University of Zagreb
Faculty of Graphic Arts

INFORMATION PACKAGE
2024/ 2025

COURSE CATALOGUE FOR EXCHANGE STUDENTS
(IN ENGLISH)

SHORT SUMMARY

Exchange students are students participating in a formal exchange programme between their home university and the University of Zagreb (i.e. Erasmus+, CEEPUS, Bilateral agreements etc.). Incoming students can choose courses from the list of 42 courses taught in English in this catalogue, published on Faculty's website. Courses in catalogue are divided according to study level (undergraduate or graduate) with course descriptions and contact emails of teachers. The Faculty of Graphics does not currently offer a full degree study programs (undergraduate or graduate) in English.

University of Zagreb
Faculty of Graphic Arts

Content

ABOUT US

The Faculty of Graphic Arts of the University of Zagreb is a public institution of higher education which organizes and conducts study courses and is engaged in scientific and expert work in the area of engineering sciences, field of graphic engineering. The Faculty is a constituent unit of the University of Zagreb, which, under the provisions of the Science and Higher Education Act and the Statute of the University, is the bearer of founding rights over the Faculty.

The study program based on the Bologna process covers three levels:
1. Undergraduate study course (BSc) - have duration of 3 years (6 semesters; 180 ECTS credits)
2. Graduate study course (MSc) - have duration of 2 years (4 semesters; 120 ECTS credits).
3. Postgraduate study course (PhD) - have duration of 3 years (6 semesters; 180 ECTS credits).

The Undergraduate Study Course of Graphic Engineering trains students for professional and creative tasks, scientific research and qualifies them to work independently in all segments of graphic industry. Accordingly, the students are trained to run and manage any printing system, as well as optimising costs and implement quality control within these systems.

The students who enrol into the Undergraduate Study program of Graphic Product Design are trained in designing graphic products, in developing communication criteria of graphic design and examining and optimizing graphic materials.

The Graduate Study Course of Graphic Engineering offers students further professional development and qualifies them to work independently in all segments of graphic industry. Accordingly, they are trained to run and manage any printing system, as well as optimising costs and implement quality control within these systems. Graduate M.A.s in graphic engineering engage independently in scientific research and development of all forms of graphic technology.

The Graduate Study Course of Graphic Product Design primarily encourages permanent research and supports the creative component of graphic design in the synthesis with graphic engineering. The students thus receive education in designing graphic products, examining and selecting optimal materials and developing and improving the work of designers, which can only be realised by means of enhancing the students' awareness of the value of communication criteria of graphic design.

STUDENT SUPPORT

<u>Address:</u>

University of Zagreb Faculty of Graphic Arts
Getaldićeva 2, 10000 Zagreb, Croatia

<u>Important contacts:</u>

International Relations Office
Ms. Ivana Žganjar, PhD
Phone: + 385 1 23 71 080 /206
E-mail: ivana.zganjar@grf.unizg.hr

Vice Dean for Science and International Relations
asst. prof. Marina Vukoje, PhD
Phone: + 385 1 23 71 080 /120
E-mail: marina.vukoje@grf.unizg.hr

ECTS Coordinator
assoc. prof. Ivana Plazonić, PhD
Phone: + 385 1 23 71 080 /121
E-mail: ivana.plazonic@grf.unizg.hr

GENERAL INFORMATION FOR INCOMING STUDENTS

INTERNATIONAL STUDENT GUIDE:
On this website, you will find a lot of important and practical information that will help you prepare your study exchange period at the University of Zagreb: http://www.unizg.hr/homepage/international-exchange/exchange-students/.
Even if your courses are in a foreign language, you should have at least the basic knowledge of Croatian for everyday use and administrative needs. On this website you will find a lot of information where you can all learn Croatian: https://www.unizg.hr/homepage/learn-croatian/.

ADDITIONAL INFORMATION:
Visa, residence permit and health insurance: please visit these pages.
Housing information and living expenses.
ICT services & facilities: After you get your username and password from the Faculty (AAI; see below) you will enrol, download the necessary installation software from http://installer.eduroam.hr, get a cable (no wireless in the dorm).

Erasmus Student Network Zagreb (ESN Zagreb) is a volunteer association that helps students on student exchange in Zagreb. They provide a "buddy", a person who will be at the student's disposal during his stay in Zagreb, for each foreign student. For more information about it please visit this page.

ACADEMIC CALENDAR 2024/25

For academic calendar of University of Zagreb please visit this page.
For academic calendar of Faculty of Graphic Arts please visit this page.

WINTER SEMESTER	
Teaching period	07.10.2024. – 31.01.2025.
Winter holidays (no classes)	24.12.2024. – 06.01.2025.
Winter examination period (no classes)	10.02.2025. – 28.02.2025.

SUMMER SEMESTER	
Teaching period	10.03.2025. – 20.06.2025.
Summer examination period (no classes)	30.06.2025. – 18.07.2025.

NATIONAL HOLIDAYS	
January 1	New Year's Day
January 6	Epiphany
April 20 and April 21	Easter and Easter Monday
May 1	Labor Day
May 30	Statehood Day
June 19	Corpus Christi
June 22	Anti-Fascist Struggle Day
August 5	Victory and Homeland Thanksgiving Day
August 15	Assumption of Mary
November 1	All Saint's Day
November 18	Remembrance Day
December 25 and 26	Christmas *(University Christmas holidays 25.12.-6.1.)*

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COURSES IN ENGLISH AVAILABLE TO INCOMING STUDENTS IN ACADEMIC YEAR 2024/2025

Undergraduate Study Programmes (BSc) – Summary

LIST OF COURSES							
SEMESTER: Winter (W)							
CODE	COURSE	TEACHER	CONTACT email	L	S	E	ECTS
254254	WAVES, SOUND AND LIGHT	asst. prof. Katarina Itrić Ivanda, PhD	katarina.itiric.ivanda@grf.unizg.hr	30	-	15	4
32894	INFORMATICS 1	assoc. prof. Tibor Skala, PhD asst. prof. Marko Maričević, PhD	tibor.skala@grf.unizg.hr marko.maricevic@grf.unizg.hr	15	-	15	3
19537	PRINTING FORMS 1	prof. Sanja Mahović Poljaček, PhD assoc. prof. Tomislav Cigula, PhD	sanja.mahovic.poljacek@grf.unizg.hr tomislav.cigula@grf.unizg.hr	30	-	30	5
19549	REPRODUCTION PHOTOGRAPHY 1	prof. Lidija Mandić, PhD	lidija.mandic@grf.unizg.hr	30	-	15	4
19543	MULTIMEDIA COMMUNICATIONS 1	assoc. prof. Tajana Koren Ivančević, PhD	tajana.koren.ivancevic@grf.unizg.hr	30	-	30	5
98042	INDUSTRY AND ENVIRONMENT	prof. Ivana Bolanča Mirković, PhD	ivana.bolanca.mirkovic@grf.unizg.hr	30	-	15	4
19559	GRAPHIC PROGRAMMING LANGUAGES	prof. Klaudio Pap, PhD assoc. prof. Maja Rudlof, PhD	klaudio.pap@grf.unizg.hr maja.rudolf@grf.unizg.hr	30	-	15	4
38011	SCIENCE OF ENVIRONMENT AND DESIGN	prof. Ivana Bolanča Mirković, PhD	ivana.bolanca.mirkovic@grf.unizg.hr	30	15	-	4
19539	PRINTING INKS	assoc. prof. Sonja Jamnicki Hanzer, PhD	sonja.jamnicki.hanzer@grf.unizg.hr	30	-	15	4
32785	GRAPHIC DESIGN 1	prof. Maja Brozović, PhD	maja.brozovic@grf.unizg.hr	15	-	45	4
19548	ORGANIZATION OF GRAPHIC PRODUCTS	asst. prof. Diana Bratić, PhD	diana.bratic@grf.unizg.hr	30	15	-	4

LIST OF COURSES							
SEMESTER: Summer (S)							
CODE	COURSE	TEACHER	CONTACT email	L	S	E	ECTS
254260	OPTICS, ELECTROSTATICS, AND FLUID MECHANICS	asst. prof. Katarina Itrić Ivanda, PhD	katarina.itiric.ivanda@grf.unizg.hr	30	-	30	5
19535	PHOTOGRAPHIC PROCESSES	assoc. prof. Rahela Kulčar, PhD	rahela.kulcar@grf.unizg.hr	30	-	15	4
19558	PRINTING FORMS 2	prof. Sanja Mahović Poljaček, PhD asst. prof. Tamara Tomašegović, PhD	sanja.mahovic.poljacek@grf.unizg.hr tamara.tomasegovic@grf.unizg.hr	30	-	15	4
19529	DIGITAL MULTIMEDIA 1	prof. Klaudio Pap, PhD assoc. prof. Maja Rudlof, PhD	klaudio.pap@grf.unizg.hr maja.rudolf@grf.unizg.hr	30	-	30	5
32895	INFORMATICS 2	assoc. prof. Tibor Skala, PhD asst. prof. Marko Maričević, PhD	tibor.skala@grf.unizg.hr marko.maricevic@grf.unizg.hr	15	-	15	3
19528	DESIGN OF GRAPHIC MEDIA 1	prof. Jesenka Pibernik, PhD	jesenka.pibernik@grf.unizg.hr	30	15	-	4
32786	GRAPHIC DESIGN 2	prof. Maja Brozović, PhD asst. prof. Dorotea Kovačević, PhD asst. prof. Josip Bota, PhD	maja.brozovic@grf.unizg.hr dorotea.kovacevic@grf.unizg.hr josip.bota@grf.unizg.hr	15	-	45	4
128242	COMPOSITION	assoc. prof. Tajana Koren Ivančević, PhD	tajana.koren.ivancevic@grf.unizg.hr	15	-	30	4
19561	QUALITATIVE RESEARCH METHODS OF COLOUR REPRODUCTION	assoc. prof. Rahela Kulčar, PhD	rahela.kulcar@grf.unizg.hr	30	-	15	4
19563	APPLICATION AND INVESTIGATION OF PRINTED MATERIALS	asst. prof. Maja Strižić Jakovljević, PhD prof. Branka Lozo, PhD	maja.strizic.jakovljevic@grf.unizg.hr	30	-	15	4
19557	BOOKBINDING 1	assoc. prof. Suzana Pasanec Preprotić, PhD	suzana.pasanec.preprotic@grf.unizg.hr	30	-	30	5
19469	OFFSET PRINTING MANAGEMENT	prof. Igor Zjakić, PhD assoc. prof. Irena Bates, PhD	igor.zjakic@grf.unizg.hr irena.bates@grf.unizg.hr	30	-	30	5

96535	QUALITY CONTROL	prof. Diana Milčić, PhD	diana.milcic@grf.unizg.hr	30	-	15	4
19538	TYPOGRAPHY	prof. Ivana Žiljak Stanimirović, PhD	ivana.ziljak.stanimirovic@grf.unizg.hr	30	15	15	5

Graduate Study Programmes (MSc) – Summary

LIST OF COURSES							
SEMESTER: Winter (W)							
CODE	COURSE	TEACHER	CONTACT email	L	S	E	ECTS
19476	DIGITAL PRINTING FORM	prof. Igor Majnarić, PhD	igor.majnaric@grf.unizg.hr	30	-	30	6
19438	PACKAGING PRINTING	assoc. prof. Irena Bates, PhD	irena.bates@grf.unizg.hr	30	-	15	5
19473	APPLICATION OF DIGITAL PHOTOGRAPHY IN REPRODUCTION MEDIA	prof. Maja Strgar Kurečić, PhD	maja.strgar.kurecic@grf.unizg.hr	30	-	15	4
19498	HOLOGRAPHY	asst. prof. Katarina Itrić Ivanda, PhD asst. prof. Vladimir Cviljušac, PhD	katarina.itric.ivanda@grf.unizg.hr vladimir.cviljusac@grf.unizg.hr	30	15	-	5
33072	GRAPHIC DESIGN 3	prof. Maja Brozović, PhD	maja.brozovic@grf.unizg.hr	15	-	45	5
40782	WEB DESIGN 1	prof. Jesenka Pibernik, PhD	jesenka.pibernik@grf.unizg.hr	30	-	30	6
53571	MOTION GRAPHICS	prof. Jesenka Pibernik, PhD	jesenka.pibernik@grf.unizg.hr	30	-	30	6
19463	MARKETING COMMUNICATIONS	asst. prof. Diana Bratić, PhD	diana.bratic@grf.unizg.hr	30	15	-	5
19494	INTRODUCTION TO THE THEORY OF EXPERIMENTAL WORK	asst. prof. Katarina Itrić Ivanda, PhD	katarina.itiric.ivanda@grf.unizg.hr	30	15	-	5
19441	PACKAGING AND ENVIRONMENT	prof. Ivana Bolanča Mirković, PhD	ivana.bolanca.mirkovic@grf.unizg.hr	30	15	-	5
19504	BROADBAND NETWORK APPLICATIONS	assoc. prof. Tibor Skala, PhD	tibor.skala@grf.unizg.hr	30	-	30	6
19477	SELECTED CHAPTERS OF QUALITY MANAGEMENT	prof. Diana Milčić, PhD	diana.milcic@grf.unizg.hr	30	30	-	6
19509	QUALITY CONTROL AND ASSURANCE IN GRAPHIC PRODUCTION	prof. Diana Milčić, PhD	diana.milcic@grf.unizg.hr	30	-	15	5

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19496	MULTIMEDIA COMMUNICATIONS 2	prof. Ivana Žiljak Stanimirović, PhD	ivana.ziljak.stanimirovic@grf.unizg.hr	30	-	30	6
19491	GRAPHICS OF THE DOCUMENTS AND SECURITIES	prof. Ivana Žiljak Stanimirović, PhD	ivana.ziljak.stanimirovic@grf.unizg.hr	30	-	15	5

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LIST OF COURSES							
SEMESTER: Summer (S)							
CODE	COURSE	TEACHER	CONTACT email	L	S	E	ECTS
19455	DESIGN AND ENVIRONMENT	prof. Ivana Bolanča Mirković, PhD	ivana.bolanca.mirkovic@grf.unizg.hr	30	15	-	5
19481	CTP TEHNOLOGY	prof. Sanja Mahović Poljaček, PhD asst. prof. Tamara Tomašegović, PhD	sanja.mahovic.poljacek@grf.unizg.hr tamara.tomasegovic@grf.unizg.hr	30	15	15	6
19502	OPTOELECTRONIC SYSTEMS 2	prof. Lidija Mandić, PhD	lidija.mandic@grf.unizg.hr	30	-	30	6
19461	SYSTEM FOR THE ENVIRONMENT MANAGEMENT	asst. prof. Marina Vukoje, PhD prof. Ivana Bolanča Mirković, PhD	marina.vukoje@grf.unizg.hr	30	15	-	5
19490	OPTICAL METHODS OF THE PRINTING SURFACE INVESTIGATIONS	asst. prof. Katarina Itrić Ivanda, PhD	katarina.itric.ivanda@grf.unizg.hr	30	-	15	5
19480	SURFACE PHENOMENA ON PRINTING FORMS	assoc. prof. Tomislav Cigula, PhD asst. prof. Tamara Tomašegović, PhD	tomislav.cigula@grf.unizg.hr tamara.tomasegovic@grf.unizg.hr	30	15	-	5
96536	INK IN DIGITAL ENVIRONMENT	prof. Lidija Mandić, PhD	lidija.mandic@grf.unizg.hr	15	-	-	3
33073	GRAPHIC DESIGN 4	prof. Maja Brozović, PhD	maja.brozovic@grf.unizg.hr	15	-	45	5
96534	WRAPPING	prof. Diana Milčić, PhD	diana.milcic@grf.unizg.hr	30	-	15	5

Courses from undergraduate study programme (BSc) – General information

WAVES, SOUND AND LIGHT			Code: 254254
Course teacher	KATARINA ITRIĆ IVANDA	Course status	compulsory
Original course title	Valovi, zvuk i svjetlost	Semester (winter/summer)	winter
Teacher's contact email	katarina.itric.ivanda@grf.unizg.hr	ECTS credits	4
Study programme (undergraduate BSc, graduate MSc)	BSc	Hours of teaching (L+S+E)	30+0+15
COURSE DESCRIPTION			
Course objectives	The goal of this course is to introduce students to the fundamentals of waves, sound, and light and their application in various areas of graphic technology. Through instructional units, students will acquire fundamental knowledge of oscillation, waves, and electromagnetic wave properties, as well as the basic parameters that describe sound. In the first part of the course, topics related to sound perception, interference, resonance, modulation, and the application of sound in multimedia, video games, and augmented reality will be covered. In the second part of the course, students will become familiar with the interaction of light and matter, absorption, reflection, transmission, color perception, and the application of Beer-Lambert's law. They will also be introduced to optical components of different image capture systems, as well as light interference, diffraction, and polarization and their application in graphic technology.		
Learning outcomes	1. List the basic characteristics of sound waves. 2. Recognize sources of sound waves and explain how they differ based on intensity and frequency. 3. Classify noise sources and their impact on sound perception. 4. Explain superposition and interference and distinguish between spatial and temporal interference of sound waves. 5. Describe sources of light and understand how they are used in various applications, including spectrometry, holography, and photography. 6. Explain the principles of operation of optical components used in different image capture and reproduction systems. 7. Acquire the concepts of light interference, diffraction, and polarization to apply them in practice (such as hologram creation, manufacturing polarizing filters and 3D models, and quality control of graphic products).		
Course content (syllabus)	1. Waves. General wave formation. Oscillation; force of a harmonic oscillator. Oscillation equation; solution of the equation, frequency and period of oscillation; Wave equation; temporal and spatial components. 2. Sound waves; sources of sound waves; reflection of sound waves; speed of sound waves; propagation of sound in a medium; wave refraction; energy, power, and intensity of sound waves. 3. Sound level; auditory response to intensity and frequency; Doppler effect (relationship between the sound source and receiver); shock waves.		

	4. Superposition and interference; spatial interference; standing waves; standing waves in an air column (one free end, two free ends, two fixed ends); temporal interference of sound waves: beats. 5. Sound perception; human auditory system; audibility threshold; noise; the role of sound in multimedia, video games, and augmented reality. 6. Quiz. 7. Light, the dual nature of light; light sources; spectral radiation density; intensity of light sources. 8. Interaction of light and matter; absorption, reflection, and transmission depending on the type of material; color perception. 9. Interaction of light and matter; Beer-Lambert's law. 10. Optical components of different image capture and reproduction systems; flat and spherical lenses. 11. Optical components of different image capture and reproduction systems; filters and sensors. 12. Interference, diffraction, and polarization of light and their application in graphic technology; photography, holography. 13. Application of optical phenomena in spectrometers, densitometers. 14. Application of optical phenomena in digital communication devices. 15. Quiz.
Required literature (available in the library and/or via other media)	Title
	F. A. Everest, K. C. Pohlmann: Master Handbook of Acoustics, 6th Edition, McGraw-Hill Education, 2015.
	S Y Lee: Fundamental Physics of Sound, World Scientific, 2020.
	F. Alton Everest: The Master Handbook of Acoustics, Fourth Edition, McGraw-Hill, 2001.
	H. D. Young i R. A. Freedman: University Physics With Modern Physics,Addison-Wesley, 2012.
	V. Henč-Bartolić i P. Kulišić: Valovi i optika, Školska knjiga, Zagreb, 2004.
	V. Henč-Bartolić i ostali: Riješeni zadaci iz valova i optike, Školska knjiga, Zagreb, 2002.

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INFORMATICS 1			Code: 32894
Course teacher	TIBOR SKALA MARKO MARIČEVIĆ	Course status	compulsory
Original course title	Informatika 1	Semester (winter/summer)	winter
Teacher's contact email	tibor.skala@grf.unizg.hr marko.maricevic@grf.unizg.hr	ECTS credits	3
Study programme (undergraduate BSc, graduate MSc)	BSc	Hours of teaching (L+S+E)	15+0+15
COURSE DESCRIPTION			
Course objectives	To standardize the level of computer literacy that, along with new knowledge and skills, they will be able to apply in business and continuing studies. Developing the ability of reliable and critical use of information and communication technologies. Developing logical and critical thinking and an algorithmic approach to solving various problems.		
Learning outcomes	Students will be able to: Explain the systematic approach and state definitions of key theories related to with the emergence of informatics. List the basic characteristics of computer generations. Apply basic principles from the field of mathematical and logical basis of computer operation. List the types of computer networks and describe their development. List the basic characteristics of Web 2.0 technology. Give an example of use i present it. Differentiate between the basic terms: multimedia and hypermedia. State the definition of artificial intelligence and state its application. Differentiate basic concepts from the field of IS security. Apply operating system, Internet, computer word processing tools and spreadsheet calculator to basic and advanced level.		
Course content (syllabus)	1. Introduction to the basic concepts of the course. Development of computers throughout history: ideas and assumptions computers, mechanical devices, more mature ideas. 2. First digital computers, commercial development, microprocessors, personal computers. Concepts architecture and organization of digital computers: von Neumann architecture, parts, connection, logical and circuit foundations. 3. Basic terms of a personal computer: hardware, software, peripheral devices, types of computers according to purpose. 4. The concept of system. Definition of information system. Business system. Systemic approach (term system, system elements, connections in the system). Terms related to the information system. Algorithm. Functions of the information system in the business system. Hardware. Software. 5. Cybernetics. System theory. Information sciences. Informatics. 6. Data and information. Communication system. Information technologies. Informational society. Information system. 7. Development of data processing and computers. Computer system. Choice of computer equipment. 8. Software support for computer operation. Mathematical and logical bases of computer operation. 9. Data organization. Logical organization of data. Physical organization of data. Addresses folder and file.		

	10. Multimedia and hypermedia. Definitions and general terms. Disadvantages of the hypermedia model and possible solutions. A brief historical overview. Application of multimedia and hypermedia. Multimedia computer systems. Basic multimedia elements. 11. Artificial Intelligence. A traditional approach to artificial intelligence. Symbolic representation of knowledge and reasoning as manipulation of symbols. Alternative approaches. Imitation of models found in nature. 12. Computer networks. Internet. Web 2.0 technologies. Development of networks. History of development and basic features. Media. Network equipment. Topology of LANs. OSI reference model. Protocols. Addressing in LAN. MAC addresses. IP addresses. Binary number system. 13. E-business. Information and communication technology in education. 14. Information society - characteristics and consequences: characteristics, state in our country and in the world, impact of IT on business, society, social groups of IT users, IT literacy, dependence of society and economy on IT, globalization and IT. 15. Protection, security and privacy in the application and use of information technology: security risks in the application and use of IT, licenses, open-source, personal security, privacy, legal consequences.
Required literature (available in the library and/or via other media)	Title
	Lecture script in digital form. Script of tasks and exercises in digital form.
	Šehanović, J., Hutinski, Ž.; Žugaj, M. Informatics for economists. Faculty of Economics Pula, Pula, 2002.
	Cerić, V., Varga. M., (2004): Information technology in business. Zagreb: Element
	Group of authors, Business computing. Znak, Zagreb, 1998.
	Manuals of programming tools from the program exercises

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PRINTING FORMS 1			Code: 19537
Course teacher	SANJA MAHOVIĆ POLJAČEK, TOMISLAV CIGULA	Course status	compulsory
Original course title	Tiskovne forme 1	Semester (winter/summer)	winter
Teacher's contact email	sanja.mahovic.poljacek@grf.unizg.hr tomislav.cigula@grf.unizg.hr	ECTS credits	5
Study programme (undergraduate BSc, graduate MSc)	BSc	Hours of teaching (L+S+E)	30+0+30
COURSE DESCRIPTION			
Course objectives	To become familiar with the types of printing plates used for different printing techniques. Define and distinguish the processing materials used for the production of different types of printing plates. Create images and transfer them on printing plates using analogue processes. Define and quantify the parameters of specific materials used to make printing plates, i.e., the requirements for creating images on the surface of printing plates.		
Learning outcomes	Students will have the knowledge and ability to identify the technological segments in graphic production, classify and explain the actions and processes within graphic prepress, and plan the sequence of process procedures in graphic technology. Upon completion of the course, students will be able to describe the printing plates workflow in the analogue process; identify and explain the functional properties of printing plates; enumerate and classify the materials used in production of printing plates; describe and evaluate the types of printing plates within a printing technology; analyse the functional properties of printing plates; explain and differentiate copying processes in production of printing plates; select materials and processes for making printing plates within a printing technology; enumerate and describe surface phenomena on printing plates. They will be able to research the literature on materials and printing plates in conventional workflow.		
Course content (syllabus)	1. Definition of printing plates and production workflow 2. Types of printing plates 3. Analogue processes, basic features of photosensitive layers and copying process 4. Digital processes, computer-controlled production of printing plates 5. Materials for production of printing plates, basic properties 6. Production of polymer printing plates 7. Production of printing plates for letterpress printing techniques 8. Production of printing plates for flexography printing 9. Production of printing plates for flexography printing 10. Production of printing plates for conventional offset printing		

	11. Production of printing plates for conventional intaglio printing 12. Production of printing plates for pad printing 13. Production of printing plates for screen printing 14. Surface phenomena on the printing plate surfaces 15. Surface phenomena on the printing plate surfaces, interaction with inks
	Title
Required literature (available in the library and/or via other media)	M. Gojo, S. Mahović Poljaček, Osnove tiskovnih formi, Sveučilište u Zagrebu Grafički fakultet, Zagreb, 2013.
	H. Kipphan, Handbook of Print Media, Springer Verlag Berlin Heidelberg New York, Heidelberg, 2001.
	K. Johansson, P. Lundberg, R. Ryberg, A Guide to Graphic Print Production, 3rd Edition, Wiley, New York, 2011.
	J. Deemer, Glossary of Graphic Communications, 4th edition, GATFPress, Pittsburg, 2008.

