Technologies Basics of MIMO (Multiple-Input Multiple-Output) technology: concept and applications. Spatial multiplexing, diversity, and beamforming. Analysis of advanced antenna systems and their applications in 5G and Wi-Fi 6 networks. Practical implementation of MIMO technology in a simulation environment. Week 11: Millimeter Waves and High-Frequency Communications Overview of millimeter waves (mmWave): characteristics and applications. Advantages and challenges in implementing high-frequency communications. The role of mmWave technology in 5G networks and future communication systems. Discussion on the possibilities of developing and expanding high-frequency communications. Week 12: Security in Wireless Communication Systems Potential threats and vulnerabilities in wireless communications. Overview of security protocols and protection mechanisms in wireless networks (WPA3, EAP). Security challenges in 5G and IoT networks. Case study: Security incidents in wireless networks and lessons learned. Week 13: Planning and Optimization of Wireless Networks The process of planning and designing wireless networks: basic steps. Tools and methodologies for optimizing wireless network performance. Resource management in wireless networks: frequency spectrum, QoS. Practical exercise: Planning and optimizing a wireless network in a simulation environment.

	Week 14: Future Technologies: 6G and Beyond Predictions and research for 6G networks: concepts and technologies. Potential applications and services in 6G networks. Challenges and opportunities in the development of future communication technologies. Discussion on research perspectives and the impact of 6G networks on society. Week 15: Practical Projects and Case Studies Analysis of real-world scenarios of wireless communication network implementation. Case studies of successful implementations of 5G, IoT, and Wi-Fi networks. Student project presentations and group discussions. Conclusions and guidelines for future career development in wireless communications.
Learning outcomes:	Knowledge: Students acquire theoretical and practical knowledge of modern wireless communication systems, including 4G, 5G, Wi-Fi 6, IoT, and future technologies such as 6G. Additionally, students are introduced to the challenges of wireless network security and planning. Skills: Students develop the skills necessary for the design, implementation, and optimization of modern wireless networks, including the use of advanced antennas, frequency spectrum planning, and the application of security protocols in wireless communication systems. Competencies: Students gain the competencies to analyze and practically apply the acquired knowledge in industrial and commercial environments, preparing for work on advanced wireless networks such as 5G, IoT, and future 6G networks
Sustainable Development Goal (SDG):	SDG4 – Quality Education: Through this course, students acquire the necessary knowledge and skills to work with modern technologies in wireless communications, ensuring inclusive and quality education in the field of information and communication technologies.

	SDG9 – Industry, Innovation, and Infrastructure: The course covers key aspects of modern infrastructure in wireless communications, supporting innovation and sustainable industrial development. SDG11 – Sustainable Cities and Communities: The application of wireless technologies such as IoT and 5G enables the development of smart cities and sustainable communities through efficient resource management and improved quality of life
Teaching methods:	Lectures: Classical lectures focused on the theoretical aspects of wireless communication systems, including practical examples and analysis of the latest research and technologies. Lectures include presentations, interactive discussions, and industry examples. Exercises: Calculations and simulations of practical cases. Seminars: Students research specific topics in the field of wireless communications and prepare seminar papers presented to the group. The focus is on independent research, analysis of scientific papers, and presentation of findings. Practical Projects: Teams of students work on practical projects related to the design, implementation, and optimization of wireless communication systems. Projects may include real-world scenarios, simulations, or case studies, and the results are presented at the end of the semester.
Assessment methods with grading structure:	Attendance: 0-5% Tests: 0-10% Projects: 0-35% Final Exam: 0-50% Final Grade (Total): 100%
Literature:	Mandatory: Andreas F. Molisch - Wireless Communications, 3rd Edition, Wiley-IEEE Press, 2022. Harri Holma, Antti Toskala, Takehiro Nakamura - 5G Technology: 3GPP New Radio, John Wiley & Sons, 2020. David Tse, Pramod Viswanath - Fundamentals of Wireless Communication, Cambridge University Press, 2005.

