UNIVERZITY OF PRIZREN
FACULTY OF COMPUTER SCIENCE

PROGRAM: SD

Curriculum - – SYLLABUS								
Level of studies		BACHELOR	***Program***	SD	***Academic year***	2017/18		
SUBJECT		Graphical computer and image processing						
Year	**II**	***Status Of the subject***	Obligatory	***Code***		***ECTS credits***	6	
Semester	II							
Teaching weeks		15		***Hours teaching***	***75***	***Lectures***	***Exercises***	
						45	30	
Teaching Methodology		Lectures, exercises, seminar papers, consultations, tests.						
Consultation		Once a week						
The teacher		Prof.Dr. Arbnor Pajaziti		***E-mail:***	arbnor.pajaziti@uni-pr.edu			
				Tel.:				
Assistant		Ass. PhD.c. Betim Maloku		***E-mail:***	betim.maloku@uni-prizren.com			
				Tel.:				

Study goal and table of content	**Benefits of student**
This course will introduce fundamental technologies for digital image and video representation, analysis, processing and compression (MPEG, JPEG etc) for senior undergraduates and graduate students. Topics include digital image/video perception, sampling, optimal quantization, transform, filtering, multi-spectral processing, restoration, analysis, feature extraction, morphological transform, coding of image/video compression (lossy & lossless), and latest applications. We will also have hands on experience in applying analytical solutions in practical applications by using MATLAB tool.	On successful completion of the module, students will be able to: -Understand and distinguish between the key principles and techniques of the fields of Computer Graphics and of Digital Image Processing. -Demonstrate understanding of, and competence in, applying these principles -Understand how Computer Graphics and Digital Image Processing are applied in real, modern applications. -Implement different image processing procedures such as sampling, optimal quantization, transform, filtering, multi-spectral processing, restoration, analysis, feature extraction, morphological transform, coding of image/video compression (lossy & lossless)

Methodology for the implementation of educational topics:
This is a combined course with lectures, discussions, conversations, practical work, exercises, workshops, seminars, task in which subjects are presented by professor of course and assistant in the laboratory.
Conditions for realization of educational topics:
• Adequate literature, table, computer, projector and other necessary IT tools for learning and exercises.

Ways of assessing of the student (in %) :	**Evaluation in%**	**Final grade**
A seminary work	10.00 %	51-60% - grade 6

Colloquia	30.00 %	61-70	7
Final test	60.00 %	71-80	8
Final Exam included three evaluation criteria;	10 + 30 + 60	81-90	9
Total	100.00 %	91-100	10

Obligations of student:

Lectures	Exercises
The student must attend regularly lectures and exercises, to use all possibilities for learning the knowledge required to use literature and wider, to be active and keep regulations on higher education in ethics and courtesy for cooperation.	The student should be active in exercises and reflect the readiness and knowledge of initiatives, ideas and demonstrations of the knowledge acquired in the lectures.

Student workload for Subject

Activities	Hour/ weeks	Days/Weeks	Total
Lectures	3	15 weeks	45 hours
Laboratory exercises	2	15 weeks	30 hours
Contacts with teachers / consultations	1	5 weeks	5 hours
Practical work	1	2 weeks	2 hours
Projects, presentations, etc.	1	2 weeks	2 hours
Own study time	3	15 weeks	45 hours
Preparation for final exam	3	5 weeks	15 hours
Time spent in the assessment (tests, final exam, etc.)	2	3 days	6 hours
Notice: 1 ECTS credits= 25 hour commitment, e.g. if the subject has 6 ECTS credits student must have 150 hours during the semester commitment.		**Total load:**	**150 hours**