REPRODUCTION PHOTOGRAPHY 1			Code: 19549
Course teacher	LIDIJA MANDIĆ	Course status	compulsory
Original course title	Reprodukcijska fotografija 1	Semester (winter/summer)	winter
Teacher's contact email	lidija.mandic@grf.unizg.hr	ECTS credits	4
Study programme (undergraduate BSc, graduate MSc)	BSc	Hours of teaching (L+S+E)	30+0+15
COURSE DESCRIPTION			
Course objectives	Identifying and understanding the basic stages of the reproduction process with an emphasis on the preparation stage. Acquiring knowledge about input processes and the principle of operation of input devices. Acquiring knowledge about factors which affect the quality of reproduction (resolution, bit depth, tonal range, color space, format records ...). Differences in preparation depending on the purpose. Identifying and understanding screen systems, amplitude and frequency modulation, hybrid screen. Knowledge of objective measurements for control reproduction quality. Ability to recognize and correct errors that occurred in the preparatory work phase.		
Learning outcomes	Describe the basic stages of the reproduction process and explain the role of graphic prepress. List and describe factors affecting the quality of reproduction. Distinguish the basic types of screen systems. Use appropriate measuring devices to control the quality of reproduction. Identify and associate errors in reproduction with possible causes in graphic preparation.		
Course content (syllabus)	1. The role of preparation in the reproduction chain, Defining student obligations and scoring. Exercises: digital image processing: levels 2. Classification of image types and their characteristics. Exercises: Digital image processing: histogram 3. Recording of originals, light sources and their spectrophotometric curve. Exercises: Digital image processing: corrections using curves 4. Why screening is carried out and the role of the screen element, which makes up the screen system. Exercises: Digital image processing: image correction 5. Characteristics of different types of screening. Exercises: Digital image processing: image correction 6. Densitometric measurements and what is expressed through densitometric measurements Exercises: Digital image processing: image correction. 7. Tone reproduction curves and their correction. Exercises: Digital image processing: image correction 8. Steps covered by RIP (raster image processor). Exercises: Digital image processing: image correction 9. Analog to digital signal conversion. Exercises: Digital image processing: image correction 10. Digital image. Exercises: Digital image processing: image correction 11. Image compression. Exercises: Digital image processing: layers 12. Image record formats. Exercises: Digital image processing: actions		

	13. Methods for control of black separation. Exercises: Digital image processing: profiles 14. What must be included in the preparation and which parameters should be checked in the PDF. Exercises: Digital image processing: image correction 15. Getting to know the most common mistakes in preparation. Preliminary exam.
Required literature (available in the library and/or via other media)	Title
	teaching material on MERLIN
	H. Kipphan et al., Handbook of Print Media, Springer, Berlin, 2001.
	R. S. Berns, Billmeyer and Saltzman's Principles of Color Technology - 3rd ed. John Wiley & Sons, New York, 2000.;
	R. C. Gonzalez & R. E. Woods, Digital Image Processing - 3rd ed., Upper Saddle River, NJ, USA: Prentice Hall, 2007

MULTIMEDIA COMMUNICATIONS 1			Code: 19543
Course teacher	TAJANA KOREN IVANČEVIĆ	Course status	optional
Original course title	Multimedijske komunikacije 1	Semester (winter/summer)	winter
Teacher's contact email	tajana.koren.ivancevic@grf.unizg.hr	ECTS credits	5
Study programme (undergraduate BSc, graduate MSc)	BSc	Hours of teaching (L+S+E)	30+0+30
COURSE DESCRIPTION			
Course objectives	Students will learn the basics of HTML and CSS. They will be able to distinguish individual HTML elements and attributes. Students will learn how to implement multimedia content on a website through HTML and CSS and how to be position elements in precisely defined positions. They will learn transformations, transitions and animations on to the web.		
Learning outcomes	The student will be able to distinguish and compare HTML elements. By applying styles, the student will be able to define appearance and positioning of elements. The student will be able to classify multimedia content on the web. The student will be able to use multimedia content when creating a website. The student will be able to connect multiple web hubs and create basic navigation. The student will be able to manipulate HTML elements in terms of transitions, transformations and animation. The student will be able to adjust the web content pages to all the most popular browsers and devices.		
Course content (syllabus)	1. Getting to know the basic HTML elements related to text and tabular display. Use of basic HTML elements and checking the appearance of the HTML document in the browser. 2. Introduction of forms, surveys, interactivity, links. Possibility of comparison and selection form for the desired survey. Setting up navigation and determining where the content will appear. 3. Getting to know CSS. Ability to influence the appearance of the website by changing styles. 4. Selectors and grouping of elements through CSS. Understanding the benefits of grouping elements through styles. 5. Introducing multimedia elements. Introducing an image into an HTML document. Image processing and preparation for posting on a website. Exercises – Colloquium. 6. Image mapping. Determining the coordinates of a part of the image as a link to another element. 7. Introduction of audio and video material into HTML. 8. Nesting of external multimedia elements in the page. Distinguishing individual audio and video format. Differentiation of HTML elements for the introduction of multimedia content on the web. 9. Absolute positioning of elements. Understanding the coordinate system. The possibility of stacking elements to precisely defined positions. 10. Absolute and relative positioning of elements. Differences, advantages and disadvantages. Exercises - Colloquium (0.9 ECTS) 11. Adapting content to different screen sizes and devices.		

	12. Manipulation with HTML elements by mouse movement. The possibility of changing the appearance of elements by mouse-over. 13. Transitions. The concept of time. Transition from one state to another in a period of time. 14. 2D and 3D transformation of HTML elements. Manipulating HTML elements through 2D and 3D transformations. Differentiation of 2D and 3D space. 15. Animation of HTML elements. Animating various HTML elements. Flow programming animations. Animation management. Exercises - Colloquium
Required literature (available in the library and/or via other media)	Title
	http://www.w3schools.com; http://www.w3.org

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INDUSTRY AND ENVIRONMENT			Code: 98042
Course teacher	IVANA BOLANČA MIRKOVIĆ	Course status	compulsory
Original course title	Industrija i okoliš	Semester (winter/summer)	winter
Teacher's contact email	ivana.bolanca.mirkovic@grf.unizg.hr	ECTS credits	4
Study programme (undergraduate BSc, graduate MSc)	BSc	Hours of teaching (L+S+E)	30+0+15
COURSE DESCRIPTION			
Course objectives	The aim of the course is to familiarize students with the impact of graphic technology processes on the environment, and to transfer theoretical knowledge in the field of environmental engineering and its practical application. The further goal of the course is to introduce students to the ecological aspect of cellulose and paper production, paper recycling in relation to other methods of disposal of used graphic products. Students are trained to understand and make sound conclusions in the field of the ecological aspect of conventional printing techniques (offset printing, flexo printing, gravure printing, and screen printing) as well as digital printing techniques (electrophotography and inkjet printing). Students are introduced to the best available techniques in the field of graphic reproduction, as well as the development of printing substrates and inks, including nanotechnology and nanomaterials. The aim is to acquire theoretical knowledge that can be improved through practical work in the laboratory. In the laboratory, units originally related to environmental issues are processed. The goal is for students to achieve information recognition and understanding, as well as to develop generic skills, presentation skills, and teamwork.		
Learning outcomes	Students will be able to analyze the ecological aspect of energy sources and assess the environmental suitability of renewable energy sources. Students will be able to describe and evaluate the ecological aspect of cellulose, paper, recycled paper, and printing inks production. Students will be able to evaluate the environmental impact and health risks of conventional and digital printing techniques. Students will be able to describe the best available techniques in the field of printing substrates, inks, and printing.		
Course content (syllabus)	1. Lectures: Major causes of environmental devastation. Principles of environmental protection. Legal regulations in the field of environmental protection. Exercises: Introduction. Laboratory work rules. 2. Lecture: Composition and properties of the atmosphere. Air pollution. Exercises: Carbon footprint. 3. Lecture: Impact of meteorological factors on air pollution. Cycle of discharge of pollutants from the atmosphere. Exercises: Air quality in the graphic industry. 4. Lecture: Ecological aspect of conventional printing techniques (offset printing, gravure printing, flexo printing, and screen printing) impact on the environment, health, and safety risks. Exercises: Chemical deinking flotation, principles, and influencing factors. 5. Lecture: Ecological aspect of digital printing techniques, impact on the environment, health risks. Exercises: Disposal of composite materials: composite recycling process.		

	6. Lecture: Ecological aspect of the production and application of printing inks. Biodegradability of inks. exercises: Recycling of prints using ultrasound. 7. Lecture: Knowledge check through a colloquium. Exercises: Durability of inks in defined environmental conditions. 8. Lecture: Production of pulp and paper and its impact on air quality. Methods for air purification. Exercises: Durability of printing substrates in defined environmental conditions. 9. Lecture: Process and wastewater. Physical, chemical, and biological indicators of water pollution. Exercises: Determination of effective concentration of residual ink on laboratory sheets and application of other spectrophotometric methods of analysis. 10. Lecture: Wastewater from conventional printing techniques. Ecological aspect of CTP technology. Exercises: Principle of the method and application of image analysis. 11. Lecture: Wastewater from the production of pulp, paper, and recycled paper. Exercises: Determination of organic matter in process waters. 12. Lecture: Wastewater from the production of pulp, paper, and recycled paper. Exercises: Determination of organic matter in process waters. 13. Lecture: Major determinants of environmental management in printing houses. Exercises: Principle and application of membrane filtration method. 14. Lecture: Characteristics of waste from the graphic and related industries. Methods of disposal - landfilling, incineration, recycling. Exercises: Composting of prints. 15. Knowledge check through a colloquium. Final colloquium on laboratory.
	Title
Required literature (available in the library and/or via other media)	M. London, Environment, Health and Sustainable Development, Open University Press, Berksire, 2011
	F. Shapiro, Environmental Regulation for Printers, Jelmar Pablishing Co., New York, 2003.
	M. K. Hill, Understanding Environmental Pollution, 2nd Ed. Cambridge University Press, Camridge, 2004.

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GRAPHIC PROGRAMMING LANGUAGES			Code: 19559
Course teacher	KLAUDIO PAP, MAJA RUDOLF	Course status	optional
Original course title	Grafički programski jezici	Semester (winter/summer)	winter
Teacher's contact email	klaudio.pap@grf.unizg.hr maja.rudolf@grf.unizg.hr	ECTS credits	4
Study programme (undergraduate BSc, graduate MSc)	BSc	Hours of teaching (L+S+E)	30+0+15
COURSE DESCRIPTION			
Course objectives	Training for performing programming tasks using graphical programming languages in graphic engineering. Graphical coordinate space, output coordinate space, and programming of the coordinate grid. Rules for writing commands and parameters in stack-oriented graphical language. Concept of graphic pages and corresponding measuring units. Absolute and relative programming of lines and paths, closing paths and filling them. Creating graphic shapes in multiple layers. Control of line endings, line joining, and line discontinuity. Programming circular and tangential shapes and circular arcs. Bezier curve and its mathematical definition. Types of Bezier curve joining. Joining Bezier curve with tangent curve. Saving and restoring graphic state. Rotations, translations, horizontal and vertical transformations of the coordinate system. Control of object fill and "holes" by programming the orientation of the path clockwise and counterclockwise. Multiple transparencies of objects by even-odd rule of origin ray crossings. Stack memory management. Arithmetic and logical operators in PostScript language (representative of PDL languages). Programming loops in graphical programming languages. Repetition and transformation of graphic shapes. Programming tonal transitions in RGB, CMYK, and HSB color spaces. Grouping graphic shapes. Individual programming manipulation of a letter and converting an envelope to a vector path. Functions of textual strings and data arrays. Program control of font and text in PostScript language. Optimization of memory usage by program stack control.		
Learning outcomes	Evaluation of features of prepress, printing, finishing, and multimedia devices. Defining the type and purpose of a message based on the user, form, and type of graphic media. Applying high-level structured programming languages Using tools and knowledge of technological processes and materials in the design, reproduction, and distribution of visual messages Applying techniques for processing and designing different media (images, sound, video, photography, animation) Differentiating coordinate system transformations from graphic shape deformations. Constructing programs for lines, curves, arcs, and other types of vector paths. Using programming branching, loops, arrays, and functions in a graphic programming Language. Designing programmable graphic elements in different color systems and graphic states. Creating user procedures for later independent use. Applying optimization of memory usage through programmatic control of stack memory in		

	printing devices. Applying programmatic manipulation of individual characters. Applying programmatic control of fonts and text
	Expanding the capabilities of standard market programs with custom programs for specific purposes.
Course content (syllabus)	1. Lecture: Graphic coordinate space, print coordinate space, and programming coordinate grid; Exercises: Programmatic positioning in graphic coordinate space and defining straight paths in it. 2. Lecture: Rules for writing commands and parameters in stack-oriented graphic language, concept of graphic page and associated measurement units; Exercises: Programming control of projected measures and multiple variations of stack writing of graphic command parameters. 3. Lecture: Absolute and relative programming of lines and paths, closing paths and filling them; Exercises: Absolute and relative programming of lines and paths, creating polygons and filling them. 4. Lecture: Control of the final shape of lines, joining lines, and line breaks; Exercises: Programming the final shape of lines, joining lines, and line breaks. 5. Lecture: Programming circular and tangent shapes and circular segments; Exercise: Programmatic implementation of given circular and tangent shapes and circular segments. Lecture: Programming Bezier curves in vector paths; Exercise: Programmatic implementation of a given path using Bezier curves. 6. Lecture: Rotations, translations, horizontal and vertical transformations of the coordinate system; Exercise: Programmatic implementation of object rotation, translation, and reflection, midterm. 7. Lecture: Control of object fill and "holes" with programming of path orientation and control of multiple object transparencies; Exercise: Programmatic implementation of objects with "holes" in multiple possible ways. 8. Lecture: Stack memory management, arithmetic and logical operators in stack-oriented language; Exercise: Use of arithmetic and logical operators with current output of stack memory state. 9. Lecture: Loops in graphic programming languages, repetition and transformation of graphic shapes; Exercise: Repetition, cloning, and transformation of graphic objects. 10. Lecture: Programming tonal transitions in RGB, CMYK, and HSB color spaces; Exercise: Programming color in various color systems and their use on graphic entities. 11. Lecture: Grouping graphic shapes; Exercise: Defining program procedures for groups of graphic shapes and basic manipulations with them. 12. Lecture: Individual program manipulation of a letter character and converting envelope into a vector path; Exercise: Program manipulation of a letter character and converting the envelope into a vector path. 13. Lecture: Functions of text strings and data arrays; Exercise: Programming with a basic set of commands for text strings 14. Lecture: Programmatic control of fonts and text; Exercise: Programmatic control of fonts and text, final exam.
	Title
Required literature (available in the library and/or via other media)	Žiljak, K. Pap, POSTSCRIPT PROGRAMIRANJE GRAFIKE, FS, Zagreb, 1998.
	/2004. Tiskovno izdanje: ISBN: 953 - 199 – 000, Elektr. izdanje: http://free-zg.htnet.hr/kpap/

	I. Adobe Systems: „PostScript Language Reference Manual", Addison-Wesley, 1985 -
	I. Adobe Systems: „PostScript Language Tutorial and Cookbook", Addison-Wesley, 1985
	H. McGilton, M. Campione: „PostScript by Example", Addison-Wesley, 1992

SCIENCE OF ENVIRONMENT AND DESIGN			Code: 38011
Course teacher	IVANA BOLANČA MIRKOVIĆ	Course status	compulsory
Original course title	Znanost o okolišu i dizajn	Semester (winter/summer)	winter
Teacher's contact email	ivana.bolanca.mirkovic@grf.unizg.hr	ECTS credits	4
Study programme (undergraduate BSc, graduate MSc)	BSc	Hours of teaching (L+S+E)	30+15+0
COURSE DESCRIPTION			
Course objectives	The students are introduced to the global environmental issues, such as air pollution, greenhouse effect, stratospheric ozone depletion, winter and summer smog, water pollution, soil pollution, solid waste, hazardous waste, emission sources, direct and indirect causes of emissions, and design approach in product creation context with the aim of reducing anthropogenic impact on environmental quality. The course content covers the specificities of emissions from the production processes of graphic and related industries, working and user activities with the goal of implementing measures through product design towards the preservation or improvement of environmental quality.		
Learning outcomes	Students will be able to recognize and describe global environmental issues and explain the principles of graphic design in the context of creating products with a lower environmental impact. They will be able to explain the impact of solid waste on the environment and the principles of design in the context of waste reduction. They will be able to explain the principles of design for preventing pollutant emissions. They will be able to list and explain the ecological principles of graphic product design. They will be able to apply design tools in the context of ecological efficiency and differentiate their limitations.		
Course content (syllabus)	1. Lecture: Introduction, importance of environmental science, general concepts of environmental protection related to design. Seminar: Introduction, individual assignments. 2. Lecture: Design and global environmental issues. Air pollution. Greenhouse effect: emission sources, mechanism of formation, impact on the environment. Seminar: Alternative product design using global warming indicators. 3. Lecture: Design and global environmental issues II. Winter smog: emission sources, mechanism of formation, impact on the environment, prevention measures. Seminar: Product design and prevention of pollutant emissions causing winter 4. smog. 5. Lecture: Design and global environmental issues III. Summer smog: emission sources, mechanism of formation, impact on the environment, prevention measures. Seminar: Design and prevention of primary pollutant emissions causing 6. summer smog. 7. Lecture: Design and global environmental issues IV. Destruction of the ozone layer in the stratosphere: mechanism of the destruction process, impact on the environment. Seminar: Design and measures for protecting graphic products from global radiation.		

	8. Lecture: Design and global environmental issues V. Pollutants in water: sources of pollution primarily in the domain of graphic materials, impact on the environment. Seminar: Design of graphic products and prevention of water pollution.
	9. Lecture: Design and Global Environmental Issues VI: Solid Waste. Hierarchy of Waste Disposal Methods. Seminar: Graphic Product Design Settings in the Context of Waste Reduction.
	10. Lecture: Knowledge Assessment through a Colloquium. Seminar: Designer's Impact on Reducing Pollutants during Production and Use of Products.
	11. Lecture: Toxic Substances in Air and Water, Environmental Impact. Seminar: Design and Prevention of Emission of Toxic Substances.
	12. Lectures: Ecological Aspects of Non-Renewable Energy Sources. Seminar: Product Design with Low Energy consumption through Production and Consumption.
	13. Lectures: Ecological Aspects of Renewable Energy Sources. Seminar: Energy Efficiency in the Workplace - Ecological Aspect.
	14. Lecture: Ecological Aspect of Transportation. (ECTS 0.21) Seminar: Product Design in the Context of Pollution Reduction during Transportation.
	15. Lecture: Design Support Tools that Increase Environmental Impact Reduction Efficiency. Seminar: Solving Examples in the Domain of Graphic Product Design.
	16. Lecture: Design Tools in the Context of Ecological Efficiency. Seminar: Solving Examples in the Domain of Graphic Product Design.
	17. Lecture: Knowledge Assessment through a Colloquium. Compensation for Justifiably Unheld Student Presentations of Seminar Papers

	Title
	L. Pepper, C.P. Gerba, M.L. Brusseau, Environmental and Pollution Science, Springer Verlag, London, 2008.
	G.T. Miller, S. E. Spoolman, Environmental Science, Brooks/Cole, Canada 2013.
Required literature (available in the library and/or via other media)	A. Chick, P. Micklethwaite, Design for Sustainability Change, AVA Publishing S, 2011
	C. Vezzoli, E.Manzini, Design for Environmental Sustainability, Springer Verlag, London, 2008

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PRINTING INKS			Code: 19539
Course teacher	SONJA JAMNICKI HANZER	Course status	optional
Original course title	Tiskarske boje	Semester (winter/summer)	winter
Teacher's contact email	sonja.jamnicki.hanzer@grf.unizg.hr	ECTS credits	4
Study programme (undergraduate BSc, graduate MSc)	BSc	Hours of teaching (L+S+E)	30+0+15
COURSE DESCRIPTION			
Course objectives	The goal of the course is to acquaint students with the production, composition, and basic properties of printing inks as well as their proper application in graphic technology. Within the course, students acquire knowledge of the properties and special features of printing inks for various printing techniques. Students will acquire basic and practical skills necessary for the selection of printing inks for printing on various substrates to achieve the desired printing quality. Students will also acquire competencies for conducting specific laboratory testing of printing inks.		
Learning outcomes	Explain the chemical and physical properties and the role of each component of printing inks. Explain the rheological properties of printing inks and how they affect print quality. Classify and explain different drying mechanisms of printing inks. Relate the influence of the properties of the substrate, the chemical composition of the printing ink, its viscosity, layer thickness, printing speed and other parameters on the quality of the final print. Determine the optimal combination of ink and printing substrate to avoid printing problems. Explain the properties and composition of inks for various printing techniques. Identify potential printing problems caused by inadequate ink properties. Identify the possible problems that can occur when printing on food packaging.		

Course content (syllabus)	1. Components of printing inks:
	   • Use of pigments and dyes
	   • Ink Vehicles (oils, resins, solvents)
	   • Additives and their types, uses and properties
	2. Drying mechanisms and ink formulations
	   • Absorption drying
	   • Oxidation-polymerisation drying
	   • Evaporation drying
	   • Quickset drying
	   • Coldset drying
	   • Heatset drying		

	• Ultraviolet curing, EB curing • Other methods of ink drying and specialty inks 3. Rheology of printing inks (ink tack, ink flow, viscosity, thixotropy) 4. Letterpress inks 5. Lithographic inks 6. Flexographic Inks 7. Gravure Inks 8. Screen Inks 9. Ultraviolet and Electron Beam Curing Systems 10. Ink jet inks 11. Manufacture of printing inks 12. The use of printing inks for food packaging
	Title
	The Printing Ink Manual, Fifth Edition, R. H. Leach, R. J. Pierce (Eds.), Springer, Dordrecht, 2008.
	C. H. Williams, The Printer's Ink Handbook, Mclean Hunter Ltd, Hertfordshire, 1992.
Required literature (available in the library and/or via other media)	N. R. Eldred and T. Scarlett, What the Printer Should Know about Ink, GATF, Pittsburgh, 1990.
	Ronald E Todd, Printing inks: Formulation principles, manufacture and quality control testing procedures, Pira International, 1994
	Teaching materials prepared by the teacher.