	Jonathan Rodriguez - Fundamentals of 5G Mobile Networks, John Wiley & Sons, 2015. Martin Sauter - From GSM to LTE-Advanced Pro and 5G: An Introduction to Mobile Networks and Mobile Broadband, 3rd Edition, John Wiley & Sons, 2021. Supplementary: Stefano Buzzi, Osvaldo Simeone, Chong Han - Foundations of MIMO Communications, Cambridge University Press, 2023. Ian Poole - A Guide to the Wireless Engineering Body of Knowledge (WEBOK), 3rd Edition, Wiley-IEEE Press, 2021. Afif Osseiran, Jose F. Monserrat, Patrick Marsch - 5G Mobile and Wireless Communications Technology, Cambridge University Press, 2016. Erik Dahlman, Stefan Parkvall, Johan Skold - 5G NR: The Next Generation Wireless Access Technology, Academic Press, 2020. Klaus David, Nico Kourtis - 6G: The Road to the Future Wireless Technologies 2030, Wiley-IEEE Press, 2022.

Course code: 24-25-2CITES010305	**Course title:** **INTELLIGENT TRANSPORT SYSTEMS**		
Level: I	**Year: III**	**Semester: V**	**Number of ECTS credits:** 6
Status: elective		**Total number of contact hours: 90** Optional breakdown of hours by type: 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 the knowledge and skills necessary in the realization of programs in the field of intelligent transport systems, analysis of the effect of ITS functionality on changes in the state parameters of the		

	classical transport system. Use of ITS functionality in the management of traffic processes.
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	1. Defining basic concepts and the role of ITS 2. Scientific and technological framework of ITS development 3. Artificial intelligence in the ITS system 4. Measuring the performance and benefits of ITS 5. Architecture of ITS 6. European ITS architecture 7. Intelligent vehicles 8. Intelligent transport infrastructure 9. Intelligent terminals 10. Intelligent cargo and transport equipment 11. Standardization of Functional Areas of ITS 12. Communication technologies in the ITS system 13. Digitization of transport 14. Planning and managing the development of the ITS system 15. Security and protection of the ITS system
Learning outcomes:	Knowledge: The Intelligent Transport Systems subject should provide the necessary level of knowledge about technologies, functions and students of ITS, methods of their planning, development and implementation. Skills: The ITS subject enables the acquisition of skills necessary for measuring, analyzing and evaluating the efficiency, safety, environmental impact and economic benefits of the implementation of ITS services. Competences: Through the teaching process of lectures, exercises, and seminar work, students should acquire appropriate competencies for designing, developing and managing intelligent transport systems.
Sustainable Development Goal (SDG):	"SDG3 - Health and well-being"; "SDG 9 Industry, innovation and infrastructure", "SDG11- Sustainable cities and communities", SDG 13- Climate protection"
Teaching methods:	Lectures, exercises and seminar work.

Assessment methods with grading structure:	1. Attendance at classes and semester work 15 points 2. First knowledge test 35 points 3. Final knowledge test 50 points
Literature:	Mandatory: 1. Ezgeta, D.: Intelligent transport systems, Faculty of traffic and communications of the university in Sarajevo, Sarajevo, 2018. 2. Bošnjak, I. : Intelligent transport systems, University of Zagreb, Faculty of Transport Sciences, Zagreb, 2006. Supplementary: 1. Ghosh, S., Lee, T.: Intelligent Transportation Systems - New Principles and Architectures, CRC Press, London, 2000. 2. Miles, J. Chen, K.: ITS Handbook, 2nd edition, PIRAC, 2004. 3. Meng Lu: Evaluation of Intelligent Road Transport Systems – Methods and Results. Institution of Engineering and Technology, London. 2016. 4. Meneguette, R.I., De Grande, R., Loureiro, A. F.: Intelligent Transport System in Smart Cities, Springer, Ontario, 2018. 5. Sładkowski, A.: Wiesław Pamuła: Intelligent Transportation Systems – Problems and Perspectives, Springer, Katowice, 2016. 6. Perallos, A.: Intelligent transport systems – technologies and applications. Wiley & Sons, Bilbao, 2016. 7. Chow, Y.J.: Informed urban transport systems, Elsever, Amaterdam, 2018. 8. Dimitrakopoulos, G., Uden, L.: The Future of Intelligent Transport Systems, Elsever, Amaterdam, 2020.

