Course Title	**Biomaterials in Tissue Engineering and Regenerative Medicine**				
Course Code	**MME 532**				
Course Type	**Elective**				
Level	Graduate				
Year / Semester	Fall Semester				
Teacher's Name	Dimitrios Tzeranis				
ECTS	8	Lectures / week	3	Laboratories / week	
Course Purpose and Objectives	Provide the required biological background so that students can understand in depth the design & applications of tissue constructs. Describe the major components of tissue constructs (cells, biomaterials, diffusible molecules). Present established and emerging techniques for the fabrication of tissue constructs and key *in vitro* applications. Present established and state-of-the-art applications of grafts in regenerative medicine.				
Learning Outcomes	After this course students 1. Will have good understanding of cell biology, tissue physiology & wound healing principles relevant to tissue engineering & regenerative medicine. 2. Will possess strong background on established and emerging fabrication methods for biomaterials and tissue constructs 3. Will possess strong background on interactions of cells with materials. 4. Will be exposed to the state of the art of tissue constructs for *in vitro* applications (3D culture, organoids, organ-on-chip systems). 5. Will be exposed to the state of the art of biomaterial-based grafts in regenerative medicine. 6. Be able to evaluate tissue construct designs from the viewpoint of a biologist, an engineer and a physician.				
Prerequisites	NO	Required	NO		
Course Content	Cell biology: regulation of gene expression, receptors and signal transduction, cell-cell interactions, extracellular matrix structure, cell-matrix interactions, diffusible molecules (cytokines, growth factors, hormones, small molecules). Cell culture: cell isolation, growth and quantification techniques. Stem cells: kinds, differentiation, induced pluripotent stem cells. Biomaterials: types, fabrication methods, characterization techniques. Instrumentation and experimentation: fluorescence microscopy and spectroscopy, fluorescence proteins. Tissue constructs: cell seeding techniques, bioreactors, microfluidic devices, 3D cell culture, organoids, tissue-on-a-chip systems. *In vitro* applications of tissue constructs: biological research, systems biology, preclinical drug discovery.				

	Wound healing: the irreversible nature of injury, inflammation, foreign body response, wound contraction, induced regeneration. Tissue constructs in regenerative medicine: animal models, grafts, case studies (skin, peripheral nerves, central nervous system, cartilage). Clinical translation.
Teaching Methodology	• Book readings. • Lectures with powerpoint presentations. • Research journal paper readings. • Design case studies.
Bibliography	• Alberts B., Bray D., Hopkin K., Johnson A., Lewis J., Raff M., Roberts K., Walter P. Βασικές Αρχές Κυτταρικής Βιολογίας Alberts, 4η Έκδοση. Εκδοσεις Πασχαλιδης, 2018. • Slack M. W. Jonathan. Βασικες αρχες βιολογιας αναπτυξης. Ακαδημαικες εκδοσεις, 2014 • Temenoff J.S., Mikos A.G., Βιοϋλικά Η Διεπαφή μεταξύ της Επιστήμης των Υλικών και της Βιολογίας. Utopia publishing, 2017. • Truskey G.A., Yuan F., Katz D.F Transport Phenomena in Biological Systems. 2nd Edition. Pearson, 2009.
Assessment	Weekly presentations of journal papers (30%), a class presentation of a semester project (35%) and a final exam (35%).
Language	English