GRAPHIC DESIGN 1			Code: 32785
Course teacher	MAJA BROZOVIĆ	Course status	compulsory
Original course title	Grafički dizajn 1	Semester (winter/summer)	winter
Teacher's contact email	maja.brozovic@grf.unizg.hr	ECTS credits	4
Study programme (undergraduate BSc, graduate MSc)	BSc	Hours of teaching (L+S+E)	15+0+45
COURSE DESCRIPTION			
Course objectives	To obtain the knowledge and acquire the skillset needed in visual design mindful of the user, form and graphic media type. The course is based on the study of the basic elements of the visual structure and their organization into functional optical systems. The analysis of graphic structure comprises of identifying the elementary meanings and data organisation models which follow from the appearance of the text and the readability of the message in accordance to the choice of the shape and size of letterforms as abstract forms and the choice of content and position of pictorial elements as figurative forms. By way of systematic analysis of graphic structure, students will become capable of organizing information in accordance to the type and intent of the message. Structural analysis is considered and conducted on the basis of every graphic media's twofold functionality: operative and persuasive communication. The message can be interpreted according to the goal and users by choosing the appropriate types of sign.		
Learning outcomes	Interpretation and reinterpretation of visual systems. Adjusting readability of graphic composition. Analysing visual message with regard to objectivity level. Apply an appropriate visual structure considering the purpose of the visual message. Show the principles of composing elements of visual form. Sketch the redesigned unit structure of the graphic media. Solve the optically harmonising newspaper page layout.		
Course content (syllabus)	1. Visual structure analysis. Sketch and analyse a newspaper article from the point of view of visual structure. 2. Visual structure analysis. Reinterpret a newspaper article based on the obtained data about its structure. 3. Increasing the readability of the visual message Increase the readability of a newspaper article by intervention in typography. 4. Increasing the readability of the visual message. Increase the readability of a newspaper article by emphasizing the hierarch of data. 5. Informational values of the message. Emphasize informative parts of the message compared to redundant ones. 6. Informational values of the message. Define the styles of titles, sub-titles, super-titles, text by applying letter scales and selecting illustrative systems.		

	7. Measuring the meaning of the message in levels of objectivity. Present the article in operative and persuasive communication.
	8. Order and disorder system Present the topic of the article from another aspect in relation to the target group.
	9. Animation of a visual message. Animate the obtained content of the article using image information.
	10. Stylization of the visual message. Stylize the content of the article using rational, conventional signs.
	11. Principles of composing. Show the static composition of the article in the dynamic relationship of elements.
	12. Color system. Stratify the hierarchy of information using pairs of contrasting colors.
	13. Message redesign. Redesigning a newspaper article.
	14. Optical balance of the graphic media page. On the newspaper page, achieve an optical balance from the obtained number of articles.
	15. Optical balance of the graphic media page. On the newspaper page, achieve an optical balance from the obtained number of article.
	Title
Required literature (available in the library and/or via other media)	Arnheim, R.: Art and Visual Perception - A Psychology of the Creative Eye, University of California Press, 2004.
	Ware, C.: Information Visualization, Third Edition: Perception for Design (Interactive Technologies), Elsevier Inc, 2013.
	Bringhurst, R.: The Elements of Typographic Design: Form and Communication, John Wiley and Sons Inc., New Jersey, 2007.
	Mesaroš, F.: Tipografsko oblikovanje, Viša grafička škola u Zagrebu, Zagreb, 1981.
	Malamed, C.: Visual Language for Designers: Principles for Creating Graphics That People Understand, Rockport Publishers, 2009
	Pettersson, R.: It Depends - Principles and Guidelines, International Institute for Information Design, Tullinge, 2012

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ORGANIZATION OF GRAPHIC PRODUCTS			Code: 19548
Course teacher	DIANA BRATIĆ	Course status	optional
Original course title	Organizacija grafičke proizvodnje	Semester (winter/summer)	winter
Teacher's contact email	diana.bratic@grf.unizg.hr	ECTS credits	4
Study programme (undergraduate BSc, graduate MSc)	BSc	Hours of teaching (L+S+E)	30+15+0
COURSE DESCRIPTION			
Course objectives	The main objective of the course is to familiarize students with the fundamentals of organizational theory and the factors that influence the organization, design, planning and management of graphic production to enable them to acquire skills for successful management of production, logistics and warehousing.		
Learning outcomes	Identify, analyse, and evaluate the key elements that influence the planning process and the preparation of a business plan. Apply mathematical procedures in the preparation of a unified aggregate and operational production plan. Propose an organizational chart of work units and a productive workplace. Plan capacities. Prepare a cost estimate for a graphic product. Make technological preparations for production. Evaluate, select, and apply database management techniques and tools. Create a project plan.		
Course content (syllabus)	1. Organization 2. Planning 3. Production 4. Capacity planning 5. Calculation 6. Preparation and monitoring of work documentation 7. Technological preparation of work 8. Technological preparation of production 9. Production monitoring 10. Production management software 11. Logistics and internal transport management 12. Inventory management 13. Database management		

	14. Planning, implementation and control of projects
	15. Business plan
	Title
	Kiran, D. R. (2019), Production Planning and Control: A Comprehensive Approach
Required literature (available in the library and/or via other media)	Rushton, A., Croucher, P., Baker, P. (2004), The Handbook of Logistic & Distribution Management
	Lectures from the course

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OPTICS, ELECTROSTATICS, AND FLUID MECHANICS		Code: 254260	
Course teacher	KATARINA ITRIĆ IVANDA	Course status	compulsory
Original course title	Optika, elektrostatika i mehanika fluida	Semester (winter/summer)	summer
Teacher's contact email	katarina.itric.ivanda@grf.unizg.hr	ECTS credits	5
Study programme (undergraduate BSc, graduate MSc)	BSc	Hours of teaching (L+S+E)	30+0+30
COURSE DESCRIPTION			
Course objectives	The aim of the course is the application of fundamental knowledge in fluid mechanics, electrostatics, as well as geometric and physical optics in the analysis of technical and technological processes in graphic reproduction. In the first part of the course, students will become familiar with fluid mechanics, where, within the scope of hydrostatics and hydrodynamics, they will address topics related to fluid viscosity, the characteristics of ideal fluids, and their application in graphic technology. Topics covered in the course will also include light interference and diffraction on devices used in quality control during graphic processes. Students will acquire knowledge related to the phenomenon of electron emission from materials under the influence of electromagnetic radiation and become acquainted with photometric quantities describing light sources. The goal is also to understand the optical interaction of light with materials, distinguish between incoherent and coherent radiation, and apply the theory of electromagnetic radiation polarization in graphic reproduction.		
Learning outcomes	1. Acquire knowledge about the rheological properties of fluids. 2. Understand and apply the laws of geometric and physical optics. 3. Describe various types of electrical phenomena in graphic technology. 4. Apply acquired knowledge from electrostatics in explaining the principles of digital printing. 5. Define the fundamental forms of electromagnetic radiation interaction with matter: reflection, transmission, and absorption, and specify systems that absorb and scatter light. 6. Analyze the interaction of light and printing substrates based on simple physical models. 7. List the basic characteristics of the physics of color.		
Course content (syllabus)	1. Introductory Lecture 2. Fluid Mechanics I – Hydrostatics - Hydrostatic pressure; buoyancy; surface tension; the influence of cohesive and adhesive forces on molecules in a fluid; wetting and non-wetting surfaces; wetting angle and its significance in the graphic industry; capillary effect; explaining the difference between real and ideal fluids; humidity. 3. Fluid Mechanics II – Hydrodynamics - Laminar flow, deformation of fluids; turbulent flow; viscosity of fluids and graphic inks; characteristics of ideal fluids, continuity equation, Bernoulli's equation. 4. Electrostatics and Electrodynamics - Electric charges; charge distribution on real bodies; surface charge density; electric force; Coulomb's law; electric field; electric potential; electric current; application of concepts in graphic technology.		

	5. Photoelectric Effect - Photoelectric effect equation; threshold frequencies; photoelectric current and photocells; application of the photoelectric effect in graphic processes. 6. Geometric Optics I - Laws of geometric optics; limitations of the validity of laws, mirror and diffuse reflection, total internal reflection; refraction of light in flat optical systems (plane-parallel plate, prism); light dispersion. 7. Geometric Optics II - Imaging in geometric optics; real and virtual objects, formation of real or virtual images; conditions for unique mapping; Gaussian approximation; conjugate equation; linear magnification; imaging on flat and spherical mirrors. 8. Geometric Optics III - Imaging on thin lenses; lens systems; optical instruments: camera; microscope; microscope magnification, resolution, Rayleigh's criterion. 9. Wave Optics I - Wave nature of light; interference of light; coherent sources and conditions for the formation of bright and dark fringes. Young's experiment; Fresnel mirrors, thin films, Newton's rings; application of interference in graphic phenomena. 10. Wave Optics II - Diffraction at an obstacle; diffraction at a slit; diffraction on an optical grating; conditions for maxima and minima of light; intensities of individual maxima; application of diffraction in graphic processes. 11. Photometry; measurement of the visible part of the electromagnetic waves; energy and photometric quantities of light sources; equivalent; human eye sensitivity in the visible light spectrum; intensity, flux, and quantity of light; Lambert's law; representation of functional relationships and finding extreme values; optimal values of illumination of certain surfaces. 12. Polarization of Light - Methods of light polarization; types of polarization; Fresnel equations; the role of polarizers in quality control devices. 13. Physics of Color - Visible light spectrum and color tone; frequency and energy of visible light; psychophysical perception of color; color representation theory using three stimuli; additive and subtractive color mixing; color of opaque and transparent objects. 14. Interaction of Light with the Printing Substrate; resonant and non-resonant interaction; reflection, transmission (refraction), absorption; systems that absorb and scatter light. Beer-Lambert system. Kubelka-Munk system. 15. Models for Describing Reflection from a Halftone Image: Murray-Davies and Yule-Nielsen models; optical and mechanical dot gain.
	Title
Required literature (available in the library and/or via other media)	P. Kulišić i V. Lopac: Elektromagnetske pojave i struktura tvari, Školska knjiga, Zagreb, 2003.
	V. Henč-Bartolić i P. Kulišić: Valovi i optika, Školska knjiga, Zagreb, 2004.
	V. Henč-Bartolić i ostali: Riješeni zadaci iz valova i optike, Školska knjiga, Zagreb, 2002.
	V. Lopac i ostali: Riješeni zadaci iz elektromagnetskih pojava i strukture tvari, Školska knjiga, Zagreb, 2003.
	P.Kulišić: Mehanika i toplina, Školska knjiga, 2005.

PHOTOGRAPHIC PROCESSES			Code: 19535
Course teacher	RAHELA KULČAR	Course status	compulsory
Original course title	Photographic processes	Semester (winter/summer)	summer
Teacher's contact email	rahela.kulcar@grf.unizg.hr	ECTS credits	4
Study programme (undergraduate BSc, graduate MSc)	BSc	Hours of teaching (L+S+E)	30+0+15
COURSE DESCRIPTION			
Course objectives	The course introduces students to the fundamental photochemical reactions and principles, and the structure and composition of photographic materials based on silver salts as the photosensitive substance. It covers the processes and chemistries involved in the creation of a photographic image. Photographic properties and characteristics of the photographic image are examined. The characteristics of negative and positive materials, as well as finished images, are discussed. Alternative photographic techniques and photosensitive emulsions required for various processes that produce a photographic image without the use of a camera are analyzed.		
Learning outcomes	The student will be able to practically apply the basic laws of photochemistry. After passing the course, the student will be able to independently, based on their knowledge of the structure and image formation, carry out the classical photographic process and select suitable materials for the desired result of the final photographic image. Additionally, they will be able to independently create a photographic image using an alternative photographic technique without the use of a camera on various surfaces.		
Course content (syllabus)	1. Photochemical reactions and basic photochemical laws. Grotthus's law, Lambert-Beer's law, Einstein's law, Reciprocity law, Schwarzschild's law. Application of these laws in photography. 2. Structure and production of photographic materials. Types of substrates and their properties. Photographic layers and their components. Preparation of photographic emulsions. 3. Precoating additives to enhance the photographic properties of photomaterials. Optical sensitizers and stabilizers. Additives to improve physical and mechanical properties. Coating of emulsion. Confectioning of photographic materials. 4. Camera. Lens. Illumination of photographic materials. Mechanism of latent image formation. 5. Processing of photographic layers in solutions. Developer and its components. Utilization and regeneration of the developer. Developer induction period. 6. Types of developers. Chemistry of development. Factors influencing development. Physical development. Development termination. Composition of fixing solution. 7. Chemistry of fixation. Types of fixers. Fixer regeneration. Washing and drying. 8. Characteristics of photographic layers. Sensitometry and its parameters. Photographic exposure. Opacity. Transparency. Reflection. Density of darkening.		

	9. Characteristic densities of darkening. Sensitometric testing of photomaterials.
	10. Gradation. Factors affecting gradation.
	11. General sensitivity DIN, ASA, ISO values. Spectral sensitivity.
	12. Ability to resolve photomaterials. MTF function. Graininess and granularity.
	13. Methods of obtaining a photographic image. Direct method. Indirect method. Negative-positive process. Negative image, negative film, positive image, positive film.
	14. Photographic paper, structure, and properties. Application of different gradations of photographic paper. Variable gradation photographic papers.
	15. Alternative photographic techniques. Photosensitive emulsions.
	Title
Required literature (available in the library and/or via other media)	M. Langford; Advanced Photography, Focal Press, Oxford, 1999.
	London, Stone, Upton; Photography, Pearson Education, 2008.
	James C., The book of alternative photographic processes, Cengage Learning, 2015.

PRINTING FORMS 2			Code: 19558	
Course teacher	SANJA MAHOVIĆ POLJAČEK, TAMARA TOMAŠEGOVIĆ	Course status		compulsory
Original course title	Tiskovne forme 2	Semester (winter/summer)		summer
Teacher's contact email	sanja.mahovic.poljacek@grf.unizg.hr tamara.tomasegovic@grf.unizg.hr	ECTS credits		4
Study programme (undergraduate BSc, graduate MSc)	BSc	Hours of teaching (L+S+E)		30+0+15
COURSE DESCRIPTION				
Course objectives	Become familiar with the digital workflow of printing plates and forms. Define and compare different CtP systems for the production of printing plates according to printing techniques, technical solutions of printing units and construction of imaging devices. Ability to plan the stages of the reproduction process in the context of graphic prepress. Definition of various production methods depending on the type and material of CtP printing plates and related calculated process conditions. Calculation of process parameters in the production of printing plates for various graphic products.			
Learning outcomes	Students will have the knowledge and be able to identify the technological phases in graphic arts prepress; be able to classify and explain the operations and processes in digital prepress; be able to plan the sequence of process operations in digital (CtP) plate making processes. After completing the course, students will be able to define the CtP system for imaging plates for different printing technologies, classify and compare units for image setting on the printing plates, compare and analyse different CtP plate types within a printing technology, apply different tools to optimise processes in plate making, calculate and select the printing plate type considering the process parameters, analyse and evaluate the development of CtP technologies. Students will be able to work in a team, apply their knowledge in literature research.			
Course content (syllabus)	1. Digital workflow - the position of printing plates/forms in the reproduction process 2. Computer to… technologies 3. Digital prepress 4. Digital (CtP) processes for production of printing plates 5. Types of CtP printing plates 6. Formation of the digital image on printing plate 7. Computer processing of information and procedures for imaging of printing plates 8. CtP processes for production of flexographic printing plates 9. CtP process for production of flexographic printing plates 10. CtP process for production of printing plates for offset printing 11. CtP process for production of printing plates for intaglio printing			

	12. CtP process for production of printing plates for screen printing 13. CtP process for production of printing plates for pad printing 14. Measuring the quality level of printing plates 15. Instrumental and visual methods of monitoring the quality level of printing plates
Required literature (available in the library and/or via other media)	Title
	S. Mahović Poljaček, CtP tehnologije, Sveučilište u Zagrebu Grafički fakultet, Zagreb, 2021.
	H. Kipphan, Handbook of Print Media, Springer Verlag Berlin Heidelberg New York, Heidelberg, 2001.
	K. Johansson, P. Lundberg, R. Ryberg, A Guide to Graphic Print Production, 3rd Edition, Wiley, New York, 2011.
	R. M. Adams, F. J. Romano, Computer to Plate: Automating the Printing Industry, GATFPress, Pittsburg, 1999.
	J. T. Lind, G. M. Radencic, GATF Computer-To-Plate Performance Study, Vol. 31, Gatf Research & Technology Reports, Printing Industries Press, 2002.
	J. Deemer, Glossary of Graphic Communications, 4th edition, GATFPress, Pittsburg, 2008.

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DIGITAL MULTIMEDIA 1			Code: 19529
Course teacher	KLAUDIO PAP, MAJA RUDLOF	Course status	compulsory
Original course title	Digitalni multimedij 1	Semester (winter/summer)	summer
Teacher's contact email	klaudio.pap@grf.unizg.hr maja.rudolf@grf.unizg.hr	ECTS credits	5
Study programme (undergraduate BSc, graduate MSc)	BSc	Hours of teaching (L+S+E)	30+0+30
COURSE DESCRIPTION			
Course objectives	Acquiring fundamental knowledge about digital multimedia components and their potential use. This subject studies digital multimedia with all its basic components. Basic knowledge is provided on digital text, digital image, sound, video, and animation. The basics of the em square, digital writing lines, and font are defined as an organized set of digital squares. The definition of vector, pixel, and raster images is explained. The mathematical definition of the Bezier curve and types of connections in vector graphics are also discussed. The digital vector path and its attributes for use, as well as the digital image element, its multichannel coding of gray levels, and organized grouping into a digital image, are defined. Basic digital transformations and filtering over digital images are studied. The histogram of the digital image is introduced, along with its use for redistributing n-channel coded gray levels. The basics of digital rasterization, color digitization in different color systems, and the basic integration of text, image, sound, video, and animation into multimedia content are covered. The definition of basic HTML elements and attributes, as well as the CSS basic command set and fundamentals of usage for multimedia content presentation on the web medium, are also included.		
Learning outcomes	Evaluation of the characteristics of prepress, printing, finishing, and multimedia devices. Classification of different media and identification of their main features depending on the type of communication. Defining the type and purpose of the message based on the user, form, and type of graphic media. Using tools and knowledge of technological processes and materials in designing, reproducing, and distributing visual messages. Classifying the basic components of digital multimedia. Differentiating between vector, pixel, and raster image formats. Using different types of encoding of digital information in different digital media. Using graphic tools for basic processing and integration of digital multimedia content. Differentiating between different color digitization systems in the digital multimedia environment. Using software tools for basic digital transformations and filtering of digital images. Applying the basics of HTML and CSS technology for simple multimedia presentations on a website.		
Course content (syllabus)	1. Lecture: Basic definitions of digital text, digital image, sound, video, and animation; Exercises: Basic font operations, editing, generating, and installation		

2. Lecture: Definition of em square, digital writing line, and font as an ordered set of em squares; Exercises: Basics of vector graphics and typography application in vector programs
3. Lecture: Definition of vector, pixel, and raster images; Exercises: Complex shapes in vector graphics and color systems
4. Lecture: Mathematical definition of Bezier curve and types of connections in vector graphics; Exercises: Introduction of pixel graphics into vector environments
5. Lecture: Definition of digital vector path and its attributes for use; Exercises: Basics of 3D simulation in vector program, Colloquium
6. Lecture: Digital image element, its multichannel coding of grayscale and organized grouping into a digital image; Exercises: Basics of coloring monochromatic images, working with selections and channels
7. Lecture: Basic digital transformations and filtering on digital images; Exercises: Basics of digital retouching
8. Lecture: Histogram of digital image and its use for redistribution of n-channel coded grayscales; Exercises: Basics of photomontage
9. Lecture: Introduction to the basics of digital rasterization; Exercises: Automation of digital content processing: Actions
10. Lecture: Basics of digitizing color in different color systems; Exercises: Basics of multi-page layout, master, styles, wrapping text around image (free forms), colloquium
11. Lecture: Basics of integrating text and images; Exercises: Basics of multi-page layout, master, styles, wrapping text around image (free forms)
12. Lecture: Basics of integrating sound and video into multimedia content; Exercises: Introduction to video, basics of cutting sequences, merging sequences, and adding sound
13. Lecture: Basics of animation in multimedia content; Exercises: Basic animations - frames, tweening
14. Lecture: Definition of basic HTML elements and attributes and CSS basic set of commands; Exercises: HTML: forms and lists
15. Lecture: Basics of multimedia content presentation on the web medium; Exercises: Introduction of multimedia content into web documents, colloquium

	Title
	K. Pap: Osnovna HTML pravila http://www.klaudiopap.com/pretraznici-i-navigacija-na-webu/
Required literature (available in the library and/or via other media)	ed. John G. Webster, Multimedia Encyclopedia of Electrical and Electronics Engineering, V37, 1999, Multimedia, 1999.
	Jesse S. Jin, Changsheng Xu, Min Xu, The Era of Interactive Media, ISBN 978-1-4614-3500-6, 2013., Springer
	Optional: V. Žiljak, K. Pap, POSTSCRIPT PROGRAMIRANJE GRAFIKE, FS, Zagreb,1998. /2004. Tiskovno izdanje: ISBN: 953 - 199 – 000, Elektr. izdanje: http://free-zg.htnet.hr/kpap

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INFORMATICS 2			Code: 32895
Course teacher	TIBOR SKALA MARKO MARIČEVIĆ	Course status	optional
Original course title	Informatika 2	Semester (winter/summer)	summer
Teacher's contact email	tibor.skala@grf.unizg.hr marko.maricevic@grf.unig.hr	ECTS credits	3
Study programme (undergraduate BSc, graduate MSc)	BSc	Hours of teaching (L+S+E)	15+0+15
COURSE DESCRIPTION			
Course objectives	Acquiring knowledge about the principles of computer system operation, the principles of design, construction and maintenance of the information system, and with areas of application and trends in information development technologies. The aim of the course is to introduce students to models of information system construction and its use in the business environment. Various aspects of computer application will be pointed out optimization of business processes and implementation of electronic business systems. It will also be defined describe the ways of presentation of processing results with an emphasis on the application of multimedia, and the development and application of virtual reality. Students will learn about the types of computer networks, and the basic one's devices necessary for their realization. The concept of the network will be expanded with knowledge from the field Internet and its technologies, internet services, the way to find data on the Internet, and the necessary infrastructure. Security and protection of information systems are the foundation uter applications in corporate conditions. Awareness of the existence of threats and importance will develop protection of data content. Data protection measures will be defined and explained, as well as specific possibilities of their application. At the pragmatic level, students will be trained to work in open-source systems.		
Learning outcomes	Students will be able to: understand and explain the principles of computer system operation, analyze and explain trends in the development of information technology, create and adapt presentations and use basic network services based on acquired IT literacy.		
Course content (syllabus)	1. Introductory lecture. Introduction to the subject and explanation of the way of work. Referral to teaching contents presented on the Internet and within the LMS system Types of information systems, models of building information systems. 2. Information systems in certain business areas, information system in the area finance and accounting, production information systems, procurement information systems, sales information systems, personnel information systems. Elements of the system software support, the concept of an operating system, types and functions of an operating system.		

