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PROSPERITAS VESTRA FINIS NOSTRA!

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FACULTY OF MEDICINE

Approved:
Dean:
(Prof. Dr. Zlatislav Stoyanov Dimitrov, DSc)

SYLLABUS

IN

"Virtual anatomy and 3D modelling"

Specialty	**MEDICINE**
Educational - qualification degree	**master**
Organizational form of education	**full-time**
Auditorial activity (Lectures/Seminars)	**32 (16/16)**
Extra-auditorial activity	**28**
ECTS- credits	**2**
Discipline type	**elective**
Semester/s of education	**VI, VIII, X**
Semester of examination	**VI, VIII, X**
Developer(s) of the Syllabus:	**Assoc. Prof. Stoyan Pavlov, MD, PhD**
	Dr. Petar Valchanov, MD

Varna, 2022

ANNOTATION

Aims of the course	3D modelling is a digital process, which allows the generation of anatomically correct three-dimensional model. Those models represent the organization of the structures in the human body on different level (molecular, cellular, histological, macroscopic or systematic) and is based on accurate morphological data, collected with histological or tomographic imaging studies. Resulting 3D models can be used for 3D visualization, volumetric 3D hologram or physically recreated with additive manufacturing. The course will present to students the basis of the main radiological and histological imaging methods and methods for 3D surface scanning; the software for image processing, 3D Segmentation, and 3D modelling. The main topic of the course are the techniques for visualization of the 3D models (3D visualization, AR, VR, 3D PDF, volumetric hologram) and the principles of 3D printing. The course includes information about the protection of intellectual property and online trading of 3D models.
Outcomes for students at the end of the course:	
Knowledge	▪ History of the visualization methods in the Anatomy ▪ Digital editing of images, acquired with biomedical studies. ▪ Tomographic imaging studies ▪ Surface 3D scanning. ▪ Editing of biomedical imaging studies (3D Segmentation). ▪ Volumetric and surface 3D models and main methods for their visualization and editing. ▪ 3D printing – principles, materials, applications. ▪ Design of medical devices and anthropological physical phantoms, 3D printed models for preoperative planning and simulators. ▪ Presenting of medical information with 3D models – case report, publication, oral presentation, poster. ▪ 3D models Publishing– intellectual rights, licenses, digital theft.
Skills	▪ *Software for analysis of medical images (ImageJ/FIJI).* ▪ *Dicom viewers (Radiant).* ▪ *Table for virtual dissections (Anatomage).* ▪ *3D viewers 3D atlases.* ▪ *Medical informatics software. (Slicer 3D).* ▪ *Software for 3D sculpting. (Autodesk Meshmixer).* ▪ *Work with 3D surface scanner (XYZPrinting 3D Scanner 2.0).* ▪ *Publishing of 3D models (Sketchfab.com). Adding of a visible or hidden watermark on a 3D model.* ▪ *3D printing of 3D models (Hyrel Hydra 16A). Postprocessing.*
Competences	• **Medical Knowledge** about established and evolving biomedical, clinical, and cognate (e.g., epidemiological and social-behavioral) sciences and the application of this knowledge to patient care. o *Medical imaging methods.* o *Resolving clinical and scientific problems regarding biomedical imaging studies.* o *Application of the studied abilities in clinical situations.*

	• **Practice-Based Learning and Improvement** that involves investigation and evaluation of their own patient care, appraisal, and assimilation of scientific evidence, and improvements in patient care. o *Assessment of scientific evidence.* o *Application of evidence-based medicine.* • **Interpersonal and Communication Skills** that result in effective information exchange and teaming with patients, their families, and other health professionals. o *Effective work as a member of medical or scientific team.* • **Professionalism,** as manifested through a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population. o *Uninterrupted personal and professional development.* • **Systems-Based Practice**, as manifested by actions that demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value. o *Work in interdisciplinary team for improving of the quality of imaging diagnostic studies.* o *Identification of systematic errors in the imaging studies and their resolving.*

Key competencies for lifelong learning[1], that the discipline develops:	
Literacy competence Literacy is the ability to identify, understand, express, create, and interpret concepts, feelings, facts and opinions in both oral and written forms, using visual, sound/audio and digital materials across disciplines and contexts. It implies the ability to communicate and connect effectively with others, in an appropriate and creative way.	**X**
Multilingual competence This competence defines the ability to use different languages appropriately and effectively for communication. It broadly shares the main skill dimensions of literacy: it is based on the ability to understand, express and interpret concepts, thoughts, feelings, facts and opinions in both oral and written form (listening, speaking, reading and writing) in an appropriate range of societal and cultural contexts according to one's wants or needs.	**X**
Mathematical competence and competence in science, technology, engineering A. Mathematical competence is the ability to develop and apply mathematical thinking and insight in order to solve a range of problems in everyday situations. Building on a sound mastery of numeracy, the emphasis is on process and activity, as well as knowledge. Mathematical competence involves, to different degrees, the ability and willingness to use mathematical modes of thought and presentation (formulas, models, constructs, graphs, charts). B. Competence in science refers to the ability and willingness to explain the natural world by making use of the body of knowledge and methodology employed, including observation and experimentation, in order to identify questions and to draw evidence-based conclusions. Competences in technology and engineering are applications of that knowledge and methodology in response to perceived human wants or needs. Competence in science, technology and engineering involves an understanding of the changes caused by human activity and responsibility as an individual citizen.	

[1] As defined in 2018 r. by the European Union Council (https://eur-lex.europa.eu/legal-content/BG/TXT/HTML/?uri=CELEX:32018H0604(01)&from=EN)

Digital competence Digital competence involves the confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society. It includes information and data literacy, communication and collaboration, media literacy, digital content creation (including programming), safety (including digital well-being and competences related to cybersecurity), intellectual property related questions, problem solving and critical thinking.	
Personal, social and learning to learn competence Personal, social and learning to learn competence is the ability to reflect upon oneself, effectively manage time and information, work with others in a constructive way, remain resilient and manage one's own learning and career. It includes the ability to cope with uncertainty and complexity, learn to learn, support one's physical and emotional well-being, to maintain physical and mental health, and to be able to lead a health-conscious, future-oriented life, empathize and manage conflict in an inclusive and supportive context.	**X**
Citizenship competence the ability to act as responsible citizens and to fully participate in civic and social life, based on an understanding of social, economic, legal and political concepts and structures, as well as global developments and sustainability.	
Entrepreneurship competence Entrepreneurship competence refers to the capacity to act upon opportunities and ideas, and to transform them into values for others. It is founded upon creativity, critical thinking and problem solving, taking initiative and perseverance and the ability to work collaboratively in order to plan and manage projects that are of cultural, social or financial value.	
Cultural awareness and expression competence Competence in cultural awareness and expression involves having an understanding of and respect for how ideas and meaning are creatively expressed and communicated in different cultures and through a range of arts and other cultural forms. It involves being engaged in understanding, developing and expressing one's own ideas and sense of place or role in society in a variety of ways and contexts.	

Methods of education
▪ lectures ▪ practical exercises, work with scientific literature, presentations

Links with other courses from the curriculum of the specialty
▪ Human anatomy and histology ▪ Radiology