Course code: 24-25-3CITES010305	**Course title: WEB ARCHITECTURES**		
Level: I	**Year: III**	**Semester: V**	**Number of ECTS credits:** 6
Status: 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):	To connect knowledge of programming, databases, and computer networks. The course aims to provide students with a thorough understanding of web architectures, current technologies used in web development, and criteria for assessing the usability of websites.
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	1. Concepts of web architecture 2. Web standards and services 3. Web protocols (Core Internet Protocols) 4. Web servers and domains 5. Web technologies and development environments 6. Basics of web design 7. Structure and syntax of HTML 8. Application of HTML syntax 9. Application of CSS and integration with HTML 10. Structure and application of XML 11. Application of JavaScript technology 12. Application of AJAX technology 13. SEO optimization 14. Internet marketing
Learning outcomes:	**Knowledge:** Students will acquire theoretical and practical knowledge in the field of web architectures, including the principles, rules, methods, and processes related to web architecture and web systems analysis. **Skills:** Students will develop the ability to apply theoretical and practical knowledge to the analysis and synthesis of web architecture systems. **Competencies:** Students will gain the ability to independently understand and apply the principles and RFC standards, use professional literature, apply measurement and research methods, conduct analysis, and develop practical solutions in the creation and management of web architectures.
Sustainable Development Goal (SDG):	SDG4 – Quality Education SDG9 – Industry, Innovation, and Infrastructure

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: g) 10 (A) - exceptional success without mistakes or with minor mistakes, 95-100 points h) 9 (B) - above average, with some mistakes, 85-94 points i) 8 (C) - average, with noticeable mistakes, 75-84 points j) 7 (D) - generally good, but with significant shortcomings, 65-74 points k) 6 (E) - meets the minimum requirements, 55-64 points l) 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: • Creating Web Pages HTML & Dynamic HTML, Thomson Course Technology, 2003 • Web Application Architecture: Principles, Protocols, and Practices, Wiley (2nd edition), 2009 • Patrick J. Lynch and Sarah Horton, Web Style Guide, Yale C/AIM, 2002

Course code: 27CITOS010306	**Course title:** Web Application Development		
Level: I	**Year: III**	**Semester: VI**	**Number of ECTS credits:** 6
Status: mandatory		**Total number of contact hours: 90** Optional breakdown of hours by type: Lectures 45 Exercises 30 Seminars/Fieldwork/Laboratory/Practice: 15	
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 theoretical and practical knowledge in the field of web-based applications. Familiarize students with web application architectures. Equip students with practical skills in web application development. Build competencies so that students can be competitive in the job market		

	and acquire sufficient expertise to offer their services to businesses at the level of junior 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. Front-end/back-end scripting 2. JavaScript 3. JavaScript development frameworks 4. Advanced JS functionalities 5. Promises 6. Back-end technologies 7. .NET Core 8. Entity Framework 9. Database communication 10. Full-stack development 11. Web-based application
Learning outcomes:	**Knowledge:** Full-stack development knowledge **Skills:** Back-end and front-end development **Competencies:** Junior full-stack developer
Sustainable Development Goal (SDG):	SDG4 – Quality Education
Teaching methods:	**Lectures:** Theoretical foundations **Exercises:** Practical application of theoretical knowledge **Laboratory exercises:** Practical project work
Assessment methods with grading structure:	Seminars and exam
Literature:	**Mandatory** Course materials (notes and slides) available on the faculty website *Web Application Architecture: Principles, Protocols, and Practices* by Wiley; 2nd edition 2009 *PHP and MySQL Web Development (5th ed.)* by Luke Welling, Laura Thomson, Addison-Wesley Professional (English)/Mikroknjiga (Serbian Latin, 3rd edition), 2016/2006 **Supplementary:** • *Learn Web Design* by Jennifer Niederst Robbins, O'Reilly (English)/Mikroknjiga (Serbian Latin), 2012/2008 • Solved exercises in PHP, ETF Belgrade, 2015