	3. Approach to the construction of an information system, life cycle of an information system, stages of construction information system, information system development planning, business analysis system, information system design, information system development, implementation new system, system maintenance.
	4. Electronic business is a condition for modern business and organization in under modern conditions, stages of development of electronic business, company-to- company business (B2B), business of the company with the end user (B2C), business of the end user s company (C2B), end user to end user (C2C) business. Block diagrams and data flow diagrams, numerical coding.
	5. Textual presentation of content, inclusion of sound in the description and presentation of content, graphically display, multimedia in the display of content. The concept of multimedia, multimedia as a technology, multimedia as a communication phenomenon, development of multimedia communication systems, hypertext and hypermedia for non-linear content movement, IT concept multimedia, virtual reality, elements for building virtual reality.
	6. Multimedia in the presentation and connection of facts in the function of learning, virtual reality step according to kinetic memory, multimedia as a condition for efficient realization of lifelong learning, multimedia description of the real system in exchange for a conceptual image of the description of the real system. Spreadsheets, simple databases.
	7. Elements of the digital communication system, data transfer in a computer network, technological computer network aspects, necessary elements for building a computer network, computers, communication channels, communication adapters, communication protocols, operating system for network management. Constituent parts, the role of computers in communication.
	8. Types of computer networks, local networks, regional networks, wide area networks, topologies computer networks, connection of topology and organizational solutions in the business system, telematic services. User interface, technological aspects of computer networks.
	9. The concept of Internet communication, the origin and development of the Internet, the working principle of the Internet, characteristics of the Internet, elements and topology of the Internet, Internet services and their application in business. Internet services, electronic mail, discussion groups, distribution lists, transmission remote data. Web infrastructure, areas of application, further development of the Internet. Conditions Internet business, development and areas of application. Principles of data transmission in the network computers.
	10. Systems and methods for finding information on the Internet, thematic catalogs, search engines, methods querying using search engines, basic logical operators, setting phrases to search engines, substitution operators, structured search, search by file type, metasearch engines, intelligent agents, alternative search methods, search strategies, evaluation of found content, according to institution, according to a well- known and recognized author, recognition of reference literature.
	11. Application of Internet technology in the function of learning, hypertext, hypermedia, application of ICT in teaching, distance learning, mixed teaching systems. Areas of application information technologies.
	12. The concept of information system protection, the concept of information system security, reasons construction of the information system protection system, the concept of computer crime, sources and forms of threats to the information

	system, nature as a source of threat, man with attribution intentionality, man with the attribution of unintentionality, technical means as a source of threats.
	13. Steps in building a business information system security system, policy definition information system security, selection of security system building strategies information system, selection of the bearer of responsibility for the construction of the security system, selection of approaches in the way of implementation of the security system.
	14. Assessment of the importance of the data content of the business system, external factors of importance data content, internal factors of data content significance, assessment of form and intensity of threats to data content with regard to the estimated significance, risk assessment o individual content, quantitative assessment measures and qualitative assessment measures. Selection protection measure.
	15. Protection measures of information systems, material carrier as a protection measure, programmatic protection measures, protection at the level of the operating system, protection at the level of application software support, backup with change of material carrier as a protection measure, protection cryptographic protection measures, symmetric crypto systems, asymmetric encryption systems, function of a digital signature, ways to create a digital signature, virus protection, technical protection measures, physical protection measures, organizational protection measures, protection measures from the area rights. Verification of the validity of the protection measures taken.
	Title
Required literature (available in the library and/or via other media)	Vlatko Čerić … et al. Informacijska tehnologija u poslovanju.
	Dobrinić, D. et al. Izravni marketing. TIVA Tiskara, Varaždin, 2005.
	Stair, R.M.; Reynolds, G.W. Principles of Information Systems. 8th ed. Thomson, Boston, 2008.
	Rainer, R.K.Jr.; Turban, E.; Potter, R.E. Introduction to Information Systems: Supporting and Transforming Business. Wiley, Hoboken, 2006.

DESIGN OF GRAPHIC MEDIA 1		Code: 19528	
Course teacher	JESENKA PIBERNIK	Course status	optional
Original course title	Dizajn grafičkih medija 1	Semester (winter/summer)	summer
Teacher's contact email	jesenka.pibernik@grf.unizg.hr	ECTS credits	4
Study programme (undergraduate BSc, graduate MSc)	BSc	Hours of teaching (L+S+E)	30+15+0
COURSE DESCRIPTION			
Course objectives	The objectives of the course are to train students in creating and shaping visual messages across various media using basic principles of graphic design, to understand fundamental concepts of image and text design, and to acquire skills in using graphic design software in the design process.		
Learning outcomes	Plan visual communication design according to the audience's needs and the context for which visual communication is intended. Create a visual message using principles of visual organization/composition, information hierarchy, symbolic representation, typographic forms, virtual texture, layout, etc. Advanced skills in using Adobe graphic programs. Classify analog and digital technologies as means of creating visual form, interaction, and the context in which communication takes place. Evaluate the design of visual forms that address a given communication problem—devise methods and steps in the design process as a system for solving systemic problems.		
Course content (syllabus)	1. Introductory Lecture (definition of students' rights and duties, seminar definition, literature definition). Introductory Seminar (presentation of student works from previous years, definition of necessary equipment). 2. Positive and negative space. Form/Gestalt. Creating a company/product name, Designing a logo for a product and/or company. Defining general stylistic guidelines. 3. Relationship between image and text: font as an image. 4. Text design in layout. Determining a typographic form that functions with the sign. Determining a typographic form that functions within relevant visual compositions. 5. Establishing hierarchy on the page. 6. Design tools. Creating textures and patterns using abstract construction elements related to developed identity. 7. Photo manipulations: photomontage and collage. Transparency and layering - creating illustrations and photomontages according to previously defined visual guidelines. 8. Universal design principles.		

	9. Composition with color. Creating infographics, illustrations, or icon systems consistent with previously established visual guidelines.
	10. Graphic design of brochures/magazines.
	11. Construction and deconstruction: network system.
	12. Construction and deconstruction: tearing the net. Designing innovative and interactive elements of the brochure and planning their implementation.
	13. Interaction design.
	14. Design of aesthetic experience. Specification and preparation of photographic material and brochure content, brochure format, and network construction.
	15. Final presentation/guest designer. Brochure layout design.
Required literature (available in the library and/or via other media)	Title
	White J. V.: Editing by design, Allworth Press, 2011.
	Martin, B., Universal methods of design: 100 ways to research complex problems, develop innovative ideas, and design effective solutions, Beverly, MA: Rockport Publishers, 2012.
	Cabarga, L., Logo, font & lettering bible, HOW Design Books, F+W Publications, 2004.
	Holtzschue, L., Understanding color: an introduction for designers,3rd ed., Hoboken: Wiley, 2006.

GRAPHIC DESIGN 2			Code: 32786
Course teacher	MAJA BROZOVIĆ, DOROTEA KOVAČEVIĆ, JOSIP BOTA	Course status	compulsory
Original course title	Grafički dizajn 2	Semester (winter/summer)	summer
Teacher's contact email	maja.brozovic@grf.unizg.hr dorotea.kovacevic@grf.unizg.hr Josip.bota@grf.unizg.hr	ECTS credits	4
Study programme (undergraduate BSc, graduate MSc)	BSc	Hours of teaching (L+S+E)	15+0+45
COURSE DESCRIPTION			
Course objectives	To obtain the knowledge and acquire the know-how in designing a visual message with respect to specific features of particular graphic media and the corresponding graphic-editorial practice. In the framework of the course students will learn how to organize visual forms into functional visual systems of particular graphic media. Students will analyse specific features of each graphic media in regard to the type and intent of the message, its character/nature and form, as well as technical and technological limitations of each media type in presenting messages. Students are requested to offer the best solutions for presenting this information through various types of graphic media based on the given input. Through active participation in the course lectures and practical application of the presented principles students will get acquainted with characteristics of newspapers and magazines as key representatives of periodical graphic media, picture books as specific educational and entertainment type of media whose visual structure is adjusted to a particular age group, and posters as a representative of outdoor advertisement media.		
Learning outcomes	Create a conceptual sketch of the hierarchy of optical values of the relationship between the structural elements of the newspaper page. Organise visual hierarchy of information on predefined newspaper format - planning a coherent system of magazine layout design. Organising grid systems for various magazine content - suggesting design solutions for effective advertisement communication. Ability of combining aesthetic and technological factors in presenting visual messages by means of outdoor advertisement media. Illustrating and designing picture-book as an educational graphic media form.		
Course content (syllabus)	1. Organization of the visual structure of the newspaper page. Sketching the visual structure of the newspaper page with regard to the defined number of articles - raster page.		

	2. Organization of the visual hierarchy of information of the newspaper page. Design a visual hierarchy of articles on a newspaper page based on a sketched raster.
	3. Designing another newspaper page while maintaining defined parameters (margins, number of columns, text styles, etc.). Design the left/right newspaper pages that will form a single entity with the page from the previous exercise.
	4. Monochrome newspaper printing: possibilities and limitations in creating information hierarchies. Design a monochrome newspaper page in relation to the obtained number and importance of articles using the defined parameters from the previous exercise.
	5. Newspaper cover page - persuasive communication. Design the cover page of the newspaper from the obtained number of information with a focus on persuasive communication.
	6. Magazine as a graphic media: definition, types of magazines, design specifics. Present the visual structure of one thematic unit of the magazine through a certain number of pages.
	7. Types and application of grid system in thematic unit design of magazines Sketch grid system for the journal according to different thematic units.
	8. Consistency of the visual hierarchy of individual thematic units with a grid system Design two pages of different thematic units and apply different grids while maintaining the visual recognition of the magazine.
	9. Introductory pages of the magazine, specifics in the design and presentation of information. Design the introductory pages of a certain thematic unit of the magazine.
	10. Magazine cover page - design aimed at the target group. Design a magazine cover page in relation to a defined target group.
	11. Advertising messages in magazines. Illustrate the solution of an advertisement in a magazine on a given topic and target group.
	12. Outdoor advertising media - lapidary solutions. Illustrate a lapidary poster solution on a given topic and target group.
	13. Outdoor advertising media - temporal solutions. Illustrate the temporal solution of the poster on the given topic and target group.
	14. Picture book - specifics, suitability for the child's age. Sketch the main characters of a picture book for a certain age of the child.
	15. Aesthetic, pedagogical, technological parameters of the picture book. Design and present an art-graphic solution for the cover and two inside pages of the picture book using sketches of the main characters throughout the story.
	Title
Required literature (available in the library and/or via other media)	R.D. Zakia: Perception and Imaging, Focal Press, New York, 2001.
	G. Ambrose, P. Harns: The Fundamental of Graphic Design, Ava Publishin, Lausanne, Switzerland, 2009.
	A. Twelow: What is Graphic Design for?, RotoVision SA, Mies, Switzerland, 2006.

COMPOSITION			Code: 128242
Course teacher	TAJANA KOREN IVANČEVIĆ	Course status	optional
Original course title	Tiskarski slog	Semester (winter/summer)	summer
Teacher's contact email	tajana.koren.ivančević@grf.unizg.hr	ECTS credits	4
Study programme (undergraduate BSc, graduate MSc)	BSc	Hours of teaching (L+S+E)	15+0+30
COURSE DESCRIPTION			
Course objectives	Students will learn to program text display for print and digital media. Text programming for printed media is performed through PostScript. Character envelope programming. Programming repeating text with the introduction of variables that change their values through a loop. Text programming by given path. Changes on each letter character. Positioning and alignment of text. Filling letters with other elements. Text programming for the web. Introduction of individualized fonts on web pages. Text styling, alignment and positioning. Animation text through HTML and CSS. Character display programming through ActionScript. Possibility of manipulation of the appearance of letters by introducing random numbers. Text input in SVG. Text animation in SVG technology. The possibility of choosing a medium for displaying typography.		
Learning outcomes	The student will be able to distinguish the media in which typography appears. The student will be able to program the way the typography will be displayed in the print medium. The student will be able to program a way to which typography will be displayed on the web. The student will be able to distinguish and define individual webs technologies for displaying typography. The student will be able to implement typography in animation.		
Course content (syllabus)	1. Programming text appearance for print media through PostScript. Checking the programmed text through the GS View browser. 2. Programming text repetition using loops. Introduction of variables. 3. Filling the letter characters with other elements. Filling the letter path with other elements. 4. Programming the path along which the text is displayed. Manipulation of each character separately. 5. Text manipulation through random numbers. Exercises – colloquium. 6. Programming text for display on the web using HTML and CSS. 7. Text styling through CSS. 8. Transforming text on the web. 9. Animating text on the web using HTML and CSS. 10. Animating text through ActionScript. Exercises – colloquium. 11. Text manipulation through ActionScript and random numbers. 12. Displaying text on the web through SVG. 13. Text animation through SVG.		

	14. Interactivity in SVG by mouse over and click.
	15. Programming text in SVG using gradients and filters. Exercises – colloquium.
Required literature (available in the library and/or via other media)	Title
	Pap, Klaudio; Žiljak, Vilko. Digitalni udžbenik PostScript grafike. Zagreb: FS, 2002. (priručnik).
	Žiljak, Vilko; Pap, Klaudio. Postscript programiranje. Zagreb: FS d.o.o., 1999. (priručnik).
	http://www.w3schools.com/ http://www.w3.org

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QUALITATIVE RESEARCH METHODS OF COLOUR REPRODUCTION		Code: 19561	
Course teacher	RAHELA KULČAR	Course status	optional
Original course title	Kvalitativne metode ispitivanja reprodukcije boja	Semester (winter/summer)	summer
Teacher's contact email	rahela.kulcar@grf.unizg.hr	ECTS credits	4
Study programme (undergraduate BSc, graduate MSc)	BSc	Hours of teaching (L+S+E)	30+0+15
COURSE DESCRIPTION			
Course objectives	This course aims to provide students with theoretical and practical knowledge of colour, enabling them to develop independent ideas and solutions related to the assessment of colour reproduction quality. Students will gain a fundamental understanding of the science of colour and its perception. Throughout the course, students will learn to communicate through colour and become acquainted with some intuitive colour systems. They will also become familiar with the characteristics of light sources, their impacts on observed colours and substrates, and how to leverage their advantages and disadvantages. Emphasis will be placed on independently determining colour characteristics based on instrumental measurements. With the knowledge acquired, students will be able to choose colour systems, and measurement techniques, and interpret results effectively.		
Learning outcomes	The student will be able to connect fundamental knowledge in the field of colour with its multidisciplinary aspects in the field of colorimetry. Categorize colour measurement devices, propose the most suitable measurement method based on the substrate type, justify the choice of the device, and critically assess differences in reproduced colours compared to standards.		
Course content (syllabus)	1. Fundamentals of the Science of Color and its Perception 2. Characteristics of Light Sources 3. Characteristics of the Sample Under Examination 4. Colour Perception (Psychophysical Experience of the Observer) 5. Theories of Color Vision 6. Simultaneous Contrast, Color Vision Deficiency 7. Psychophysical Aspects of Color 8. Determination of Tristimulus (X, Y, Z) Values 9. CIE Chromaticity Diagram 10. Limitations of the CIE Chromaticity Diagram 11. CIELAB Color Representation System 12. Determining Total Color Difference		

	13. Colour Measurement Standards (Ostwald System, Munsell System, NCS System)
	14. Metamerism
	15. Standard Measurement Geometries, Color Measurement Devices, Device Selection for Color Measurement
Required literature (available in the library and/or via other media)	Title
	R.S. Berns; Principles of Color Technology. John Wiley and Sons, Fourth Edition,2019
	R.W.G. Hunt; The Reproduction of Colour, John Wiley and Sons, Chichester, England,2004.
	M. Langford; Advanced Photography, Focal Press, Oxford, 1999;
	N. Ohta, A.R.Robertson; Colorimetry.Fundamentals and Applications, John Wiley and Sons, England, 2005.

APPLICATION AND INVESTIGATION OF PRINTED MATERIALS			Code: 19563
Course teacher	MAJA STRIŽIĆ JAKOVLJEVIĆ, BRANKA LOZO	Course status	optional
Original course title	Primjena i ispitivanje grafičkih materijala	Semester (winter/summer)	summer
Teacher's contact email	maja.strizic.jakovljevic@grf.unizg.hr branka.lozo@grf.unizg.hr	ECTS credits	4
Study programme (undergraduate BSc, graduate MSc)	BSc	Hours of teaching (L+S+E)	30+0+15
COURSE DESCRIPTION			
Course objectives	The aim of the course is to familiarize students with various aspects of functional applications that are achieved by printing, especially ink-jet technology, with an explanation of its advantages as a non-impact technique, to point out the variety of functions that can be achieved through the choice and combination of materials, to introduce students to upcoming trends, to direct them towards own creative ideas.		
Learning outcomes	Students will be able to list and describe different types of 2D codes; Explain the technology of 3D ink-jet printing; List the materials used in 3D printing; Be able to explain what chromogenic inks are and the mechanism of the colour change; Be able to list and explain different types of chromogenic inks; Explain which part of the RFID system is printable; Explain the differences between electronic paper and other screen products and explain the principle of electrophoresis; Find out about other functional applications and development and application possibilities.		
Course content (syllabus)	1. Review of content, presentation of various aspects of printed functional applications; definitions of basic terms. 2. Explanation of function and principles of 2D code generation, types, explanation of interactivity. 3. Limits of reading 2D codes and error correction system, intentional design errors as a function of creativity. 4. Electronic book, principle of e-paper screen operation, differences compared to other screen products. 5. The working principle of the e-paper screen, electrophoresis. 6. Explanation of 3D printing technique, types and principles of AM, 3D InkJet printing, development of color printing, differences. 7. The purpose of 3D printing by areas, development and perspectives, examples, 3D scanning, use of 3D printing records. 8. Materials for 3D printing, types of powder, binder function, color function, infiltrators, role and differences by type. 9. The first written intermediate knowledge test. 10. Explanation RFID, parts, printed parts, antennas, other printed electronics, examples. 11. Explanation of the concept of chromogenic inks, types, division according to different criteria, purpose of inks. 12. Thermochromic inks, types and mechanisms of color change, biochromic inks, indicators, types. 13. Bio-paper, explanation of different uses, biocides in/on paper, application.		

	14. Other examples of functional applications, advantages of InkJet technique, microscreen printing and other examples.
	15. Second written knowledge test.
Required literature (available in the library and/or via other media)	Title
	Teacher's lectures on the department's website
	Developments in Printing Technology, Pira International, Leatherhead, 2007
	Lozo, Branka; Stanić, Maja, 3D Ink Jet Printing, Ed: Stasiak W, James, Sprinfield: Society for Imaging Science and Technology, USA, 2010
	Thompson, B., Printing materials: science and technology, Pira International, Leatherhead, 2004
	Z Corporation, 3D Printing Technology Whitepaper, Z Corporation, Burlington, USA, 2005 Gebhardt, A., Short Course on Rapid Prototyping, Aachen University of Applied Sciences, Aachen, Germany, 2005

BOOKBINDING 1			Code: 19557
Course teacher	SUZANA PASANEC PREPROTIĆ	Course status	optional
Original course title	Knjigoveštvo 1	Semester (winter/summer)	summer
Teacher's contact email	suzana.pasanec.preprotic@grf.unizg.hr	ECTS credits	5
Study programme (undergraduate BSc, graduate MSc)	BSc	Hours of teaching (L+S+E)	30+0+30
COURSE DESCRIPTION			
Course objectives	The course follows finishing processes throughout publishing and craft bookbinding. It studies the bookbinding and binding block system types. It focuses on establishing the characteristics of bookbinding regarding bookshelf system, binding unit, adhesive and paper types. The aim of the course is to find the best solutions within the frame of bookbinding engineering. Practical work focuses on specific details including individual handmade book. It allows the students to understand a complex network of binding technology. Students are asked to write seminar paper on the course topics during the semester. Also, student needs to create handmade book of his choice. The oral speech is also included to the students give explanations about binding design. The final grade (with marks 2, 3, 4, or 5) is the average of the grades obtained through seminar papers and work practice.		
Learning outcomes	Students understand how to properly choose engineering book concepts which leads binding efficiency. Students can correctly identify binding standardized procedure within Standards Framework ISO/TC 130. Students are able to give examples how to cope with technological bindery style processes. Students can reliably demonstrate how to tailor paper features in order to optimize the visual-tactile book appearance. Students can correctly present comprehensive binding knowledge by constructing a handmaking prototypes.		
Course content (syllabus)	- Bookshelf classification system - Bookbinding types (paperback, hardback, mechanical) - Binding block systems (adhesive, thread and wire stitching, comb) - Binding units' type (individual sheets/leaf, folded sheets) - Adhesive binding methods (double-fan and rough spine) - Differences between Craft bookbinding and Book publishing - Finishing process steps (cutting, folding, gathering, binding block systems, trimming) - Technological principle of binding block system - Classification and type of folded sheet - Basic gathering principles (collating, inserting) - Craft binding block variants (side wire stitching, thread-stitching with linen tape)		

	• Perfect binding diagram (block spine processing and gluing) • Adhesive type applications (PVAc, hot-melt, PUR) in bookbinding • Perfect binding strength rating (pull test, FOGRA standard) • Paper suitability for perfect binding (high grades papers, recycle and wood-contained papers) • Book covers in craft bookbinding • Bookbinding materials and equipment • Creating handmade book (design bindings to suit specific projects)
	Title
	Pasanec Preprotić, Suzana; Vukoje, Marina; Petković, Gorana; Rožić, Mirela: Novel Approaches to Enhancing Sustainable Adhesive System Solutions in Contemporary Book Binding: An Overview // Heritage (Basel), 6 (2023.), 1; 628-646. doi:10.3390/heritage6010033
	Pasanec Preprotić, Suzana; Petković, Gorana; Bracić, Mario; Marošević Dolovski, Ana: Comprehensive Principles for Enhancing the Adhesive Bound Book Performances // Tehnički glasnik, 2023 (2023.), 17(4); 543-553. doi:10.31803/tg-20230127170218
	Pasanec Preprotić, Suzana; Dijana Stančin; Gorana, Petković: Projektiranje procesa u nakladničkom uvezu knjiga - Analiza radnog procesa // Polytechnic and design, 10 (2022.), 4; 222-232. doi:10.19279/TVZ.PD.2022-10-4-01
Required literature (available in the library and/or via other media)	Dasović, Eva; Petković, Gorana; Pasanec Preprotić, Suzana: Oblikovanje i budućnost knjižnog uveza u svijetu e-knjige // Tehnički glasnik, 9 (2015.), 4; 440-445
	Pasanec Preprotić, Suzana; Vukoje, Marina; Petković, Gorana; Rožić, Mirela: Sustainable approach to book designing concepts in bindery sector: An overview // Proceedings - 11th International Symposium on Graphic Engineering and Design GRID 2022 / Vlaidić, Gojko (ur.). Novi Sad, 2022. str. 629-645. doi:10.24867/GRID-2022-p69
	Additional literature: 1. Weston, H., Bookcraft, Technique for Binding, Folding and Decorating to Create Books and More, Quarry Books, London, 2008. 2. Kipphan, H., Handbook of printmedia: technologies and production methods, Springer Verlag Heidelberg, New York, 2001. 3. Southworth, M., Southwourth, D.: Quality and Productivity in the Graphic Arts: Quality Control in the Bindery-Werner Rebsamen, Graphic Arts Publishing Co, New York, 1989. 4. Clark, T., Bookbinding with adhesives, McGRAW-HILL Book Company Europe, England, 1994.

OFFSET PRINTING MANAGEMENT			Code: 19469
Course teacher	IGOR ZJAKIĆ, IRENA BATES	Course status	optional
Original course title	Upravljanje ofsetnim tiskom	Semester (winter/summer)	summer
Teacher's contact email	igor.zjakic@grf.unizg.hr irena.bates@grf.unizg.hr	ECTS credits	5
Study programme (undergraduate BSc, graduate MSc)	BSc	Hours of teaching (L+S+E)	30+0+30
COURSE DESCRIPTION			
Course objectives	To teach students how to obtain and standardize a printing quality in different printing techniques.		
Learning outcomes	The course provides students with basic knowledge about standardization and quality management of various printing techniques. The subject teaches the principles of reproduction of raster elements, how their deformation affects the reduction of print quality, how print quality is managed with the help of measuring fields, how visual control is used to identify and solve printing problems, then, the subject teaches how to standardizes the printing process and how modern computer systems achieve uniform and high-quality printing. In addition to the above, students learn about hi-fi printing techniques and ways to increase quality in reproduction, as well as ways and methods of varnishing in printing, which achieves a higher quality graphic product.		
Course content (syllabus)	1. Introduction to the subject. The importance of quality in printing. The link between technology and design. Expectations and global quality trends. Separation of products by quality. Defining the quality of different printing techniques. 2. Colour in printing, importance of color in commercial purposes, problems of defining quality with customers, principles of multi-color reproduction in printing with technological process. 3. Raster systems and error assumptions. Advantages and disadvantages of different types of rasterization, deformation of raster elements. 4. Errors in printing, causes, methods of detection, sequence of printing and connection with machines, Geometrical deformation of raster elements, examples. Optical deformation of raster elements, examples, realistic and optimal reproduction. 5. Printing methods, control strips, signal and measurement strips. Shearing, duplicating, smearing, color density, color density range, reproduction of microlines, examples. 6. Methods of establishing the geometric deformation of raster elements. Colour density range. 7. Methods of establishing the geometric deformation of raster elements. Colour density range.		