Week	Lectures Topic	Hour	Exercises Topic	Hour
1	**Course Introduction and Prerequisites**	3	**Introduction to Matlab software.**	2
2	**Digital image fundamentals**	3	**Lab exercises with Matlab software:** Light, brightness adaption and discrimination, pixels, coordinate conventions, imaging geometry and perspective projection.	2
3	**Gray-level and color image processing**	3	**Lab exercises with Matlab software:** Spatial domain filtering, sampling and quantization.	2
4	**Image enhancement in spatial domain**	3	**Lab exercises with Matlab software:** Intensity transformations, contrast stretching, histogram equalization, correlation and convolution, smoothing filters, sharpening filters, gradient and Laplacian.	2
5	**Image transform and frequency domain enhancement ((DFT, DCT, etc)**	3	**Lab exercises with Matlab software:** Hotelling transform, Fourier transforms and properties, FFT (decimation in frequency and decimation in time techniques),	2

			convolution, correlation, 2-D sampling, discrete cosine transform, frequency domain filtering.	
6	**Spatial Domain Filtering**	3	**Lab exercises with Matlab software:** Intensity transformations, contrast stretching, histogram equalization, correlation and convolution.	2
7	**HW2 presentation, Video surveillance application**	3	**Lab exercises with Matlab software:** Smoothing filters, sharpening filters, gradient and Laplacian.	2
8	**Midterm exam**	3	**The first laboratory test**	2
9	**Image restoration**	3	**Lab exercises with Matlab software:** Basic framework, interactive restoration, image deformation and geometric transformations, image morphing, restoration techniques, noise characterization, noise restoration filters, adaptive filters, linear, position invariant degradations, estimation of degradation functions, restoration from projections.	2
10	**Morphological image processing**	3	**Lab exercises with Matlab software:** Basics, SE, erosion, dilation, opening, closing, Hit-or-Miss transform, boundary detection, hole filling, connected components, convex hull, thinning, thickening, skeletons, pruning, geodesic dilation, erosion, reconstruction by dilation and erosion.	2
11	**Wavelet based Image Compression**	3	**Lab exercises with Matlab software:** Expansion of functions, Multi-resolution analysis, Scaling functions, MRA refinement equation, Wavelet series expansion, Discrete Wavelet Transform (DWT), Continuous Wavelet Transform.	2
12	**Image segmentation**	3	**Lab exercises with Matlab software:** Fast Wavelet Transform, 2-D wavelet Transform, JPEG- 2000 encoding, Digital Image Watermarking.	2
13	**Image descriptors**	3	**Lab exercises with Matlab software:** Boundary detection based techniques, Point, line detection, Edge detection, Edge linking, local processing, regional processing, Hough transform, Thresholding, Iterative thresholding.	2

14	**Object recognition**	3	**Lab exercises with Matlab software:** Otsu's method, Moving averages, Multivariable thresholding, Regionbased segmentation, Watershed algorithm, use of motion in segmentation.	2
15	**Final Exam**	3	**The second laboratory test**	2

LITERATURE:

Basic Literature:
Course slides are provided by instrutor.

1. Anil K. Jain, *Fundamentals of Digital Image Processing*, Prentice Hall, 1989 William K. Pratt, *Digital Image Processing*, 3rd Edition, John Wiley, 2001.
2. Kenneth R. Castleman, *Digital Image Processing*, Prentice Hall, 1996.
3. Arun N. Netravali, Barry G. Haskell, *Digital Pictures*, Plenum, 2e, 1995.
4. Sonka, Hlavac and Boyle, *Image Processing, Analysis, and Machine Vision*, 3rd edition,CENGAGE-Engineering
5. Majid Rabbani and Paul Jones, *Digital Image Compression Techniques*, SPIE, 1991, ISBN 0819406481
6. Allen Gersho and Robert M. Gray, *Vector Quantization and Signal Compression*, Springer, 1991, 0792391810

Additional Literature:

1. Xhevahir Bajrami“ Grafika kompjuterike dhe Procesimi i Imazheve” Ligjërata të autorizuara, 2015

NOTICE:

- In general presentations of lectures will be made through Power Point system, table, use of materials and computer software and the Internet.
- Also, the professor will provide additional materials (papers, publications, national bulletins and sound research findings and final).
- In the absence of the possibility that practical work is organized every week, in cooperation with the management of the University, this activity will be organized on certain days, organizations, companies, farms, processing manufacturing unit.
- During each session, will be organized conversations with students.

Notice for the student:

- The students are required to be regular in the lectures and exercises.
- The contribution of the students in the form of conversation with the students will be evaluated.
- Arrival time at lectures and exercises is mandatory.