Course code: 28CITOS010306	**Course title:** Mobile Application Development		
Level: I	**Year: III**	**Semester: VI**	**Number of ECTS credits:** 6
Status: mandatory		**Total number of contact hours: 90** Optional breakdown of hours by type: Lectures 30 Exercises 30 Seminars/Fieldwork/Laboratory/Practice: 30	

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 theoretical and practical knowledge on the basic principles of developing mobile applications for the Android operating system. To familiarize students with development environments used for mobile application development. To introduce the lifecycle of applications from planning, development, testing, to deployment and publishing on Google Play.
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	☐ Java for Android ☐ Introduction to Android and basics of application development ☐ Development environments for mobile applications (Eclipse, Android Studio) ☐ Dependency management using Gradle ☐ Graphic interface elements in Android (intents) ☐ Local data reading and saving in Android ☐ Services and asynchronous task execution in the background ☐ Application of web services ☐ Testing and continuous integration ☐ Distribution of finished applications ☐ Advanced topics: Kotlin, Event-driven programming
Learning outcomes:	**Knowledge:** Theoretical and practical knowledge in the field of mobile application development. Basic principles, rules, methods, and

	procedures in mobile app development, architecture analysis, and programming for mobile devices. **Skills:** Ability to apply theoretical and practical knowledge in the analysis, synthesis, and programming of mobile application systems based on the Android operating system. **Competencies:** Students will independently develop Android applications using Android Studio or Eclipse environments. They will use best practices in object-oriented programming on the Android platform and master all essential elements of Android applications. They will become familiar with the basics of using graphic elements and web services for data retrieval. Students will design, shape, and implement databases using MS SQL, SQLite, and Transact SQL. They will learn how to publish applications on Google Play.
Sustainable Development Goal (SDG):	SDG 9: Industry, Innovation, and Infrastructure
Teaching methods:	The course is delivered through lectures, exercises, laboratory work/fieldwork/practice. The following methods are applied: oral presentations, discussions, demonstrations, graphic work, drawing, and group work. Oral presentations are delivered with various systems and processes in mobile app development, using video and audio materials, along with individual presentations of specific app development issues. Discussion and debates on practical problems, independent research, and analysis of mobile app development are encouraged. In lectures, theoretical concepts and principles are demonstrated with descriptive examples and problem-solving tasks. Additional examples are discussed and solved during exercises and laboratory work/fieldwork/practice, which ensures continuous work and preparation for independent problem-solving.
Assessment methods with grading structure:	Evaluation of creativity in class and exercises, independent work, assessment of a partial test during the course, and the final exam. The

	student's performance is tracked and assessed as follows: • Homework/seminar/practical work/class attendance: 15 points (pass with more than 50%). • First partial exam/test/knowledge check: 35 points (pass with more than 50%). • Final exam (second partial exam): 50 points (pass with more than 50%). • Final exam (comprehensive): 85 points (pass with more than 50%). The total number of points that a student can earn during the course is 50 points, which together with the final exam totals 100 points. For students who did not pass the first partial exam, a comprehensive final exam is organized, covering all the material and valued at 85 points, with additional points for seminar work/practical work, totaling 100 points. The student's final performance is graded as follows: • 10 (A) – exceptional success with minimal errors: 95-100 points • 9 (B) – above average with some errors: 85-94 points • 8 (C) – average with noticeable errors: 75-84 points • 7 (D) – generally good but with significant deficiencies: 65-74 points • 6 (E) – meets the minimum requirements: 55-64 points • 5 (F FX) – does not meet minimum requirements: less than 55 points The total evaluation of all student obligations during the semester and the final exam is based on the total number of points earned from pre-exam obligations and partial and final exams. The maximum is 100 points, assessed according to the following scale: • Attendance, Homework/Seminar/Practice: 15 points • First partial exam/test/knowledge check: 35 points • Final exam (second partial exam): 50 points • Final exam (comprehensive): 85 points
Literature:	**Mandatory** □ Course materials (notes and slides) available on the faculty website □ Wei-Meng Lee, *"Beginning Android Application Development"*,