	8. Calibration and characterization procedures, Fogra principles, GATF, field D, K/S fields. Transfer of tonal values, Hartmann system of programmed printing, control system Felix-Brunner, measuring microelements, degrees of coloring, control system Gretag. 9. Proper definition of print quality, tone error in print, grayness of color in print, color efficiency in print, relative print contrast, color acceptance. Print order. 10. Mixed color printing. Color difference control methods. Quantitative detection of missing colors in mixing, color gamut and print behavior. Pantone, HKS etc. 11. The difference between mixed and CMYK color printing. Defining colors. The link between design and reproduction of the final product. 12. Printing errors. Toning, excess wetting solution, wiping, damaged TF, damaged rubber cover, deformations of the printing material affecting the quality, scraping, improper powdering, appearance of unwanted lines in the print. 13. Reduction and methods of increasing color reproduction in printing. Hi-Fi printing methods - Hexachrome, Opaltone, MaxCYM, highly pigmented printing, printing with additional mixed colors. Increasing color reproduction, methods of achieving greater commercial effect, advantages of Hi-Fi printing. 14. Printing management - CPC 1, 2, 3, 4, PRINECT, PECOM, MaxNet, DoNet, etc. Possibilities and quality improvements, speeding up work, importance of the link between management and apparatus production management. Varnishing in printing - classic oil varnishes, water-dispersive varnishing, UV varnishing on prints with classic colors, UV colors and hybrid colors, methods, advantages and disadvantages, inducing different commercial effects, examples. 15. Colloquium
	Title
Required literature (available in the library and/or via other media)	I. Zjakić: upravljanje kvalitetom ofsetnog tiska. HSN, 2007.
	I. Zjakić: tehničko uređivanje u procesu izrade knjige, HSN, 2013.;
	H. Kiphan:Handbook of Print media, Springer, 2001.

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QUALITY CONTROL			Code: 96535
Course teacher	DIANA MILČIĆ	Course status	compulsory
Original course title	Kontrola kvalitete	Semester (winter/summer)	summer
Teacher's contact email	diana.milcic@grf.unizg.hr	ECTS credits	4
Study programme (undergraduate BSc, graduate MSc)	BSc	Hours of teaching (L+S+E)	30+0+15
COURSE DESCRIPTION			
Course objectives	Quality control course introduces students to the product and process control. Students will acquire knowledge on planning methods and tools to ensure quality in graphical industry. By the end of the course students will have ability to understand the criteria and standards of applied techniques and methods for assure quality of product, industrial process and any process in company.		
Learning outcomes	Critically evaluate contemporary concepts of quality. Apply quality management tools and methods. Apply statistical techniques for quality improvement and decision making. Use statistical packages to monitor and evaluate process quality. Estimate the appropriateness of the conclusions from the obtained data.		
Course content (syllabus)	1. Basic principles of modern quality control and basic terms in the quality field. Development of statistical methods of quality control. Quality definitions. 2. Quality costs. Control costs. Taguchi's philosophy. Taguchi loss function 3. Statistical methods of quality control. Analysis of normally distributed data. Analysis of non-normally distributed data 4. Process capability assessment and analysis. Process capability coefficients. Process stability. 5. Choice of control method. Sampling and sampling plans. 6. Sampling plans for attributes. AQL, AOQL and LQ concept. Sampling plans according to standards 7. Mathematical basis of sampling plans. How to calculate the OC and AOQ curve points. Risk calculation. Supplier Quality Index (Bendix). 8. Sampling plans for variables. Sampling plans according to s-method 9. Sampling plans for variables: R-method, sigma-method. Lot-plot test chart. 10. Introduction to SPC. Sensitivity of control charts. Application. Types of variations. Process "under control". 11. Control charts for variables. Shewhart control charts. 12. Control charts for attributes. 13. Capability of the measurement system. Determination of R&R using control charts. 14. Quality improvement methods. FMEA analysis.		

	15. Quality control tools. Checklist. Pareto analysis. Brainstorming. Ishikawa diagram.
	Title
	Loseph A. De Feo, Juran's Quality Management and Analysis, 2014.
	Nancy Tague, Quality toolbox, ASQ Quality Press, Wisconsin 2005.
Required literature (available in the library and/or via other media)	Edward G. Schilling, D.V. Neubauer, Acceptance Sampling in Quality Control, CRC Press Taylor and Francis Group, 2017

TYPOGRAPHY
Code: 19538

Course teacher	IVANA ŽILJAK STANIMIROVIĆ	Course status	compulsory
Original course title	Tipografija	Semester (winter/summer)	summer
Teacher's contact email	ivana.ziljak.stanimirovic@grf.unizg.hr	ECTS credits	5
Study programme (undergraduate BSc, graduate MSc)	BSc	Hours of teaching (L+S+E)	30+15+15

COURSE DESCRIPTION	
Course objectives	Acquiring knowledge in the field of typography. Knowledge of the classification of letter cuts regarding historical development and optical characteristics. Knowledge of the planning, design and realization of one's own individualized typeface and knowledge of redesigning and solving the tasks of standardizing typefaces for use on different platforms. The subject interprets the historical development of typography, classification, the future of typography, designing an individualized font. Professional tools for creating fonts and independent work with them are introduced. Designing individualized typography, handwritten forms, own design solutions and pictograms. Using the Bezier curve in character design. Letter Heights and space, as a carrier graphic space of the character. Connections and ligatures, formation of style sets regarding typographic features. Conceptual (ideography, pictography), syllabic and phonetic alphabet in digital typography. Creating a font from pictures, drawing a character, portrait. Pi fonts. Code font. Glagolitic font, work with Glagolitic. Standardization in TrueType, OpenType and ClearType standard for display screen and multimedia devices. Coding and mathematical background of font definition. Measurement of blackening of letters and text. Rules in typography regarding legibility, connection in handwritten forms, alignment of thickness values, font editing, alignment, spacing between letter characters. Typographic dictionary and standardization for communication on relations designer, graphic artist, printer, web designer. Classification of typography into individual font categories, considering historical development and optical characteristics. Contemporary classification of individualized design typographic solutions on the web.
Learning outcomes	Knowledge of the historical development of typography and the classification of typography into individual font categories. The ability to create your own database through classification. Knowledge of the creation and realization of individualized typographic cuts of own design solutions. The ability to solve the redesign of letter characters and edit the characteristic characters of the specific language. Designing all necessary signs for international application. Knowledge of typography for signage, pictograms, and code font. Knowledge of typography standards and coding for use on different platforms in print and on the web.

Course content (syllabus)	1. Lecture: Historical development of typography, overview of the whole typography in use, future development typography, designing an individualized font. The Bezier curve as the basis of the character outline. Definition of typeface anatomy and letter hights. Seminar: Introduction to the software package for creating a font and instructions for creating an individualized digital signature in the form of a font and a personal portrait in the form of a pictogram in "True type" format for use via a computer keyboard. Creation of a font from images, drawing of letters, signatures, portraits. Exercises: Creating a template for creating an original individualized handwriting, choosing a tool (point pen, rounded pen, brush) for creating a handwriting shape regarding the ascending and descending strokes. Familiarization with programmes for designing fonts and standards, redesign of the existing font and addition of characteristic characters for international use. 2. Lecture: Classification of handwritten forms of letter cuts according to optical characteristics and tool, bold, alternating, uniform stroke and brush stroke. Seminar: Design with application of individualized digital signature and portrait in pdf form with included parameters for printing and display on computer screen. Classification of handwritten fonts, generation of personal data in handwritten forms. Exercise: Transfer of letter characters into digital form and template processing in graphics programs for image and text processing. Work in table area character cells, as the bearer of the graphic space of the letter sign. 3. Lecture: Classification of basic typographic forms: renaissance, transitional and classic antique according to optical characteristics and historical development from Roman lapidary capital, Carolingian and humanist minuscule, to Renaissance, transitional and classicist antique. Seminar: Individual classification of fonts from the category of basic shapes. Generating personal data in Renaissance, Transitional and Classicist fonts. Exercise: Transferring digitalized handwritten characters and punctuation to a program for construction of the letter character, placement in code positions in the background layer, vectorization. 4. Lecture: Classification of individual fonts: artistic antique, semi-grotesque, newspaper antique, free stroke, semi-Egyptian according to optical characteristics and historical development. Seminar: Creating an individual base of basic forms with all alphabetic characters and Croatian or specific characters in programs for inclusion and classification of fonts, testing in programs for breaking, and standardization in postscript and pdf format. Exercise: Using the Bezier curve to shape the uppercase, cursive, and punctuation characters of an individualized handwritten font. 5. Lecture: Classification of technical forms according to optical characteristics and historical development of technical form, grotesk, egyptian, italian, OCR. Seminar: Classification of fonts from the category of individual cuts and shapes. Generating personal data in

artistic antique, semi-grotesque, newspaper antique, free stroke, and semi-Egyptian fonts.
Exercise: Editing tracking, kerning and digital character spacing testing.

6. Lecture: Classification of special and profile shapes, outline letters, shaded letters, crossed out letters, decorated letters ranked according to optical characteristics.
Seminar: Creating a database of individual forms with all alphabetic characters and Croatian characteristic characters in programs for inclusion and classification of fonts, testing in programs for breaking, and standardization in postscript and pdf format.
Exercise: Adjustment of thickness values of letter characters, height. Correct layout in typography regarding readability, connection, alignment of thickness values, font editing, alignment, spacing between letter characters.

7. Lecture: Classification of mathematical signs, accents, general symbols, music font, code font, according to optical characteristics.
Seminar: Classification of fonts from the category of technical cuts and shapes. Generation of personal data in fonts: grotesque, Egyptian, Italian and OCR fonts for machine reading.
Exercise: Generating and saving the font in standard format, installing the font, testing, printing, and comparing with the original template.

8. Lecture: New modern classification, database creation through classification. Standardization in TTF format, Postscript, and pdf format.
Seminar: Creating a database of technical forms with all alphabetic characters and Croatian characteristic characters in programs for inclusion and classification of fonts, testing in programs for refraction, and standardization in postscript and pdf format.
Exercise: Presentation of the finished font. Uploading the final document in professional TTF format to the online database. Designing a presentation in a graphic program for image and text processing. Saving in standard professional pdf format.

9. Lecture: Connection and ligatures, formation of style sets regarding typographic features.
Seminar: Classification of fonts from the category of special and profile cuts and shapes. Generating personal data in fonts: poster letters, outline letters, shaded letters, hatched letters, decorated letters.
Exercise: Choice of font for redesign and creation of texture for incorporation into letter characters.

10. Lecture: Measuring blackening of letters and text through software solutions.
Seminar: Creating a database of special and profile shapes with all alphabetic characters and Croatian characteristic characters in programs for inclusion and classification of fonts, testing in programs for breaking, standardization in postscript and pdf format.
Exercise: Creating a textured font, shaded letters, hatched letters, decorated letters.

11. Lecture: Glagolitic script, working with Glagolitic font, code positions.
Seminar: Classification of fonts from the PI font category; mathematical signs, accents, general symbols, music

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font. Generating data in fonts.
Exercise: Finalization and presentation of the font with texture, saving it in TTF format and uploading it to the online database.

12. Lecture: Standardization in TrueType, OpenType for print and ClearType standard for screen display screens and multimedia devices.
Seminar: Creating a database of PI fonts with all letters, accents, special characters, testing in break programs e.g. page break with formulas, and standardization in postscript and pdf format.
Exercise: Choice of topic and design of pictograms for digitization

13. Lecture: Typographical dictionary and standardization for communication between designers, graphic artists, printer, web designer.
Seminar: Classification of fonts from the category of new modern classification of LCD fonts, retro fonts, fonts with the appearance of foreign characters and fonts in the form of code fonts. Generating data in fonts of your choice.
Exercise: Processing of individualized template of pictograms, digitalization.

14. Lecture: Symbols (ideography, pictography), syllabic and phonetic script in digital typography.
Seminar: Classification of characteristic fonts with signs and logos, markings for signaling and sports events.
Exercise: Editing pictograms in a font creation program.

15. Lecture: Contemporary classification of individualized designer typography solutions on the web. The future development of typography and the future development of standards for the application of typography in conventional and multimedia environments.
Seminar: Creation of a database from the category of the new modern classification with all letter characters, accents, specific characters, testing in break programs, page break with formulas, and standardization in postscript and pdf format.
Exercise: Finalization and presentation of the pictogram font, saving it in TTF format and uploading it to the online font database.

	Title
Required literature (available in the library and/or via other media)	Bringhurst, Robert. The Elements of Typographic Style, version 3.2 / Robert Bringhurst. Point Roberts : Hartley & Marks, Publishers, cop. 2008.
	Lupton, Ellen. Thinking with type: a critical guide for designers, writers, editors, & students / Ellen Lupton. New York: Princeton Architectural Press, cop. 2010.
	Linotype: „Typographic Categories", http://www.linotype.com/ , Monotype Fonts

Courses from graduate study programme (MSC) – General information

DIGITAL PRINTING FORM			Code: 19476
Course teacher	IGOR MAJNARIĆ	Course status	optional
Original course title	Digitalni tisak	Semester (winter/summer)	winter
Teacher's contact email	igor.majnaric@grf.unizg.hr	ECTS credits	6
Study programme (undergraduate BSc, graduate MSc)	MSc	Hours of teaching (L+S+E)	30+0+30
COURSE DESCRIPTION			
Course objectives	Students deepen the theoretical foundations based on Computer to Press and Computer to Print technologies. All relevant NIP printing technologies will be analyzed in more detail, including their basic working principles. They learn about the design features of digital printing machines that can print from rolls and sheets, whose role is crucial for creating a quality print. During the course, problems caused by the interaction of printing substrates, printing inks (toners), and other factors that can be found in the working environment (digital printing press) are identified. During the class, students will create computer templates and print prints using different digital techniques, after which they will compare them with each other, applying various measurement methods to evaluate the quality of reproduction. The evaluation will be performed using advanced methods of image analysis, with a standard comparison based on densitometric, colorimetric and spectrophotometric measurement methods.		
Learning outcomes	Students will be able to list all digital printing techniques and determine their direct application with regard to productivity and print quality. After passing the course, students will be able to explain in detail all construction variants of digital printing machines (Electrography, Inkjet, Magnetography, Ionography, Electrography, Photography, Thermography, X-graphy) together with the basic processes that take place during the generation of a print. This alone will allow for quantitative and qualitative evaluation. For the two most dominant digital printing techniques (Inkjet and Electrophotography), students will be able to prepare hand-made digital files, and print them with the desired adjustment of adequate settings on the printer (using linearization and appropriate ICC profiles). For the needs of digital printing, students will be able to critically select adequate consumables (printing substrates and inks) and in accordance with them in order to achieve adequate print quality. On the basis of theory and practice obtained during lectures and exercises (performed by densitometric and colorimetric measurements), the student will be able to independently evaluate conventionally printed and digitally printed prints and assess which of them is more applicable for the realization of different graphic products.		

Course content (syllabus)	1. Introductory lecture (def. rights and responsibilities of students, def. seminars in Digital Printing, def. literature). Introductory exercise (def. rights and duties of students, def. necessary equipment and literature).
	2. Digital printing systems, the difference between individual and mass. Personalization and printing on the claim. Presentation of Non-Impact Printing (NIP) technologies, Applications in digital printing, and development trends. Creating your one-page digital product in the Adobe Illustrator application (print 4/0). Production of P.S. file, creating a PDF file suitable for digital printing on known machines (known PPD and precisely defined driver).
	3. Part I: basics of the electrostatic process. Photosensitive materials and properties of photoconductors. Powder and liquid toners. Chronological development of EP printing machines. Stages of formation of black and white EPs. of imprints Drum photoreceptor impingement processes. Creating your own double-sided printed digital product in the Adobe Illustrator application (print 4/4). Production of P.S. file, which is printed in margo, creation of a PDF file suitable for digital printing on an HP Indigo machine (known PPD and precisely defined driver).
	4. II. part: the basis of the electrophotographic process. Lighting modes ROS and LED. Principle of laser operation. Modulation of laser radiation. Laser beam directors. The principle of image formation in photocopiers. Presentation of the creation of digital products in Adobe Acrobat applications with the help of a plug-in for digital imposition (standard book sheets and non-standard book sheets). Printing examples on the Laserjet 9050 dn printer, defining sheet rotation, activation of digital finishing.
	5. III. part: The the basis of the electrophotographic process. Principles of development in electrophotographic machines. Principles of possible transfers in electrophotography. Creating your multi-page digital product in Adobe Acrobat applications with the help of a plug-in for digital imposition (standard book sheets and non-standard book sheets).
	6. III. part: The the basis of the electrostatic process. Principles of fusion of electrophotographic prints. Fusing with rollers, non-contact fusing, fusing with solvents. Principles of photoreceptor cleaning. Creating your digital product that contains special effects. Generating files for automatic cutting, Generating special spot colors, Activation of achromatic and metallic colors, and Generating files for in-line varnishing (segment varnishing and varnishing of certain samples). Creation of files for personalized printing.
	7. Constructions of multi-colored EPs. machines. Transport systems for guiding paper. Finishing options for electrophotographic machines. Possible special effects.
	8. COLLOQUIUM. Description of the basic structure of the HP Indigo printing machine. Disassembly of basic machine components, description of their structure and purpose.
	9. Working principle of the ionographic printing process. Ionographic machine constructions. Postulates of magnetism, the principle of magnetography, construction of magnetographic machines of the coloring system, and carrying out the calibration procedure of the machine. Paper transport adjustment and duplex unit adjustment.
	10. Principle of operation of electrographic printing machines. Principle of operation of thermographic machines. The working principle of photographic machines. Types of printing substrates for photographic printing. Working with HP

	Indigo RIP. Sending performed files to RIP. Adjustment of separations, printing, and correction of prints (colors, positions). 11. Principle of formation of droplets. Continuous InkJet printing. Principle and operation of binary InkJet printing. The principle and operation of guided IRIS printing. Working principle of thermal Inkjet, Variants of construction of the basic cell and tank. Achieving photo quality printing. Test printing in the Inkjet technique. Performing linearization within color management software (EFI RiP). Generating the ICC profile of the production footprint. Test printing with the application of the desired profile. 12. The working principle of piezoelectric InkJet printing. Variants of the structure of the basic cell. Principle of operation of the Electrostatic InkJet. Cell structure. Achieving higher resolution in print. Ultrasonic Inkjet. Dyes for InkJet printing techniques. Presentation of basic machine components of UV LED Inkjet, description of their structure and purpose. Working with Roland's RIP. Printing specially created files. (Cutting and printing, varnishing, spot color, and white color printing). 13. Working principle of X-graphic printing systems. Direct imaging, Electrography, TonerJet printing, Nanography. The working principle of hybrid digital printing. Making a print using the principle of indirect thermal transfer. Preparation of the transfer medium and its transfer to the shirt. Creating a doom effect as a possibility to create a special relief pattern. 14. Machines for digital printing with permanent printing form. The principle of creating a permanent form with a laser in offset printing machines. Construction of digital machines with permanent printing form. Satellite machines based on Computer to Press technology. Changing the shape without removing it from the machine. Tandem Computer to Press machines. Change of printing form. Dyes and printing media. Other Computer to Press printing technologies. Visit (excursion) a Croatian digital printing house. 15. COLLOQUIUM
	Title
Required literature (available in the library and/or via other media)	B. Baumler, C. Senff, Laserdruck, Polygraph Verlag GmBH, Frankfurt am Main, 1988.
	G. A.Nathmann, Nonimpact Printing, Graphic Arts Technical Fundation, Pittsburgh, 1989.
	F. J. Romano, H. M. Feuton, On Demand Printing, Graphic Arts, Technical Fundation, Pittsburgh,1998.
	H. Kipphan et al., Handbook of Print Media, Springer, Berlin, 2001.
	G.Goldman, The World of Printers, Piong, OCE Printing Systems, 2004.
	I. Manarić, Studija indirektne elektrofotografije, Grafički fakultet, Zagreb, 2007.

PACKAGING PRINTING			Code: 19438
Course teacher	IRENA BATES	Course status	optional
Original course title	Tisak ambalaže	Semester (winter/summer)	winter
Teacher's contact email	Irena.bates@grf.unizg.hr	ECTS credits	5
Study programme (undergraduate BSc, graduate MSc)	MSc	Hours of teaching (L+S+E)	30+0+15
COURSE DESCRIPTION			
Course objectives	The possibility of applying knowledge of packaging and label printing methods. The possibility of applying knowledge of quality management in offset printing. The possibility of applying knowledge of quality management in flexographic printing. The possibility of applying knowledge of quality management in gravure printing. The possibility of applying knowledge of quality management in screen printing. The possibility of applying knowledge in the quality management of digital printing. The possibility of applying knowledge of decoration, protection and coding methods. The possibility of applying knowledge in the use of packaging materials. The possibility of applying knowledge of standardization of printing quality in packaging printing. The possibility of analyzing and synthesizing the reproducibility parameters of the packaging and label printing process.		
Learning outcomes	Categorize the history of packaging and label printing. Categorize the printing materials. Evaluate and categorize packaging printing technologies. Analyze trends and standards that describe the quality of packaging and label printing. Categorize and propose an environmentally friendly way of packaging printing. Categorize and propose decoration and protection and categorize codes. Evaluate the quality of packaging and label printing Suggest how to improve the quality of flexographic, offset and gravure printing.		
Course content (syllabus)	History of packaging and label printing. Methods and possibilities of packaging printing with letterpress printing. Advantages and disadvantages of packaging printing with letterpress printing technique. Types of printing substrate and methods of packaging printing. Printing on flexible and rigid substrates. Methods and possibilities of packaging printing using offset printing. Advantages and disadvantages of packaging printing with offset printing technique. International trends and quality standards in offset printing. Methods and possibilities of packaging and label printing with gravure printing technique. Advantages and disadvantages of packaging printing with gravure printing technique. International trends and quality standards in gravure printing. Methods and possibilities of packaging and label printing with flexographic printing technique. Advantages and disadvantages of packaging printing using flexographic printing technique. International trends and quality standards in flexographic printing. Methods and possibilities of packaging printing with screen printing technique. Advantages and disadvantages of packaging printing using screen printing technique. International trends and quality standards in screen printing. Processes and possibilities of packaging printing with digital printing technique. Advantages and disadvantages of packaging printing using digital printing technique. International trends and quality standards in digital printing.		

	Environmental awareness in packaging and label printing (types of printing substrate, types of inks, recycling of packaging, etc.). Types of decoration and protection. Types of codes and labels used to transmit stored information.
Required literature (available in the library and/or via other media)	Title
	Bolanča S., (2013), Tisak ambalaže, Hrvatska sveučilišna naklada, Zagreb
	Vujković, I., Galić, K., Vereš, M. (2007), Ambalaža za prehrambene namirnice, Tectus, Zagreb
	Kiphhan, H., (2001), Handbook of Print Media, Springer, Berlin
	Brody, A. L., Marsh, K. S., (1997.), The Wiley Encyclopedia of packaging technology, 2ed. John Wiley & Sons, Inc., New York, Chichester, Weinheim, Brisbane, Singapore, Toronto
	Flexography: Principles and Practices, 5th edition, Foundation of Flexographic Technical Association Inc. (1999), Ronkonkoma; New York
	Fairley, M., (2004), Encyclopedia of Labels and Label Technology, London, England

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APPLICATION OF DIGITAL PHOTOGRAPHY IN REPRODUCTION MEDIA		Code: 19473	
Course teacher	MAJA STRGAR KUREČIĆ	Course status	optional
Original course title	Primjena digitalne fotografije u reprodukcijskim medijima	Semester (winter/summer)	winter
Teacher's contact email	maja.strgar.kurečić@grf.unizg.hr	ECTS credits	4
Study programme (undergraduate BSc, graduate MSc)	MSc	Hours of teaching (L+S+E)	30+0+15
COURSE DESCRIPTION			
Course objectives	Teach the basics of digital photography with a balanced emphasis on technical, aesthetic and conceptual skills. Provide students with creative and technical assignments to make personal work. Provide students with the skills to analyse and critique images in a global context.		
Learning outcomes	Use practical image capture and editing skills in digital photography. Understand exposure techniques in manual mode. Classify image capture equipment and judge suitability of the equipment for a given photography project. Evaluate and interpret aesthetics and concept of a photography project. Demonstrate creative and critical communication through the visual medium of photography. Create a portfolio of work.		
Course content (syllabus)	1. Anatomy of a DSLR camera 2. Camera Lens 3. Understanding exposure (ISO / aperture / shutter) 4. Image size and quality 5. ISO sensitivity and image quality 6. File format - RAW vs. JPEG 7. Image editing in Adobe Photoshop 8. Visual design concept 9. Composition 10. Basic principles of lighting 11. Studio portrait / outdoor portrait 12. Creative photographic techniques 13. Photo essay 14. Context in Photography 15. Final Project Presentation		
Required literature (available in the library and/or via other media)	Title		
	Langford, M., Fox, A., & Smith, R. S. (2015). Langford's Basic Photography: The Guide for Serious Photographers.		

	Focal Press. Kelby, S. (2020). The Digital Photography Book. Rocky Nook, Inc.
	London, B., Stone, J., & Upton, J. (2017). Photography. Pearson.
	Terry Barrett, P. (2011). Criticizing Photographs. McGraw-Hill Education

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HOLOGRAPHY			Code: 19498
Course teacher	KATARINA ITRIĆ IVANDA VLADIMIR CVILJUŠAC	Course status	optional
Original course title	Holografija	Semester (winter/summer)	winter
Teacher's contact email	katarina.itric.ivanda@grf.unizg.hr vladimir.cviljusac@grf.unizg.hr	ECTS credits	5
Study programme (undergraduate BSc, graduate MSc)	MSc	Hours of teaching (L+S+E)	30+15+0
COURSE DESCRIPTION			
Course objectives	The aim of the course is to acquire fundamental and specialized knowledge in holography and it's implementations in graphic technology.		
Learning outcomes	The aim of the course is to acquire fundamental and specialized knowledge for implementation of holography in graphic technology. Students will be able to define the basic physical principles that must be followed in the design, production, and application of holograms. Identify the basic physical assumptions related to the relationships between the finished graphic product, printing technology, design solutions, and holograms. Recognize the potential applications of holograms in graphic technology. Identify different possibilities for realizing holograms within a graphic product with respect to different design solutions. Identify the optimal method for producing holograms used in the graphic industry. Recognize different types of holograms and their specific applications in graphic technology. Select optimal solutions for designing holograms as a graphic product. Define and apply protective elements of holograms and the level of protection required for a specific graphic product. Acquire basic knowledge for creating computer-generated holograms.		
Course content (syllabus)	1. Introduction 2. Coherent Light Optics I 3. Coherent Light Optics II 4. Simple transmission holograms I 5. Simple transmission holograms II 6. White-Light Transmission Holograms 7. Reflective holograms 8. Synthetic and computer-generated holograms 9. Holographic interferometry 10. Holographic materials 11. Hologram printing I 12. Printing holograms II		

	13. Holography and information technologies 14. Holographic Imaging technology 15. Art and Holography
	Title
Required literature (available in the library and/or via other media)	HOLOGRAPHIC IMAGING: Stephen A. Benton, V. Michael Bove, Jr., John Wiley & Sons, Inc., Hoboken, New Jersey, 2008
	PRACTICAL HOLOGRAPHY, Third Edition, Graham Saxby, IOP Publishing Ltd., 2004
	LECTRO-OPTICS HANDBOOK 2nd ed., The McGraw-Hill, 2000
	HOLOGRAMS & HOLOGRAPHY: DESIGN, TECHNIQUES, & COMMERCIAL APPLICATIONS, Vacca, John R., CHARLES RIVER MEDIA, INC. Hingham, Massachusetts, 2001

GRAPHIC DESIGN 3			Code: 33072
Course teacher	MAJA BROZOVIĆ	Course status	compulsory
Original course title	Grafički dizajn 3	Semester (winter/summer)	winter
Teacher's contact email	maja.brozovic@grf.unizg.hr	ECTS credits	5
Study programme (undergraduate BSc, graduate MSc)	MSc	Hours of teaching (L+S+E)	15+0+45
COURSE DESCRIPTION			
Course objectives	To obtain the knowledge and acquire the skills in design of a sign as a carrier of a message with regard to the functions that the message should convey. Course is focused on systematic analysis of symbols and the concept of creating meaning through visual communication. Form, in the context of visual communication, is thought of as a mean s for information transmission through graphic media communication systems. Symbols (signifiers) are not analysed on the basis of case studies, but rather as integral parts of an organised information system. Particular attention is given to notions and definitions of sign and meaning, as given by various influential authors. Through lectures and practical exercises, students study visual forms from the standpoint of their structure, as highly or scarcely structured symbols, and their respective formal appearance. The development of the tendency towards reduction of figurative shapes to wholly abstract signs is being considered. Pictorial systems and their practical application are studied, including standardised systems of pictograms in everyday use. Semantic analysis is carried out concerning general functions of symbols and their application in shaping visual messages through: relations between symbol and referent, author and message, parts and whole of the message, assessment of appropriateness of a symbol structure regarding target audience, accessibility of the visual message and the contribution of the graphic structure in clarifying the message's content. Through practical work, students will obtain knowledge and acquire skills for designing signs on the basis of content, attitude, inventiveness, context, non-content factors and style.		
Learning outcomes	Create different signs with respect to structuredness. Analyse signs and their meanings. Integrate signs into a unique formal system. Propose a suitable illustrative system for the presentation of information. Design a sign in accordance with the focus on a particular function in the communication process.		
Course content (syllabus)	1. A highly structured sign. Concept and solution of a highly structured sign on a given topic. 2. A low-structured sign. Concept and solution of a low-structured sign on a given topic. 3. Pictograms. Design the defined number of signs as a unique system of pictograms. 4. Analysis of sign and meaning. Reduce the given figurative form to a completely abstract sign through a certain number of phase – sketching.		

–	5. Illustrative systems. Reduce the given figurative form to a completely abstract sign through a certain number of phase – realization.
	6. Illustrative systems. Illustrate a specific location with independent signs.
	7. Illustrative systems – examples. Corrections of the selected illustrative system according to the information hierarchy.
	8. General sign functions. Design a certain product with regard to the level of quality.
	9. Referential function of the sign. Present the animation of a stylized form through a certain number of phase.
	10. Emotional function of the sign. Present personal view of a certain concept in the form of a sign.
	11. Aesthetic function of the sign. Form sign for concepts characterized by symmetry and rhythm.
	12. Conative function of the sign. Show signs for different target groups.
	13. Contact function of the sign. Design sign with an emphasized contact function.
	14. Metalinguistic function of the sign. Present sign with an emphasized metalinguistic function.
	15. Representation of individual sign functions. Analyse the obtained sign through the representation of individual functions.

	Title
Required literature (available in the library and/or via other media)	van der Vlught, R.: Logo life: Life Histories of 100 Famous Logos, BIS Publishers, Amsterdam, 2012.
	Abdullah, R.; Hübner, R.: Pictograms, icons & signs: a guide to information graphics, Thames & Hudson, 2006.
	Robbins, N.B.: Creating More Effective Graphs, John Wiley & Sons, Hoboken NJ, 2005.
	Ware, C.: Information Visualization: Perception for Design, San Francisco CA, Morgan Kaufmann Publishers, 2004.
	Harris, R.L.: Information Graphics, Oxford University, New York and Oxford Press, 2000.
	Bertin, J.: Semiology of Graphics: Diagrams Networks Maps, University of Wisconsin Press, Madison Wis., 1983.

WEB DESIGN 1			Code: 40782
Course teacher	JESENKA PIBERNIK	Course status	compulsory
Original course title	WEB dizajn 1	Semester (winter/summer)	winter
Teacher's contact email	jesenka.pibernik@grf.unizg.hr	ECTS credits	6
Study programme (undergraduate BSc, graduate MSc)	MSc	Hours of teaching (L+S+E)	30+0+30
COURSE DESCRIPTION			
Course objectives	Students are being trained in the design and testing of websites using user-centered design methods.		
Learning outcomes	Plan goals, purpose, content structure, and interface. Design user interaction with the interface. Devise target audience, personas, customer journey mapping, task analysis, flow modelling. Identify and apply user-centered design process methods: user interviews, card sorting, tree testing, guerrilla usability testing, creating and annotating wireframes and prototypes, writing micro-copy for the website. Integrate typography, images, icons, and video into a cohesive web design of a specific style. Design websites that are functional, attractive, useful, and user-friendly. Create a design specification for websites (design-spec). Use typography and color in web design. Define principles of accessibility and inclusivity in web design. Use basic HTML, CSS technologies.		
Course content (syllabus)	1. Introduction, fundamentals of information architecture. Definition of rights and duties of students, definition of exercises, definition of literature, presentation of students' work from previous years, definition of necessary equipment. 2. Website development process using user-centered design methods. Application to SILK / setting up a group blog - students are required to actively participate and track their progress on SILK throughout the semester. 3. Defining the target audience. Depending on prior knowledge, slice PSD to HTML (convert a given PSD file into an HTML page) or design and code a small HTML page with multiple subpages, menu, tables, video, and images. 4. Defining purpose and goals. Initiation of website documentation - defining goals, researching future users (conducting surveys, interviews), and shaping research results. 5. User scenarios and task analysis. Group/individual work: beginning the design of the first individual page in exercises, creating sketches/LOFI wireframes. 6. Design principles. Group work: card sorting and tree testing for the final website. Incorporating testing into project documentation. 7. Conceptual sketches. Creating flowcharts, user journey, and CX maps.		

	8. Prototyping. Group/individual work: creating HIFI wireframes, a fully functional prototype of the page. 9. Hierarchical organization, networks. Group/individual work: Testing prototypes on a real target user group - documenting and presenting test results, making wireframe adjustments based on test results. 10. Navigation organization. Designing an individual website according to wireframes in software of choice. 11. Web colors. Adjustments to documentation/design/wireframes. 12. Web typography. Commenting on individual pages, voice and tone according to personas (addressing users, writing micro-copy, "human interface"). 13. Form design. Complete specification of individual web page. 14. Icon design. Website evaluation, user testing. 15. Final presentation. Preparation for the final presentation.
Required literature (available in the library and/or via other media)	Title
	Caddick R., Cable S., Communicationg the User Eyperience, Wiley 2011.
	Garrett J. J., The Elements of User Experience, New Riders, 2011.
	Barnum C. M., Usability Testing Essentials, Elsevier, 2011.

MOTION GRAPHICS			Code: 53571
Course teacher	JESENKA PIBERNIK	Course status	compulsory
Original course title	Pokretna grafika	Semester (winter/summer)	winter
Teacher's contact email	jesenka.pibernik@grf.unizg.hr	ECTS credits	6
Study programme (undergraduate BSc, graduate MSc)	MSc	Hours of teaching (L+S+E)	30+0+30
COURSE DESCRIPTION			
Course objectives	The aim of the course is to explore the narrative possibilities of motion graphics as a new medium that combines text and graphics in motion. Students will acquire basic knowledge of progressively solving complex visual problems from the design perspective (motion choreography, dramatic structure) and technology (Adobe suite).		
Learning outcomes	Integrate visual vocabulary (typography, images, icons, and video) into a cohesive project. Interpret meanings and emotions conveyed through composition, movement, pace, sound, form, and image depending on the target audience. Apply advanced techniques of Adobe graphic programs. Evaluate the properties of motion (info) graphics in relation to graphic design, web design, information design, and film Apply basic principles of animation. Apply appropriate creative techniques (effects within the composition) and technical standards in the process of creating motion graphics. Ability to work effectively in a team and successfully manage workload and time.		

Course content (syllabus)	1. Introductory lecture - definition of student rights and duties, definition of exercises, definition of literature, presentation of student works from previous years, definition of necessary equipment
	2. History and development of motion graphics
	  • Animation techniques
	  • Task: Creating a stop motion animation
	3. Traditional and computer-generated motion graphics
	  • Basics of animation in Adobe After Effects
	  • Task: Creating motion graphics in After Effects
	4. Individual contributions to the development of motion graphics
	  • Motion design – design for space and time (elements of spatial structuring and framing)
	  • Task: Simulating the spatial relationship of elements and framing using motion graphics
	5. Film credits and trailers (subtitling)
	  • Kinetic typography		

	• Task: Representing connotative meanings of words using motion graphics
	6. Motion graphics concepts: Book announcement
	   • Kinetic typography – sentence animation (animated poster)
	   • Task: Conveying a message in a temporal medium using typographic elements and simple geometric shapes
	7. Motion graphics concepts: Digital book
	8. Moving typography: Conveying meaning and emotions through motion (word)
	   • Real - virtual: Combination of real footage and motion graphics elements
	   • Task: Using keying technique to create motion graphics emphasizing the interaction between video footage and virtual elements of motion graphics
	9. Moving typography (sentence)
	   • Project task: presentation of project tasks
	   • Task: Selecting a project task theme and conducting an analysis of motion graphics of competitive products
	10. Movement choreography: Interpretation of space and time
	   • Project task: personas
	   • Task: Defining the target audience and creating a minimum of 3 persona examples
	11. Concept articulation: conclusion
	   • Project task: brainstorming
	   • Task: Conducting brainstorming related to the project task theme and creating a mental map
	12. Concept articulation: construction of space
	   • Project task: storyboard
	   • Task: Creating a storyboard for the project task
	13. Styles and editing techniques: Sequence composition
	   • Project task: storyboard – Part 2 (task: Correction of the storyboard)
	14. Styles and editing techniques: Transitions
	   • Project task: realization
	   • Task: Implementation of the project task – motion graphics in Adobe After Effects
	15. Final presentation
	   • Project task: realization
	   • Task: Implementation of the project task – motion graphics in Adobe After Effect

	Title
Required literature (available in the library and/or via other media)	Krasner J., Motion Graphic Design, Routledge, 2013.
	Braha Y., Bryne B.,Creative Motion Graphic, Titling for Film, Video and the Web, Routledge, 2013
	Taylor, A., Design Essentials for the Motion Media Artist, Focal Press, 2010.

	Laurel, B., Design research, methods and perspectives; Cambridge, Massachusetts: MIT Press, 2003.

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MARKETING COMMUNICATIONS			Code: 19463
Course teacher	DIANA BRATIĆ	Course status	optional
Original course title	Tržišne komunikacije	Semester (winter/summer)	winter
Teacher's contact email	diana.bratic@grf.unizg.hr	ECTS credits	5
Study programme (undergraduate BSc, graduate MSc)	MSc	Hours of teaching (L+S+E)	30+15+0
COURSE DESCRIPTION			
Course objectives	The main objective of the course is to familiarise students with the role and importance of marketing techniques and tools in modern business. Students will be provided with the necessary theoretical and practical knowledge to understand marketing concepts in specific business environments and acquire the necessary skills to develop marketing strategies by combining and integrating different elements of the marketing mix in synergy with the principles of graphic design, and to carry out marketing activities.		
Learning outcomes	Proposals for the optimal design of the communication mix. Proposing the structure of an integrated communication plan and drafting a communication strategy and tactics. Selecting the most appropriate media for conveying specific messages. Select appropriate forms of advertising for a product, service, brand or company. Prepare an advertising plan and an advertising budget plan. Evaluate the advertising campaign in terms of communication efficiency standards. Strategically integrate promotional activities, institutional advertising and sponsorship into marketing communications. Strategically integrate sales promotion, personal selling, and direct marketing into marketing communications. Measure the effectiveness of marketing communications. Establish a long-term relationship plan with customers.		
Course content (syllabus)	1. Communication and marketing 2. Integrated marketing communication 3. Elements of communication and visual identity 4. Marketing mix configuration 5. Promotion mix configuration 6. Advertising and advertising plan 7. Institutional advertising, publicity, sponsorship, and PR 8. Personal selling, direct and interactive marketing 9. Branding and image 10. Packaging and marketing communication 11. Digital marketing 12. Social networks marketing 13. Integrated communication plan		

	14. Consumer behavior and influence on purchase
	15. Measuring the effectiveness of marketing communication
Required literature (available in the library and/or via other media)	Title
	Kotler, P., Armstrong, G. (2020), Principles of Marketing
	Kotler, P., Kartajaya, H., Setiawan, I. (2021), Marketing 5.0: Technology for Humanity
	Blakeman, R. (2018), Integrated Marketing Communication: Creative Strategy from Idea to Implementation
	Belch, G., Belch, M. (2017), Advertising and Promotion: An Integrated Marketing Communications Perspective
	Lectures from the course

INTRODUCTION TO THE THEORY OF EXPERIMENTAL WORK			Code: 19494
Course teacher	KATARINA ITRIĆ IVANDA	Course status	optional
Original course title	Uvod u teoriju eksprimentalnog rada	Semester (winter/summer)	winter
Teacher's contact email	katarina.itric.ivanda@grf.unizg.hr	ECTS credits	5
Study programme (undergraduate BSc, graduate MSc)	MSc	Hours of teaching (L+S+E)	30+15+0
COURSE DESCRIPTION			
Course objectives	The aim of the course is to acquire basic and professional knowledge, skills and abilities to implement experimental design techniques to improve the production process in graphic technology.		
Learning outcomes	Becoming familiar with experimental design. Preparatory actions (collecting literature, selecting collaborators, etc.). Observation and experimentation. Resolution and propagation of errors. Testing hypotheses. Hypotheses, models, theories, and laws. Defining and analysing measured quantities. The possibility of designing and analysing comparative experiments. Experimental noise (error) and its sources. Types, propagation and elimination of noise. Data acquisition. The existence and treatment of possible alternative hypotheses. Uncertainty (measurement inaccuracy) and experimental design. Building models. Assessing and deciding which factors to use in modelling. Monitoring experiments. Reviewing sampling methods. Deciding when computer simulation can replace experimentation. Statistical processing. Interpretation of measured data. Characteristics of instruments and sensors. Instrument and sensor noise. Standards and common measurements of some quantities. Calibration of instruments and sensors. Determining instrumental function. The course applies fundamental and general knowledge in the analysis of technical and technological processes, classification and explanation of actions and processes within technological units, and applies knowledge from mathematics, chemistry, physics, and modern computer tools to scientific and engineering problems. Also, it enables students to use appropriate mathematical techniques and concepts to obtain quantitative solutions to problems in the graphic industry. This course aims to enable students to understand the logic behind experimental design, understand the factors that promote better experimental design, understand the logic behind inferential statistical testing, present statistical analysis results accurately, concisely and coherently. To apply their understanding of experimental design and statistics, and critically evaluatepublished research. Furthermore, students will learn to design experiments in the field of graphic technology (both technology and design) and report the results in the necessary scope and structure. (Variations of this objective could be used in traditional lectures and courses, as well as in laboratory courses), conduct (or simulate) an experiment in the field of graphic technology (e.g. paper aging) and report the results, develop a mathematical model or computer simulations to correlate or interpret the results of the experiment, interpret data, that is, state and discuss several possible reasons for deviations between predicted and measured results in the experiment, choose the most likely reason and justify the choice, and formulate methods to confirm the explanation.		

Course content (syllabus)	Introduction and objectives. Science and Scientific Method. Experimental design in different fields. Experimental Design in Different Fields - NOISE. Visit to the laboratories at the Faculty of Graphic Arts. Foundations of Experimental Design (I): Causality, Variables, Control, Sampling. Basics of experimental design (II): Validity, reliability, types of experimental projects. Measurement in Experiment: Methods and Methodology. Introduction to descriptive statistics. Error analysis (uncertainty analysis) I. Error analysis (uncertainty analysis) II. Induction and Pattern Recognition. Information Manipulation. Presentation of research proposal; conclusions on experimental research I. Presentation of research proposal; conclusions on experimental research I

	Title
Required literature (available in the library and/or via other media)	SCIENTIFIC METHODS, Richard D. Jarrard, (online book), Dept. of Geology and Geophysics, University of Utah, jarrard@mines.utah.edu, 2001.
	How to Lie with Statistics, Darrell Huff, W.W. Norton & Company Inc, 1954.
	The Design of Experiments (9th ed.). Fisher, Ronald A., Macmillan (1971)

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PACKAGING AND ENVIRONMENT			Code: 19441
Course teacher	IVANA BOLANČA MIRKOVIĆ	Course status	optional
Original course title	Ambalaža i okoliš	Semester (winter/summer)	winter
Teacher's contact email	ivana.bolanca.mirkovic@grf.unizg.hr	ECTS credits	5
Study programme (undergraduate BSc, graduate MSc)	MSc	Hours of teaching (L+S+E)	30+15+0
COURSE DESCRIPTION			
Course objectives	Students identify and recognize ecological symbols on packaging with many examples in order to recognize them. Introducing students to the impact of packaging materials and packaging products on the environment. Students learn about the importance of different types of packaging materials and their contribution to the environment in terms of energy consumption and pollution. They learn about new nano and smart materials and find out their balance in relation to environmental pollution. Students identify possible problems in the healthiness of the packaging product (especially food). Possible ways of recycling or disposing of the packaging product as the end of one life cycle of the packaging product and the opening of a new life cycle, all with the aim of increasing sustainability.		
Learning outcomes	Students will be able to recognize the ecological symbols on the packaging and know their meaning. Students will know the ecological impact on the environment through all phases of the packaging product's life cycle. Students will be able to compare the amount of energy required to produce packaging materials and packaging. Students will be able to evaluate the impact of the production of packaging materials (cellulose, paper, PE-LD, PE-HD, PVC, PET, glass, and metal) on the environment. Students will be able to recognize the possible impact on the health of a packaging product. Students will be able to list new packaging materials and their impact on the environment. Students will be able to classify legal legislation. Students will be able to propose a way to recycle or dispose of the packaging product.		
Course content (syllabus)	1. Lecture: Introduction. Seminar: Introduction, individual assignments. 2. Lecture: The role of packaging. Location of packaging for promotional purposes. Seminar: Packaging design as a carrier of packaging product promotion. 3. Lecture. The role of packaging. Location of packaging for promotional purposes. Seminar: Packaging design as a carrier of packaging product promotion. 4. Lecture: Impact on air and water quality by pulp and paper production. Seminar: Gradation of pollutants from the pulp and paper industry. 5. Lecture: Ecological aspect of the production of PE-LD, PELLD, PE-HD, PVC, PET. The ecological aspect of the production of glass and metal packaging. Seminar: Polymerization. Properties of polymers. 6. Lecture: Printing on the packaging and the environment. Packaging security in the context of migration. Seminar: Impact of packaging on human health. Diseases.		

	7. Lecture: Nanotechnology and paper, cardboard and plastic packaging. Seminar: Nanotechnology - new materials. The impact of nanomaterials on the environment and human health.
	8. Lectures: Colloquium Seminar: Smart packaging and the environment.
	9. Lecture: Complete waste management system. Ordinance on packaging waste. Seminar: Legal acts in the Republic of Croatia and the EU.
	10. Lecture: Disposal of used paper and cardboard packaging. Composting, landfilling, and burning. Seminar: Ecological approach to the end of life of a packaging product.
	11. Lecture: Methods of recycling paper and cardboard packaging. Seminar: Problems in the recycling of multilayer paper packaging. Sticky particles.
	12. Lecture: Influence of printing technique, type of dye, and printing substrate on the quality of recycled fibers. The ecological aspect of the recycling process: CO_2 balance, heavy metals, and organochlorine compounds. Seminar: Ecological valorization of the quality of recycled fibers.
	13. Lectures: Methods of plastic recovery. Seminar: Material recovery.
	14. Lectures: Ecological aspects of glass packaging recycling and recovery of metal packaging. Seminar: Energy recovery.
	15. Lecture: Colloquium Seminar: Compensation for missed seminars.

	Title
	Lox, Packaging and Ecology, PIRA International, Leatherhead,1999
Required literature (available in the library and/or via other media)	S. E. Selke, Packaging and the Environment, CRC Press, Rev.Ed., Portland, 1999.
	Göttsching, H. Pakarinen, Recycled Fiber and Deinking, FPEA and TAPPI, Helsinki, 2000.