	WROX/Wiley (English)/Computer Library (Serbian), 2011/2012 **Supplementary:** • Android Developers: http://developer.android.com

Course code: 29CITOS010306	**Course title: Security of Computer Systems and Networks**		
Level: I	**Year: III**	**Semester: VI**	**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 of computer systems and networks 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, 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 of computer systems and networks - History and future of cyber security - Basics of information security and information and communication systems - Types of attacks and threats - Types of protection - Cryptography - Cryptographic protocols - Security of operating systems - Database security - Network and Internet security - Safety of programming languages		

	- Security of mobile devices - Social network security and social engineering - Cryptocurrency security
Learning outcomes:	Knowledge: Students will acquire theoretical and practical knowledge about security of computer systems and networks and their application in various fields of traffic and communications. Skills: Students are expected to master the skills and tools used in security of computer systems and networks. Competencies: Students will be trained to participate in activities related to security of computer systems and networks 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: 30-31-1CITES010306	**Course title: Communications Infrastructure**		
Level: I	**Year: III**	**Semester: VI**	**Number of ECTS credits:** 6
Status: Elective		**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):	Acquaintance of students with infrastructural components of communication systems and methods of planning, designing and building telecommunication infrastructure.		

Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	• Concepts of Communication System Infrastructure • Structure and Components of Communication Systems • Transmission Systems in Telecommunications • Construction of Access Telecommunications Infrastructure • Construction of Intermediate Telecommunications Infrastructure • Construction of Aerial Telecommunications Infrastructure • xDSL Technologies and Infrastructure • Ethernet Infrastructure • Optical Communication System Infrastructure • Cable Distribution Systems Infrastructure • Wireless Communication Systems Infrastructure • Facilities for ICT Equipment and Data Centers • Interrelationship Between Technology and Infrastructure • Technical Standards in Communication System Design • Network Design and Preparation of Technical Documentation
Learning outcomes:	Knowledge: Through the teaching process (lectures, exercises, laboratory work, company visits, and practical work) and assignments/ quizzes/ seminar papers/ project tasks, students will acquire the necessary knowledge for the design, construction, and maintenance of communication networks, with a focus on optical telecommunications networks and cable infrastructure. Skills: Upon passing the exam, students will be able to apply specific software tools used in the design of telecommunications infrastructure. Competencies: With the acquired knowledge and skills, students will be capable of applying the required rules, procedures, and tools necessary for planning telecommunications infrastructure.
Sustainable Development Goal (SDG):	SDG9 – Industry, Innovation and Infrastructure
Teaching methods:	The course is conducted through lectures, exercises, and practical components. Lectures are delivered through oral presentations with the

	aid of visual examples from practice. Discussions are initiated on issues related to the planning, modeling, and analysis of information systems. Students are required to attend classes and complete certain obligations during the course (e.g., quizzes, preparation and presentation of seminar papers and/or project assignments, etc.). Various methods are used in teaching, including oral presentations and discussions, demonstrations of examples, graphical and video presentations, and group work using appropriate methodological approaches. Visits to relevant companies are organized when possible.
Assessment methods with grading structure:	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: A. Čolaković, "Communication Infrastructure (SCRIPT)," Faculty of Traffic and Communications, Sarajevo, 2023. Fiber to the Home Council Europe, "FTTH Handbook," 2018. Fiber to the Home Council Europe, "FTTH Handbook," 2011. Supplementary: – Documentation published by the Regulatory Agency for Communications of Bosnia and Herzegovina: www.rak.ba – Jason P. Jue, Vinod M. Vokkarane, "Optical WDM Networks," Springer, 2006. – Stephan Pachnicke , "Fiber-Optic Transmission Networks: Efficient Design and Dynamic Operation," Springer-Verlag Berlin Heidelberg, 2012. – Ioannis P. Chochliouros, George A. Heliotis, Ioannis P. Chochliouros, George A. Heliotis, "Optical access networks and advanced photonics: technologies and deployment strategies," Information Science Reference, 2010. – Chinlon Lin, "Broadband optical access networks and fiber-to-the-home: systems technologies and deployment strategies," Wiley, 2006. – James Booth, "Fiber Optic Telecommunications Networks: Lit Fiber Services," Independently published, 2019. – A. Stipetić: Kabelska kanalizacija, Fakultet prometnih znanosti Zagreb, 2000. – Sharon Evans, Sharon Evans, "Telecommunications Network Modelling, Planning and Design," Institution of Electrical Engineers, 2003.