BROADBAND NETWORK APPLICATIONS			Code: 19504	
Course teacher	TIBOR SKALA	Course status		optional
Original course title	Širokopojasne mrežne primjene	Semester (winter/summer)		winter
Teacher's contact email	tibor.skala@grf.unizg.hr	ECTS credits		6
Study programme (undergraduate BSc, graduate MSc)	MSc	Hours of teaching (L+S+E)		30+0+30
COURSE DESCRIPTION				
Course objectives	Knowledge of broadband technologies and training for independent broadband design applications for mobile technologies and optimization of multimedia content for broadband applications. Electromagnetic spectrum and digital communications. Information transfer media: copper wire, optical fiber, radio transmission, satellite transmission, microwave, infrared and laser. Definition throughput, bandwidth and long distance communication. Broadband networks. The basics digital telephony, ISDN and development towards broadband connectivity. Types of broadband access: xDSL technologies, optical technologies, electric power network lines (PLC), satellite technology and wireless connections. Interactive broadband multimedia communications. Application of XML language for describing data content and filtered projected rendering via XSLT and SVG technology for different types of display technologies and operating systems in broadband network devices. The use of HTML5 and CSS3 technology in multimedia applications in broadband networks applications.			
Learning outcomes	Students will know: Preparation of complex design tasks for the design and realization of a graphic product in accordance with resources. Valorization of the elements of a particular phase of the implementation of the plan in relation to the set task (plan research, production, design). Planning and evaluation of processes and necessary resources in accordance with the development of graphic technology. Application of graphic engineering knowledge in the field of functional applications (printed electronics, prototyping, bioprinting, mobile applications). Modeling of the graphic process with highly structured programming languages. Optimization of process procedures in graphic reproduction. Developing ideas for shaping and communicating visual messages in the form of new media. Analyze the electromagnetic spectrum and types of media for information transmission. To compare bandwidths, bandwidths and the impact of noise on communications over long distances. Distinguish types of broadband access. Design broadband applications for mobile technologies. Optimizing multimedia content for broadband applications.			
Course content (syllabus)	1. Lecture: Electromagnetic spectrum and digital communications; Exercises: Creating short programs using HTML5 technology. 2. Lecture: Information transmission media: copper wire, optical fiber; Exercises: Creating short programs using HTML5 technology. 3. Lecture: Information transmission media: radio transmission, satellite transmission, microwave, infrared, and laser; Exercises: Creating short programs using HTML5 technology.			

	4. Lecture: Definition of Bandwidth, Bandwidth and Long Distance Communications; Exercises: Creating programs using HTML5 technology.
	5. Lecture: Broadband networks; Exercises: Creating programs using HTML5 and CSS3 technology.
	6. Lecture: Basics of digital telephony, ISDN and development towards broadband connectivity; Exercises: Creating programs using HTML5 and CSS3 technology.
	7. Lecture: Types of broadband access: xDSL technologies; Exercises: Creating a program using HTML5 and CSS3 technology, colloquium.
	8. Lecture: Types of broadband access: optical technologies, lines power networks (PLC); Exercises: Creating programs using XML, HTML5, and CSS3 technologies.
	9. Lecture: Types of broadband access: satellite technologies; Exercises: Creating programs using XML, HTML5, CSS3, and Javascript technologies.
	10. Lecture: Types of broadband access: wireless connections; Exercises: Creating programs using XML, HTML5, CSS3, and Javascript technologies.
	11. Lecture: Interactive broadband multimedia communications; Exercises: Creating an interactive application for broadband use.
	12. Lecture: Application of XML language for the description of data content and filtered design display for different types of display technologies and operating systems in broadband network devices; Exercises: Creating an interactive application for broadband use.
	13. Lecture: Application of XML language for the description of data content and filtered design display for different types of display technologies and operating systems in broadband network devices; Exercises: Creating an interactive application for broadband use.
	14. Lecture: HTML5 and CSS3 technologies in multimedia applications in broadband network applications; Exercises: Creating an interactive application for broadband use.
	15. Lecture: HTML5 and CSS3 technologies in multimedia applications in broadband network applications; Exercises: Creating an interactive application for broadband use, colloquium.
	Title
Required literature (available in the library and/or via other media)	Marlyn Kemper Littman, Building Broadband Networks CRC Press, Jun 3, 2002
	Technology & Engineering A.Salminen, F. Tompa , Communicating with XML, ISBN 978-1-4614-0991-5, e-ISBN 978-1-4614-0992- 2, Springer, 2011
	Pap, Klaudio. Razvoj grafičkih jezika baziranih na XML-u // Tiskarstvo 03 / Lovreček, Mladen (ur.). Zagreb: FS, 2003. 141-143
	Craig Cook, Jason Garber, Foundation HTML5 with CSS3, ISBN 978-1-43 02-3876-8, 2012, Springer
	Gavin Williams, Learn HTML5 and JavaScript for Android, ISBN 978-1-4302-4347-2, 2012, Springer

SELECTED CHAPTERS OF QUALITY MANAGEMENT			Code: 19477
Course teacher	DIANA MILČIĆ	Course status	optional
Original course title	Odabrana poglavlja upravljanja kvalitetom	Semester (winter/summer)	winter
Teacher's contact email	diana.milcic@grf.unizg.hr	ECTS credits	6
Study programme (undergraduate BSc, graduate MSc)	MSc	Hours of teaching (L+S+E)	30+30+0
COURSE DESCRIPTION			
Course objectives	The goal of the course is to familiarize students with different methods of quality improvement and quality management, and management systems, in order to apply them in the optimization of the graphic reproduction process.		
Learning outcomes	Develop a critical understanding and knowledge in quality related management concepts, disciplines and techniques. Develop knowledge of the approaches and methodologies used to achieve continuous improvement, assurance, governance and leadership in quality. Design and implement and critically evaluate Quality systems.		
Course content (syllabus)	1. Basic principles of quality management, process approach 2. Integrated quality management systems 3. Integrated quality management systems, application to graphic production 4. Continuous improvement methods (PDCA, Kaizen, Crosby), General improvement approach 5. Quality management system according to ISO 9000 6. Quality management system according to ISO 9000 7. Total quality management TQM 8. Application of TQM on graphic production process 9. Six sigma 10. Application of "six sigma" on graphic production process 11. "Leana" management 12. Application of "Leana" " on graphic production process 13. QFD - quality function development 14. FMEA – analysis of possible errors and consequences 15. Knowledge management		
Required literature (available in the library and/or via other media)	Title		
	J. Mason, Quality Management Systems, Oberson NSW Pty, Baulkham Hills NSW, 2014. T. Pyzdek, P. Keller, The Handbook for Quality Management, McGrawHill, New York, 2013.		

	P. D. Mauch, Quality Management, CRC Press, 2010.

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QUALITY CONTROL AND ASSURANCE IN GRAPHIC PRODUCTION		Code: 19509	
Course teacher	DIANA MILČIĆ	Course status	optional
Original course title	Kontrola i osiguranje kvalitete grafičke proizvodnje	Semester (winter/summer)	winter
Teacher's contact email	diana.milcic@grf.unizg.hr	ECTS credits	5
Study programme (undergraduate BSc, graduate MSc)	MSc	Hours of teaching (L+S+E)	30+0+15
COURSE DESCRIPTION			
Course objectives	The aim of the course is to acquaint students with basic ISO norms and specifications in the field of graphics production and tools and methods for achieving compliance with standards. The goal is to train students that by choosing appropriate methods and tools, they manage processes in terms of achieving conformity norms.		
Learning outcomes	Determine the conformity of the system or process with the norms. Evaluate the effectiveness of a system or process by selection suitable methods and tools. Plan corrective actions for the purpose of improving the efficiency of the system or process. Choose appropriate methods and tools for carrying out corrective actions		
Course content (syllabus)	1. ISO 12647 standard 2. ISO 2846 standard 3. ISO 15076 standard 4. Application of interpolation methods to reproduction processes. 5. Modeling of reproductive processes using the method of least square deviations. 6. Quality management system according to ISO 9000 7. Total quality management TQM 8. Application of TQM on graphic production process 9. Six sigma 10. Application of "six sigma" on graphic production process 11. "Leana" management 12. Application of "Leana" " on graphic production process 13. QFD - quality function development 14. FMEA – analysis of possible errors and consequences 15. Knowledge management		
Required literature (available in the library and/or via other media)	Title		
	J. Mason, Quality Management Systems, Oberson NSW Pty, Baulkham Hills NSW, 2014.		

	H. Kipphan, Handbook of Print Media, Springer Verlag Berlin Heidelberg New York, Heidelberg, 2001.
	T. Pyzdek, P. Keller, The Handbook for Quality Management, McGrawHill, New York, 2013.

MULTIMEDIA COMMUNICATIONS 2			Code: 19496
Course teacher	IVANA ŽILJAK STANIMIROVIĆ	Course status	optional
Original course title	Multimedijske komunikacije 2	Semester (winter/summer)	winter
Teacher's contact email	ivana.ziljak.stanimirovic@grf.unizg.hr	ECTS credits	6
Study programme (undergraduate BSc, graduate MSc)	MSc	Hours of teaching (L+S+E)	30+0+30
COURSE DESCRIPTION			
Course objectives	Knowledge of advanced multimedia communications and technologies, interactive "rich media", communication via the Internet and communication on the cloud. Designing and generating individualized multimedia coded information and communication through applications, "near field" communication and communication in augmented reality. The course deals with advanced multimedia communications and technologies, interactive "rich media" and mobile App design. Programming of multimedia elements of text, image, sound, video, and interactive form as the highest level of multimedia. An overview of the development of multimedia from the "desktop publishing" revolution to the "post pc" period is given. New technological achievements are analysed in order to plan the future of multimedia and design advanced multimedia communications, design process of mobile App design and innovations. Share of multimedia in communication via the Internet. Internet development, HTML5 and the future of application development. The future of mobile multimedia devices and mobile App design. New generation of services for creativity, production. Applications for designing multimedia content on tablets. Designing animation of graphic products such interactive 3D book for presentation in multimedia environments, publishing on the web. Connecting multimedia content on the cloud, Adobe "creative cloud". Coded multimedia content, coded marking of graphic products, coded communication. Generation and design of individualized 2D codes, QR codes and labels for advanced multimedia communication. Implementation of coded information in conventional graphic product, business documentation and packaging for direct connection to cloud databases. Barcode readers and infrared cameras for automatic controls and cash registers, verification of coded information. Work with optical readers and applications I-nigma, Neo Reader, Custom Tag. Communication in augmented reality, visual - near IR area. Codes in NIR and "Near field" communication. Communicating via the cloud. The benefits of multimedia, attention, connectivity, interactivity, and individualization.		
Learning outcomes	Integrating knowledge from advanced multimedia communication and interactive rich media. Categorization of mobile multimedia devices in order to plan new generations of services for creativity and production. Creating animation of a graphic product in multimedia environments. Using knowledge about modern network communication, the development of the internet and the future of application development, mobile app design.		

	Connecting multimedia content on the cloud. Designing individualized 2D codes, QR codes and labels for advanced multimedia communication. Designing multimedia marking of graphic products for automatic reading and checking. Designing communication in augmented reality, visual - near IR area.
Course content (syllabus)	1. Lecture: Advanced multimedia communications and technologies, interactive "rich media". Programming multimedia elements of text, image, sound, video and interactive form as the highest level of multimedia. Exercise: Getting to know tools for creating multimedia codes and planning an individualized multimedia presentation. 2. Lecture: An overview of the development of multimedia from the "desktop publishing" revolution to the "post pc" era. Exercise: Work with text, image, sound, video and interactive format standards, formats and display on different devices and platforms. 3. Lecture: New technological developments, multimedia future planning and design advanced multimedia communications, application and innovation. Exercise: Creation of a form for multimedia presentation in HTML standard. Incorporation of individualized and designed multimedia content of images, text and interactive form. 4. Lecture: The share of multimedia in communicating via the Internet. The future of mobile app development. The future of mobile multimedia devices. Exercise: Embedding your own presentation in an HTML standard, document and connecting all content in the form of a personal multimedia presentation. Installation of an interactive form for multimedia communication in the form of questions and answers for the survey. 5. Lecture: Coded multimedia content, coded labeling of graphic products, coded communication. Exercise: Creating an individualized QR code and checking its readability. QR code processing in programs for vector and pixel graphics. 6. Lecture: Generation and design of individualized 2D codes, QR codes and tags for advanced multimedia communication. Exercise: QR Code Redesign – embedding an image into the background and front of the codes, getting to know the limitations and possibilities of designing an individualized QR code. 7. Lecture: Implementation of coded information in a conventional graphic product, business documentation and packaging for direct connection to databases. Exercise: Modification of the QR code - embedding the logo in the QR code. 8. Lecture: Barcode readers and infrared cameras for automatic controls and cash registers, coded verification information. Work with optical readers and applications I-nigma, Neo Reader, Custom Tag.

	Exercise: Designing a personal Vcard code and its individualized multimedia content with associated multimedia presentation of personal data.
	9. Lecture: New generation services for creativity and production. Applications for professional design of multimedia content on tablets. Exercise: Creation of individualized Custom TAG code and readability check. Getting to know the possibilities and limitations in individualization through computer graphics.
	10. Lecture: Individualization of computer graphics, and embedding in HTML standard language. Exercise: Adding individualized elements to CustomTag elements, embedding personal individualized data and connecting to a personal multimedia presentation. Selection and presentation of selected 2D codes.
	11. Lecture: Designing presentation of a graphic product such as packaging, interactive book for presentation in multimedia environments, web publishing. Exercise: Designing animation of a graphic product, basic elements in animation.
	12. Lecture: Connecting multimedia content on the cloud, Adobe "creative cloud". Designing 3D presentation of a graphic product. Exercise: Packaging with individualized codes.
	13. Lecture: Communication in augmented reality, visual - near IR area. Exercise: Designing presentation of a graphic product with individualized codes on the cover.
	14. Lecture: New generations of devices for multimedia communication, mobile app design process Exercise: Designing an interactive mobile App design prototipe.
	15. Lecture: Comparison of codes in NIR and "Near field" communication. The future of marking graphic product for multimedia application. Advantages of multimedia; connectivity, interactivity and individualization. Exercise: Multimedia presentation of app design with the use of image, sound, text, video in the presentation, and the use of coded structures and interactive entry into multimedia content.
	Title
Required literature (available in the library and/or via other media)	Jens Ohm: „Multimedia Communication Technology", Springer, 2004. Germany, ISBN: 3-540-01249-4
	Ashok Banerji, Ananda Mohan Ghosh: „Multimedia Technologies", Tata McGraw Hill, NewDelhi, 2010., ISBN 978-0-07-066923-9

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GRAPHICS OF THE DOCUMENTS AND SECURITIES			Code: 19491
Course teacher	IVANA ŽILJAK STANIMIROVIĆ	Course status	optional
Original course title	Grafika dokumenata i vrednosnica	Semester (winter/summer)	winter
Teacher's contact email	ivana.ziljak.stanimirovic@grf.unizg.hr	ECTS credits	5
Study programme (undergraduate BSc, graduate MSc)	MSc	Hours of teaching (L+S+E)	30+0+15
COURSE DESCRIPTION			
Course objectives	Design of graphics for individualized documents and securities with planned protection against forgery. The subject deals with security graphic elements on documents and securities. An analysis of the project task of creating graphics for documents and securities is being carried out. Design of all elements on documents and securities, examples on wallets, tickets, passports, postage stamps. The typography of the denomination, microtext, and the planning of hidden information are analyzed and designed in visual, ultraviolet and near-infrared spectrum. Marks for the blind and visual impairment, watermark and portrait. Subordination of typography to the requirements of security printing: for letterpress, intaglio and screen printing. Line and pixel graphics as information and as anti-copying technology. Planning of engraving and transition graphics in mutually different securities performance technologies. Planning of graphics on documents depending on the sequence of implementation technologies: design of metal and UV threads in paper, analysis of UV and infrared inks, design of protective graphics for intaglio printing, folio printing, screen printing, iris and ink application plan. Optically variable colors. Designing security elements for kinegram. Designing typography and portraits in lenticular technology for application on cards. Installation individualized raster element through PostScript in the portrait. Designing security line graphics and individual rosettes. Designing dinamic rosettes in lenticular 3D graphics. Security graphics on transparent polypropylene for packaging. Linearization of drawings from vector to pixel shape. Innovations in security graphics. Counterfeiting and anti-counterfeiting planning. Designing individualized documents and securities. Prerequisite for taking the course exam: class activity, online activity, exercise assignments, presentation.		
Learning outcomes	Knowledge about security graphic elements on documents and securities. Planning graphics on documents depending on the sequence of security technologies implemented. Design of nominal typography, microtext, typography in line graphics and planning of hidden text and information. Designing individualized security pixel postscript graphics. Design and implementation of security line graphics and individualized rosettes. Graphic planning for the UV and IR spectrum. Planning of security 3d graphics for lenticular technologies on documents and cards.		

	Planning graphics for kinegrams. Knowledge of counterfeit protection systems. Design of individualized documents and securities.
Course content (syllabus)	1. Lecture: Introduction to the overview of all security graphic elements on documents and securities. Analysis of the project task of creating graphics for documents and securities. Exercise: Setting the basic design concept of individualized document and security, the elements of which will be implemented in other exercises. 2. Lecture: Lecture on security graphic elements on banknotes, basic elements, portrait, comparison of security elements, trends in protection and graphic design of securities. Marks for the blind and partially sighted, watermark and portrait. Exercise: Planning of the first security elements and arrangement of elements. Portrait. Watermark planning, information design for the blind and visually impaired. 3. Lecture: Lecture on security graphic elements on personal documents and passports, protection standards and trends in the country and worldwide. Exercise: Designing security graphic elements for use on personal documents. 4. Lecture: Lecture on security graphic elements on securities, documents, diplomas, checks, vouchers and tickets. Possibilities of protection, individualization in smaller and larger editions. Exercise: Designing security graphic elements on documents, checks and tickets with individualized information. 5. Lecture: Lecture on security graphic elements on postage stamps, historical development of stamps, the possibilities of security graphics, double infrared elements, new technologies in the execution of postage stamps, planning the preparation of security elements on the sheet. Exercise: Designing security graphic elements on a personal postage stamp. 6. Lecture: Lecture on design elements of security nominal typography, microtext. Typography planning in line graphics. Planning hidden typography for the visual, ultraviolet and near infrared spectrum. Subordination of typography to the requirements of security printing: for letterpress, intaglio, intaglio and screen printing. Exercise: Nominal typography and microtext on securities, individualzied design. 7. Lecture: Line and pixel graphics as information and anti-copying technology. Designing an individualized raster element. Planning of engraving and the transition of graphics in mutually different securities performance technologies. Exercise: Designing security line and pixel graphics. 8. Lecture: Linearization of drawing from vector to pixel state. Designing and installation individualized raster element through PostScript in the portrait. Exercise: Creating original rasterized proprietary PostScript graphics. Design and installation of an individualized raster element through PostScript in the portrait.

	9. Lecture: Planning graphics on documents depending on the order of implementation technologies: design of metal and UV threads in paper, analysis of UV and infrared inks, design of security graphics for intaglio printing, folio printing, screen printing, iris and dye application plan. Optically variable colors. Exercise: Designing and planning the design of metal and UV threads in paper, prepress. 10. Lecture: Designing security line graphics and individualized rosettes in Postscript programming language. Designing dinamic rosettes in Postscript for performance in lenticular 3D graphics. Designing typography and portraits in lenticular for application on cards. Designing security elements for kinegram. Exercise: Independent design of security line graphics and individualized rosettes in lenticular 3D graphics. Projecting the change of typography and portrait in the lenticular. Designing 3D graphics for lenticular technologies. 11. Lecture: Security graphics on transparent polypropylene. Analysis of securities worldwide derived from polypropylene and trends in the use of polypropylene in security graphics in the future. Exercise: Planning of security graphics on transparent materials. 12. Lecture: Innovations in security graphics. New achievements. Dual graphics planning capabilities in ultraviolet (UV), visible (V) and near infrared spectrum (NIR). Exercise: Planning and drafting graphics for the UV spectrum, planning and drafting graphics for the IR spectrum. 13. Lecture: A lecture on counterfeiting, and counterfeiting protection planning. Exercise: Scanning and recording of securities with a forensic camera, analysis of security graphic elements from recorded securities. 14. Lecture: Lecture on designing a complete individualized document and security method preparation of the document with all security elements for implementation. Exercise: Merging all individualized elements during the exercises into a unique and protected graphic product (e.g. banknote, passport, ticket, value card). Designing individualized documents and securities. 15. Lecture: Lecture on the possibilities of conventional and multimedia document presentation and securities. Exercise: Creation of a percentage of individualized documents and securities with legends and descriptions of protection in the UV, V and NIR spectral ranges.
	Title
Required literature (available in the library and/or via other media)	Vilko Žiljak, Klaudio Pap: „POSTSCRIPT programiranje grafike", FS, Zagreb, 1998. ISBN: 953-199-000
	I. Žiljak, K. Pap, J. Žiljak Vujić, "Infrared Design", FS, Zagreb, (2008), ISBN 978-953-7064-09-9, međunarodna recenzija: Darko Agić, Vesna Kropar Vančina, Frank Romano, Andrew Tribute, Kurt Wolf, Anastasios E. Politis
	Klaudio Pap, Jana Žiljak Vujić, Ivana Žiljak: „Design of digital screening", // FS, Zagreb, 2008. ISBN 978-953-7064-10-5, NSK: 667861, međunarodna recenzija: Darko Agić, Hr, Andrew Tribute, Eng. I. Žiljak, K. Pap
	I. Žiljak, K. Pap, J. Žiljak Vujić, "Infrared Security Graphics", FotoSoft, Zagreb, (2009), ISBN 978-953-7064-11-2
	David Standish: „The Art of Money: The History and Design of Paper Currency from Around the World"

DESIGN AND ENVIRONMENT			Code: 19455
Course teacher	IVANA BOLANČA MIRKOVIĆ	Course status	compulsory
Original course title	Dizajn i okoliš	Semester (winter/summer)	summer
Teacher's contact email	ivana.bolanca.mirkovic@grf.unizg.hr	ECTS credits	5
Study programme (undergraduate BSc, graduate MSc)	MSc	Hours of teaching (L+S+E)	30+15+0
COURSE DESCRIPTION			
Course objectives	The main goal of the course is to train students to apply graphic design principles for environmental sustainability. Within the sustainability approach framework, industrial ecology and life cycle assessment settings are used primarily from "cradle to cradle". Students are explained the ecological principles of selecting and saving raw materials and materials, ways to save energy, and the best available printing techniques (BAT), then design for reuse, recycling, and develop a logical conclusion of the right path of choice. Students are introduced to quantitative methods and tools, and the further goal is the development of group work skills and the development of presentation skills.		
Learning outcomes	Students will be able to describe and apply design principles for environmental sustainability. Students will be able to explain the settings of industrial ecology. Students will be able to assess the life cycle of a graphic product "from cradle to cradle" and apply it when creating a graphic product. Students will be able to explain the carbon footprint and other ways of determining the impact of products, materials or processes on the quality of the environment and apply them in design. Students will be able to create a graphic product by choosing materials in accordance with environmental sustainability. Students will be able to choose the best available reproduction techniques when creating products. Students will be able to describe and evaluate the results of the application of eco indicators and apply them in solving the task. Students will be able to choose which design eco tools to use in the given examples. Students will be able to evaluate the advantages of reusing and/or recycling products.		
Course content (syllabus)	1. Lecture: Introduction, the importance of product creation in the context of environmental quality, generally about the concepts of environmental protection related to design Seminar: Introduction, individual assignments 2. Lecture: Sustainable development, environmental sustainability and design. Seminar: Design and concept of ecological sustainability, examples of good practice. 3. Lecture: Design for the environment. Design for X. Seminar: Design and optimization of ecological characteristics of products including phases of production. 4. Lecture: Design and ecological efficiency. Seminar: Production and service strategy aimed at increased economic profit. 5. Lecture: Industrial ecology. Historical development. Key settings Seminar: Design for production with sustainable use of resources and energy. 6. Lecture: Industrial metabolism. Seminar: Flows of materials and energy in industrial production systems viewed from a biological point of view.		