Course code: 30-31-2CITES010306	**Course title: Simulations in communications**		
Level: I	**Year: III**	**Semester: VI**	**Number of ECTS credits:** 6
Status: elective		**Total number of contact hours: 90**	

	Optional breakdown of hours by type: Lectures: 45 Tutorials: 30 Seminars: 0 Fieldwork: 0 Laboratory Tutorials: 15 Practice: 0 Concert activities: 0 …
Course participants:	**Academic staff and associates selected in the field to which the course belongs/course**
Prerequisite for enrollment:	NO
Course goal (goals):	Getting to know the theoretical and practical aspects of simulations in communications. Mastering the basics of mathematical modeling and simulation of communication networks. Acquisition of skills necessary for planning, configuring and evaluating the performance of communication networks. Familiarization with simulation tools and their application in the simulation of communication networks. Training to work with the network simulator NS-3 (Network Simulator 3).
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	1. Modeling and simulation in communications. 2. Division and types of simulation models. 3. Classification and assessment of parameters of simulation models. 4. Validation and verification of simulation models. 5. Development process of simulation. 6. Simulation of discrete events. 7. Probability theory in simulations. 8. Random numbers in simulations. 9. Queuing theory in simulations.

	10. Statistical testing in simulations. 11. Approaches to simulation planning, execution and acceleration. 12. Design and examples of network simulators. 13. Properties and method of use of the network simulator NS-3. 14. Building blocks of network simulator NS-3.
Learning outcomes:	Knowledge: Theoretical and practical knowledge in the field of simulations in communications. Knowledge of the methodology of modeling and simulation of communication networks. Understanding of the basic problems in forming a simulation model, planning and configuring the simulation of communication networks, and processing the simulation results. Skills: Application of theoretical and practical knowledge in the field of simulations in communications. Planning, configuring and evaluating the performance of communication networks. Work in the network simulator NS-3. Competencies: Ability to understand modeling and simulation issues in communications, use mathematical tools for modeling communication networks, apply simulation tools for planning and configuring communication networks, and process simulation results.
Sustainable Development Goal (SDG):	SDG4 – Quality education SDG9 – Industry, innovation and infrastructure
Teaching methods:	Teaching is realized through lectures, exercises, and laboratory exercises. The lectures cover theoretical concepts and principles with the presentation of descriptive examples and the solving of specific tasks. Additional examples are considered through exercises and laboratory exercises, which enables continuous work and preparation for solving practical problems independently. Completion of assignment/seminar work/practical work aims to develop individual and/or team work abilities and practical skills.
Assessment methods with grading structure:	The criteria for monitoring the student's work and evaluating the student during the course are carried out in the following way: Assignment/seminar work/practical work/ 15 points (%), passed if more than 50% is won.

	Partial exam/test/knowledge check/35 points (%), is passed if over 50% is won. Final exam 50 points (%), passed if more than 50% is won. Final exam (integral) 85 points (%), passed if more than 50% is won. The total number of points (%) that a student can achieve according to the above-mentioned monitoring during classes is a maximum of 50 points (%), which with the final exam makes 100 points (%). For students who did not pass the 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 assignment/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 using the following grading system: a) grade 10 or A - exceptional success in achieving learning outcomes without errors or with minor errors (between 95-100 points); b) grade 9 or B – success above average in achieving learning outcomes, with some errors (between 85-94 points); c) grade 8 or C – average in achieving learning outcomes but with noticeable errors (between 75-84 points); d) grade 7 or D - generally good in achieving learning outcomes, but with significant deficiencies (between 65-74 points); e) grade 6 or E - meets the minimum conditions for achieving learning outcomes (between 55-64 points); f) grade 5 or F - does not meet the minimum requirements, less than 55 points. 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 and passing the partial and final exam, and according to the quality of acquired knowledge and skills, and contains a maximum of 100 points, and is determined according to the following scale: Student obligations Points (%)

	Attendance at lectures and exercises.....0 points (%) Assignment/Seminar/Practice/.....15 points (%) Partial exam/Test/Knowledge check/.....35 points (%) Final exam .....50 points (%) Final exam (integral) .....85 points (%) The above scale can be adjusted according to Study rules for the first and second cycle of studies, integrated, professional and specialist studies at the University of Sarajevo (Article 49).
Literature:	Mandatory: 5. Teaching and learning material available on the Moodle page of the Faculty of Traffic and Communications 6. Jeruchim, M.C., Balaban, P., Shanmugan, K.S.: Simulation of Communication Systems – Modeling, Methodology and Techniques, Kluwer Academic Publishers, 2002. 7. Fujimoto, R.M., Perumalla, K.S., Riley, G.F.: Network Simulation, Synthesis Lectures on Communication Networks, 2007. 8. Rangisetti, A.K.: Advanced Network Simulations Simplified. Practical guide for wired, Wi-Fi (802.11n/ac/ax), and LTE networks using ns-3, Packt Publishing, 2023. Supplementary: 5. Law, M.A.: Simulation Modeling & Analysis, McGraw-Hill, 2007. 6. Le Boudec, J.Y.: Performance Evaluation of Computer and Communication Systems, EPFL, 2009. 7. Sokolowski J.A., Banks C.M.: Principles of Modeling and Simulation: A Multidisciplinary Approach, John Wiley and Sons, Ltd., 2009. 8. Guizani, M., Rayes, A., Khan, B., Al-Fuqaha, A.: Network Modeling and Simulation, John Wiley and Sons, Ltd., 2010.

Course code: **30-31-3CITES010306**	**Course title: Communications technology**		
Level: I	**Year: III**	**Semester: VI**	**Number of ECTS credits:** 6

Status: elective	**Total number of contact hours: 90** Optional breakdown of hours by type: Lectures 45 Tutorials 20 Seminars/ Concert activies/Practice 25
Course participants:	**Academic staff and associates selected in the field to which the course belongs/course** [Do not enter names in this section. Use the formulation as indicated in this section]
Prerequisite for enrollment:	No
Course goal (goals):	Development of relevant knowledge about the basics and basic technologies of telecommunication networks and technologies for providing telecommunication services. Through practical seminar papers, processing of real situations of incorporating new technologies into business processes.
Topics covered (Units of study): *(if necessary, the weekly implementation plan is established taking into account the specificities of organizational units)*	• Introduction – domains of telecommunications technology study and basic laws of telecommunications technology; • Network technologies – reference model, basic roles and characteristics of networks, division of networks; • PSTN networks - routing, access and transmission technologies; Technologies of intelligent networks and signaling techniques and networks; Technologies of data transmission networks: ISDN, X.25, Frame relay, ATM; • IP and Internet technologies, convergent and NGN networks; • 5G, SDN and NFV technologies; • IoT, IoE, Big Data data management technologies; • Service provision technologies – development methods; telecommunication services; • Theory of traffic flow analysis and traffic models; • Methods of sizing telecommunication networks; • Management technologies for telecommunications and business systems OSS/BSS;