	7. Lectures: Industrial symbiosis. Seminars: Examples of good practice: examples of symbiosis in the graphic industry. 8. Knowledge verification through a colloquium Seminar: Design and pollution prevention. 9. Lecture: Product life cycle assessment. ISO standards. Seminars: Case studies: life cycle assessment for book and e-book. 10. Lecture: Assessment of the life cycle of a graphic product. Phases of analysis. Seminar: Evaluation of the impact of the graphic product according to the impact factors. Design and database. 11. Lecture: Analysis and comparison of environmental load. Methods: EI, EDIP, CML and others Seminars: Calculation methodology: EI, EDIP. Examples from practice in the domain of materials and printing. 12. Lecture: Tools of eco-friendly design: Tools that include the product life cycle at all stages. Seminars: Examples of the use of ecological design tools that include the life cycle 13. Lecture: Environmentally friendly design tools that have a qualitative approach. Seminars: Examples of using ecological tools for design with a qualitative approach. 14. Lecture: Tools for environmentally friendly design with a quantitative approach. Seminars: Examples of the use of tools for ecologically acceptable design with a quantitative approach. 15. Knowledge verification through a colloquium.
Required literature (available in the library and/or via other media)	Title
	Fiksel, Design for Enviroment, Mc Graw Hill, New York 2012
	W.Jadlička, Suistanable Graphic Design, J. Wiley &Sons, 2009
	J. Ehrenfeld, Sustainability by Design, Yale University Press,New Haven, 2008

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CTP TEHNOLOGY			Code: 19481
Course teacher	SANJA MAHOVIĆ POLJAČEK	Course status	optional
Original course title	CTP tehnologija	Semester (winter/summer)	summer
Teacher's contact email	sanja.mahovic.poljacek@grf.unizg.hr	ECTS credits	6
Study programme (undergraduate BSc, graduate MSc)	MSc	Hours of teaching (L+S+E)	30+15+15
COURSE DESCRIPTION			
Course objectives	Definition of CtP processes and digital workflow in the production of printing plates. Definition of the elements of the Computer to Plate (CtP) system for creating an image on the surface of printing plates. Analysis of devices for imaging printing plates and classification according to architecture, radiation sources and printing techniques. Definition and comparison of different systems for the production of printing plates depending on the technical solutions of the printing units and the structure of the printing plates. Differentiation and evaluation of the technologies available on the market and the possibility of their application in the different workflows.		
Learning outcomes	Students will have the knowledge and ability to define the digital workflow in graphic arts prepress, classify and explain various CtP processes; plan the workflow of processes in graphic arts technology. After completing the course, students will be able to define the CtP system for imaging plates, classify and compare devices for imaging plates, compare and analyze different types of CtP plates, calculate the parameters of imaging plates for different printing techniques, apply different tools for creating imposition templates and optimizing the printing process, calculate and select the type of printing plate taking into account the process parameters, analyze and evaluate the development of CtP technologies, work in a team, apply foreign language skills in literature research.		
Course content (syllabus)	1. Computer to … technologies (0.25 ECTS) 2. CtP - Computer to Plate (0.25 ECTS) 3. Optimization of digital information for imaging process (0.25 ECTS) 4. Imaging devices - architecture, radiation sources (0.25 ECTS) 5. Adjustable imaging devices (0.25 ECTS) 6. CtP printing plates for intaglio printing (0.25 ECTS) 7. CtP printing plates for intaglio printing - electro gravure (0.25 ECTS) 8. CtP printing plates for flexographic printing (0.25 ECTS) 9. CtP printing plates for flexographic printing (0.25 ECTS) 10. CtP printing plates for offset printing (0.25 ECTS) 11. CtP printing plates for offset printing (0.25 ECTS) 12. CtP printing plates for screen printing (0.25 ECTS)		

	13. CtP printing plates for pad printing (0.25 ECTS) 14. Trends in CtP, non-process printing plates (0.25 ECTS) 15. Trends in CtP, non-process printing plates (0.25 ECTS)
	Title
	S. Mahović Poljaček, CtP tehnologije, Sveučilište u Zagrebu Grafički fakultet, Zagreb, 2021.
	H. Kipphan, Handbook of Print Media, Springer Verlag Berlin Heidelberg New York, Heidelberg, 2001.
Required literature (available in the library and/or via other media)	K. Johansson, P. Lundberg, R. Ryberg, A Guide to Graphic Print Production, 3rd Edition, Wiley, New York, 2011.
	R. M. Adams, F. J. Romano, Computer to Plate: Automating the Printing Industry, GATFPress, Pittsburg, 1999.
	J. T. Lind, G. M. Radencic, GATF Computer-To-Plate Performance Study,Vol. 31, Gatf Research & Technology Reports, Printing Industries Press, 2002.
	J. Deemer, Glossary of Graphic Communications, 4th edition, GATFPress, Pittsburg, 2008.

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OPTOELECTRONIC SYSTEMS 2			Code: 19502
Course teacher	LIDIJA MANDIĆ	Course status	optional
Original course title	Optoelektronički sustavi 2	Semester (winter/summer)	summer
Teacher's contact email	lidija.mandic@grf.unizg.hr	ECTS credits	6
Study programme (undergraduate BSc, graduate MSc)	MSc	Hours of teaching (L+S+E)	30+0+30
COURSE DESCRIPTION			
Course objectives	Learn about new technologies, know the principle of operation and application, distinguish between technologies and recognize their application.		
Learning outcomes	Explain the principle of device operation, evaluate devices of the same type according to characteristics, choose devices according to the purpose, to independently research with the aim of lifelong learning.		
Course content (syllabus)	1. Various LED technologies 2. New screen technologies 3. Principle of 3D monitor operation 4. Touch screens 5. Touch screen technologies 6. Touch screen technologies 7. Wireless technologies 8. Working principle of RFID 9. Application of RFID 10. NFC and application 11. Motion sensors 12. Comparison of different motion sensors 13. Printed electronics 14. Printed electronics 15. New technologies		
Required literature (available in the library and/or via other media)	Title		
	Miles, Sarma and Williams: RFID Technology and Applications Cambridge University Press, 2010; Saleh, Teich, Fundamentals of photonics, Wiley, 2007		

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SYSTEM FOR THE ENVIRONMENT MANAGEMENT		Code: 19461	
Course teacher	MARINA VUKOJE IVANA BOLANČA MIRKOVIĆ	Course status	optional
Original course title	Sustav upravljanja okolišem	Semester (winter/summer)	summer
Teacher's contact email	marina.vukoje@grf.unizg.hr	ECTS credits	5
Study programme (undergraduate BSc, graduate MSc)	MSc	Hours of teaching (L+S+E)	30+15+0
COURSE DESCRIPTION			
Course objectives	The aim of the course is to train students to participate in the implementation of the environmental management system in the company. Students get to know the reasons for environmental protection and the advantages that they achieve by introducing ecologically sustainable production management. The goal is to acquaint students through the contents of the course with how to achieve competitive advantages through environmental protection. A further goal is to train students to carry out environmental management through life cycle assessment "from cradle to cradle", eco-balancing and ecological labeling. One of the goals of the course is to train students to participate in solving the specifics of environmental management for small businesses.		
Learning outcomes	Students will be able to evaluate the advantages achieved by introducing ecologically sustainable production management. Students will be able to participate in planning the modernization of the company based on the principles of sustainability. Students will be able to apply environmental management as a fundamental factor of a successful company. Students will be able to participate in the application of the environmental management system. Students will be able to recognize and evaluate the impact on the environment in the area of emissions of pollutants, process and waste water, consumption of materials and energy for a specific production process. Students will be able to evaluate the eco-balance in order to optimize the ecological suitability of production and products.		
Course content (syllabus)	1. Defining basic concepts in environmental protection. 2. Reasons for preserving the environment in production. Connection between production and the environment. 3. Principles of sustainable development. Socio-economic foundations of ecological sustainability. 4. Monitoring environmental changes and selecting ecological sustainability policy. 5. Important determinants of ecological management. Seven rules of the 7Rs management system. 6. Relationship between development, environmental protection, and economic growth. 7. Environmental management system: scope, definitions, system requirements. 8. Knowledge check through colloquium. 9. Environmental management system model, planning, implementation, and operation. 10. Description of the production process - environmental protection and technological process.		

	11. Environmental management through the product life cycle, definitions, division, assessment methodology, functional unit, system boundary. Generic elements of life cycle assessment. 12. Environmental management through eco-balancing. 13. Environmental management through ecological labeling. 14. Ecological settings for small entrepreneurship and specificities of environmental management. 15. Knowledge check through colloquium.
Required literature (available in the library and/or via other media)	Title
	J.Kausek, Environmental Management Quick and Easy, Quality Press, Milwaukee,2007;
	J.Kaplan,Greening your Small Business, Prentice Hall Press, Nev York, 2009,
	M. Common, S Stagl, Ecological Economics, Cambrige University Press, Cambrige, 2005.

OPTICAL METHODS OF THE PRINTING SURFACE INVESTIGATIONS		Code: 19490	
Course teacher	KATARINA ITRIĆ IVANDA	Course status	optional
Original course title	Optičke metode ispitivanja tiskovnih površina	Semester (winter/summer)	summer
Teacher's contact email	katarina.itric.ivanda@grf.unizg.hr	ECTS credits	5
Study programme (undergraduate BSc, graduate MSc)	MSc	Hours of teaching (L+S+E)	30+0+15
COURSE DESCRIPTION			
Course objectives	The course provides students with knowledge of methods for examining the optical properties of various types of printing surfaces, both unprinted and printed. It enables them to plan research methodologies and use measuring devices to demonstrate formulated hypotheses. In laboratory exercises, students apply the knowledge acquired through the curriculum, which is continuously connected to the foundational courses throughout all forms of instruction.		
Learning outcomes	Describe the correlation between mutually dependent physical quantities and apply them to real situations in graphic reproduction. Use computer programs for statistical processing and graphical presentation of data. Observe, record, and analyze data obtained from laboratory tests. Create measurement conditions to assess the stability of printing surfaces. Utilize relevant standards for assessing the quality of printing surfaces based on their optical characteristics. Interpret the reflection spectra of printing surfaces and colorants. Apply the Kubelka-Munk model to calculate the absorption and scattering coefficients on measured printing surfaces, whether recycled or non-recycled. Describe spectrophotometers and recognize when/how to use them in graphic reproduction. Analyze the interaction of light and printing substrate based on physical models, understanding the optical/physical enlargement of the raster element. Explain the interaction of light with the printed substrate using simple physical models (Murray-Daveis and Yule-Nielsen). Define accelerated aging (degradation of the printing surface under controlled conditions) and natural aging.		
Course content (syllabus)	1. Introduction. Electromagnetic radiation, spectrum. Energy of radiation. Radiation sources. Impact of electromagnetic radiation on the environment. Visible radiation. Perception of visible radiation. Thermal radiation. Ultraviolet radiation. Microwaves. Radio waves. X-ray radiation. Gamma radiation and cosmic rays. 2. Emission and absorption spectra. Characteristics of spectra. Spectra of gases, liquids, and solids. Operation principle of spectrometers. Types of spectrometers; prism and optical grating. Standard light sources.		

	3. Reflection of electromagnetic radiation on a completely opaque surface; surface, mirror, reflection. Printing substrates and surface reflection. Layered and unlayered surfaces. Reflectance curves in the visible spectrum and the structure of the printing surface. 4. Light scattering within bound particles; turbid media, cloudy systems. Kubelka-Munk scattering theory and its application in investigating the optical properties of printing surfaces. Reflectance, scattering, and absorption spectra. Relationship between scattering and structure, types, substrates. 5. Murray–Davies and Yule-Nielsen improved scattering theory. 6. Scattering on non-recycled and recycled substrates. Analysis of particle impurities in printing substrates. 7. Scattering and colored substrates, papers. Reflectance curves and factors of scattering and absorption. Limitations of applying the Kubelka–Munk scattering theory to recycled and fully colored substrates. 8. Scattering and types of printing substrates (transparent/opaque). 9. Scattering and related optical properties of printing surfaces. Brightness, transparency, opacity. Familiarization with optical measurement standards; ISO, TAPPI. 10. Fluorescence; explanation of the phenomenon. Detection of the phenomenon in reflectance measurements. Fluorescent materials. 11. Aging and stability of printing surfaces. Visible and UV radiation. Selection of specific radiation sources and measurement of radiation energy. 12. Stability of printing surfaces and the influence of moisture and temperature. Effect of substrate acidity on stability. Accelerated and natural aging. 13. Physical changes within the substrate caused by aging. 14. Overview of selected testing methods. Analysis of all student results in the group. 15. Familiarization with literature data on proposed methods and suggestions for new content for testing printing surfaces.
Required literature (available in the library and/or via other media)	Title
	P. Kulišić i V. Lopac : Elektromagnetske pojave i struktura tvari, Školska knjiga, Zagreb, 2003.
	H. Kipphan: Handbook of Print Media: Technologies and production methods, Berlin, Springer,2001
	N. Pauler: Paper optics, AB Lorentzen & Wettre, Sweden, 2001.

SURFACE PHENOMENA ON PRINTING FORMS		Code: 19480	
Course teacher	TOMISLAV CIGULA TAMARA TOMAŠEGOVIĆ	Course status	optional
Original course title	Površinske pojave na tiskovnim formama	Semester (winter/summer)	summer
Teacher's contact email	tomislav.cigula@grf.unizg.hr tamara.tomasegovic@grf.unizg.hr	ECTS credits	5
Study programme (undergraduate BSc, graduate MSc)	MSc	Hours of teaching (L+S+E)	30+15+0
COURSE DESCRIPTION			
Course objectives	To define and analyse surface phenomena which are specific for printing forms. To choose measurement methods which enable characterization of materials and processes in printing forms production. To evaluate influence of the processing parameters. To optimize printing forms production. To determine composition of fluids in the printing processes for the highest functionality.		
Learning outcomes	Proposing new and functional solutions for graphic products having in mind used materials and production processes of printing forms; evaluation and characterization of advanced imaging processes in graphic industry; implementation of the eco-system in graphic processes; optimization of processing steps in graphic reproduction. After finishing the course, the student can: define and classify surface phenomena in the graphic industry; analyse and evaluate the influence of the material and its surface treatment on functionality in graphic reproduction processes; explain and evaluate physicochemical properties of fluids and the parameters that affects them; choose and apply measurement methods in surface properties analysis, evaluate the material processing and propose optimization solutions, propose additives ratio in liquids to increase functionality; evaluate and elaborate modification of material processing; literature search related to materials for the production of printing forms.		
Course content (syllabus)	1. Definition of surfaces, surface phenomena on printing forms 2. Adsorption in graphic reproduction processes 3. Wetting in graphic reproduction processes 4. Methods of determining the wetting degree on the surfaces of the printing form 5. Capillarity in graphic reproduction processes 6. Mechanical properties of surfaces, structure related topography of solids 7. Surface roughness, roughness parameters 8. Methods for determining roughness parameters 9. Processes of printing forms production that affect the change in the roughness of the material 10. Physico-chemical properties of liquids in the graphic industry		

	11. The role and composition of the wetting solution 12. Surfactants 13. Methods for determining the surface properties of liquids 14. Methods for determining the free surface energy of materials 15. Parameters affecting solid-liquid interaction
	Title
Required literature (available in the library and/or via other media)	K. L. Mittal, Contact Angle, Wettability and Adhesion, Volume 5, VSP, Leiden, 2008
	S. Hartland, Surface and Interfacial Tension: Measurement, Theory and Applications, Marcel Dekker, 2004
	H. Kipphan, Handbook of Print Media, Springer Verlag Berlin Heidelberg New York, Heidelberg, 2001
	P. C. Hiemenz. R. Rajagopalan, Principles of Colloid and Surface Chemistry, Third Edition, Marcel Dekker, New York, 1997
	P. Atkins, J. de Paula, Atkin\'s Physical Chemistry, 8th edition, Oxford University Press, Oxford, 2006

INK IN DIGITAL ENVIRONMENT
Code: 96536

Course teacher	LIDIJA MANDIĆ	Course status	optional
Original course title	Boja u digitalnom okruženju	Semester (winter/summer)	summer
Teacher's contact email	lidija.mandic@grf.unizg.hr	ECTS credits	3
Study programme (undergraduate BSc, graduate MSc)	MSc	Hours of teaching (L+S+E)	15+0+0

COURSE DESCRIPTION

Course objectives	Classification of parameters affecting color appearance. Explain the importance of modeling the chromatic model adaptations. Connect chromatic adaptation models with color appearance models. Explain models for image appearance.
Learning outcomes	Evaluation of the characteristics of prepress, printing, finishing and multimedia devices Expected learning outcomes at the subject level explain the parameters that affect the appearance of colors compare the different ones chromatic adaptation models connect models for color appearance with application differentiate models for colors appearance from the image appearance model.
Course content (syllabus)	1. Experience of color and parameters that influence the experience of color; 2. Color characteristics that are included in the color appearance model, 3. Human visual system and adaptation 4. Parameters affecting color appearance 5. Parameters affecting color appearance 6. Color spaces 7. Device characterization 8. Device characterization 9. Models of chromatic adaptation 10. Models of chromatic adaptation 11. Models of chromatic adaptation 12. Color appearance model 13. Color appearance model 14. Model for image appearance 15. Image appearance model
Required literature (available in the library and/or via other media)	Title
	MD Fairchild. Color Appearance Models, Second edition. Chichester, UK: John Wiley and Sons, Ltd., 2005
	Reinhard, Khan, Akyuz, Johnson, Color Imaging: fundamentals and Applications, A.K. Peters, 2008

GRAPHIC DESIGN 4 — Code: 33073

GRAPHIC DESIGN 4			Code: 33073
Course teacher	MAJA BROZOVIĆ	Course status	compulsory
Original course title	Grafički dizajn 4	Semester (winter/summer)	summer
Teacher's contact email	maja.brozovic@grf.unizg.hr	ECTS credits	5
Study programme (undergraduate BSc, graduate MSc)	MSc	Hours of teaching (L+S+E)	15+0+45

COURSE DESCRIPTION	
Course objectives	To obtain the knowledge and acquire the know-how in presenting design concept for a visual identity and its application in form of a book of graphic standards. Course focuses on finding and realizing design concepts for visual identity of a company (or a product) through trademark/logotype design, elaboration of all aspects of visual identity and presentation of its intended applications in form of a book of graphic standards. Through lectures and practical work on project assignments, students obtain knowledge and practical skills needed to present design concepts for visual identity, in accordance to the requirements of public competitions. Theme units of the course encompass examples of client's requirements, analysis of the affinity of different job-types/companies, selecting the best solutions, development of design concepts or models, delivering proposals for trademark/logotype design, its presentation and assessment, as well as implementation of the final draft. Student research activities on the project assignment consist in elaborating all aspects of visual identity and materializing it in the form of a book of graphic standards. These include the following: description of the objectives, SWOT analysis in regard to competition, construction of a trademark, appropriate typographic customization and colour pallet definition, listing of authorized and prohibited implementations, creating previews of application on corporate communication, promotional materials and other aspects of its intended use.
Learning outcomes	Analysis and critical assessment of marks functioning as visual identity. Evaluate existing, competitive and own author's logo solutions. Designing various concepts for trademark/logotype while respecting the specific needs of the client. Presentation of proposed design concepts for trademark/logotype according to the given framework. Conducting a development project aimed at shaping visual identity. Producing a book of graphic standards according to the client's requests. Autonomous completion of project assignments in simulated conditions of public competition.
Course content (syllabus)	1. Visual identity - definition, purpose, goals, examples Analyze graphic solutions of existing signs and company's logos of various activities 2. A set of guidelines for creating a visual identity Compilation of guidelines for designing the company's visual identity according to the student's choice

	3. Examples of visual identities of related activities, analysis of signs and logos Analyze the visual identities of competing companies in relation to the selected company for which the student drew up guidelines in the previous exercise
	4. Examples of different proposals for sign and logo solutions Design five proposals for a conceptual design of a sign, logo, or its combination in relation to the set of guidelines for creating a visual identity
	5. Successfulness evaluation of selected solutions in real circumstances of the sign Select the best solution from the five proposed solutions within a group of students
	6. Construction of signs, logos, slogans in the coordinate system, determination of empty space Construct the sign, logo, and slogan of the chosen solution in the coordinate system, define the empty space
	7. Sign/logo application in different sizes, determination of the minimum allowed size, correction needs in small sizes Determine the minimum size of the sign/logo, correct the conceptual solution due to the possible loss of certain parts
	8. Defining the basic and extended color palette, applying systems Define the number and types of colors of the sign/logo through different applying systems
	9. Defining official typography: primary and secondary Analyze examples, select primary and secondary typography, selection justification
	10. Obligatory performance forms of the sign/logo and their application Perform the sign/logo in the following forms: monochrome, negative, grayscale, line version
	11. Permitted and forbidden application forms of the sign/logo Recommend other permitted forms of sign/logo and define forbidden applications
	12. Sign/logo application on different substrates (monochrome, multicolor, photos) Anticipate the need to apply the sign/logo on different substrates and define the appearance of the sign/logo on grayscale, monochrome, and multi-colored substrates, photographs
	13. Examples of business documentation, advantages, and disadvantages Design business documentation that reflects the recognizability of the subject's visual identity
	14. Examples and purpose of sign/logo application for the purpose of promotional activities Apply the sign/logo on small promotional materials and signage
	15. Examples analysis of different books of standards Organize visual identity items in the form of a book of standards
	Title
Required literature (available in the library and/or via other media)	J. Murphy, M. Rowe: How to Design Trademarks and Logos (Graphic Designers Library),F&W Pubns, 1991.
	B.M. Pederson (Editor): Graphic Corporate Identity, Graphic Press, 1994.
	Manual of graphic standards

WRAPPING		Code: 96534	
Course teacher	DIANA MILČIĆ	Course status	optional
Original course title	Pakiranje	Semester (winter/summer)	summer
Teacher's contact email	diana.milcic@grf.unizg.hr	ECTS credits	5
Study programme (undergraduate BSc, graduate MSc)	MSc	Hours of teaching (L+S+E)	30+0+15
COURSE DESCRIPTION			
Course objectives	The aim of the course is to acquire basic and professional knowledge in the field of packaging and to train students for selection suitable packaging equipment depending on the product and form of packaging.		
Learning outcomes	Describe the components of the packaging value chain and demonstrate how these influences the design of packages component. Design the variants of packaging for different levels of packing and recommend the most suitable. Select suitable materials and technology for the manufacturing of a particular type of packaging. Recommend the packing machines and equipment.		
Course content (syllabus)	1. Classification of packaging and packaging machines. 2. Supply of packaging lines. 3. Lines for packaging in flexible packaging. 4. Lines for packing liquid substances. 5. Lines for packing bulk substances. 6. Closing the packaging. 7. Lines for filling cardboard packaging. 8. Quality control systems on packaging lines. 9. Containers and transport systems on packaging lines. 10. Drive and control parts of packaging lines. 11. Final packaging operations: wrapping and palletizing. 12. Packaging system design: necessary equipment. 13. Computer support for packaging system design. 14. Designing the packaging system: term and financial plans. 15. Integration of treated thematic units.		
Required literature (available in the library and/or via other media)	Title		
	Henry, J. R., Packaging machinery handbook, CreateSpace Independent Publishing Platform, 2012.		
	Emblem, A., Emblem, H., Packaging technology, Woodhead Publishing, 2012.		
	Henry, J. R., Machinery matters, John R. Henry, CreateSpace Independent Publishing Platform, 2011.		

	L. A. Edmund, Packaging: Specifications, Purchasing and Quality Control Packaging and Converting Technology, CRC Press, 1996.

University of Zagreb
Faculty of Graphic Arts

ENROLMENT PROCEDURE

All procedures after the signing of the Learning Agreement are handled by the International Relations Office (ivana.zganjar@grf.unizg.hr).
Below you can find all the steps that follow the signing of the document.

Step 1: Contact GRF International Relations Office
GRF IRO coordinator will provide exchange students all needed information about the enrolment procedure.
Step 2: Obtaining OIB/PIN number
OIB number (hrv. OIB = osobni identifikacijski broj) needs to be assigned to each visiting student. All information's about getting OIB/PIN number student will get on e-mail from central IRO office.
Step 3: Enrolment
In order to get enrolled into selected courses please prepare documents which will be listed in a e-mail from GRF IRO coordinator.
Step 5: Procedures during enrolment
If you wish to substitute a course with another course offered in English – you must do so according to the rules of home (sending) institution. This must be arranged by the student – the student must obtain the course leader's consent for withdrawing from the course, as well as consent for enrolment from the leader of the newly selected course. These consents should be in writing (email) and must be forwarded to the IRO GRF Office (ivana.zganjar@grf.unizg.hr). This will be followed by changes to the Learning agreement which will be organised between the student and the ECTS coordinator (ivana.plazonic@grf.unizg.hr).
Step 6: Procedures after the semester
After the semester contact the IRO GRF coordinator (ivana.zganjar@grf.unizg.hr) to get certificate of Departure.