	• NGOSS architectures and frameworks, life cycle and methodologies; • Tariff models and pricing technologies; • Technological aspect of regulation of telecommunications.
Learning outcomes:	Knowledge: Theoretical and practical knowledge in the field of telecommunications technologies. Students should understand the philosophy of technology development and the impact of technology on business after listening to lectures and carrying out exercises. Skills: After successful completion of the prescribed tests and seminar papers, students should be able to choose the appropriate technology for a given business model, as well as choose the appropriate telecommunications service for the customer's given need. Competencies: Students should develop the ability to independently understand and accept the features of new technologies, use professional literature, research, create analyses, assessments and practical solutions in the function of defining telecommunication services.
Sustainable Development Goal (SDG):	SDG4 - Quality education, SDG8 - Decent work and economic growth, 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. The oral presentation is followed by a presentation and display of various technologies from the field of communication technologies with the use of video and audio recordings, as well as an independent presentation of individual concrete solutions for the given service. 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. Debates and

	discussions about problems from practice, individual observations from different environments, independent research and analysis in the field of communication technology are also initiated. In laboratory exercises / field work / practice, the skills necessary for individual and team work are developed in order to carry out tasks in the given field.
Assessment methods with grading structure:	Evaluation of creativity in classes and exercises through the creation of homework / independent works / practical works, evaluation of the partial exam during the course as well as the evaluation of the final / remedial exam. The criterion for monitoring the work and evaluating the student is done in the following way: – Homework/seminar work/practical work - 15 points (%), passed if over 50% is won; – I Partial exam/test/knowledge check - 35 points (%), passed if more than 50% is won; – Final exam (II Partial) - 50 points (%), passed if over 50% is won; – Final exam (Integral) - 85 points (%), passed if more than 50% is won. The total number of points (%) that a student can achieve according to the above-mentioned monitoring during classes is a maximum of 50 points (%), which with the Final (II partial) 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 exam is organized as written and/or oral. At the final exam, the student can take the material that he did not take and/or successfully completed during the semester. A necessary condition for successfully completing the exam is a result of at least 55% of the maximum number of points in the I partial and final (II partial) part of the exam, and a sufficient condition is that the sum of the achieved points (assignment/practical work + I partial + II partial) will be 55 The task is realized through doing homework and taking quizzes or

	doing practical work. The points achieved on the quizzes and submitted homework cannot be corrected. For students who did not successfully complete the 1st partial exam, the final exam consists of the entire material covered during classes. The make-up exam is organized in the same way as the final exam. 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. 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 and passing the partial and final exam, and according to the quality of acquired knowledge and skills, and contains a maximum of 100 points, and is determined according to the following scale: Student obligations Points (%) Attendance at lectures and exercises... - Assignment / Seminar / Internship .....15 points (%) I Partial exam / Test / Knowledge check .....35 points (%) Final exam (II Partial) .....50 points (%) Final exam (Integral) .....85 points (%)
Literature:	Mandatory: 1. Notes and slides from lectures - materials from the course website 2. William A. SHAY, Contemporary technologies and networks, University of Wisconsin - Green Bay, ISBN: 86-7310-310-X, "Svetlost" Čačak, 2004

	3. Andrew S. Tanenbaum, David J. Wetherall, Computer Networks, translation 5th edition, 2013 4. I. Bošnjak: Technologies of telecommunication traffic II, Faculty of Communication Sciences, Zagreb, 1997 (first, third and fourth chapters) 5. W. Rahul, OSS/BSS for Converged Telecommunication networks, Xawy (2016) 6. ITU, Telecom Network Planning for evolving Network Architectures, 2007 7. ITU-T, 5G Basics, 2017 8. ITU, Telecommunications Regulation Handbook, 2011 9. International standards and recommendations Supplementary: 1. Villy B. Iversen, Teletraffic Engineering And Network Planning 2. Debashis De, Mobile Cloud Computing Architectures, Algorithms and Applications, West Bengal University of Technology Kolkata, India, CRC Press Taylor, 2016 3. C. X. Mavromoustakis, G. Mastorakis, J. M., Internet of Things (IoT) in 5G Mobile Technologies, Springer 2016