CLASS DAYS and TIME: Tuesday and Thursday  
Classroom: Online with Zoom  
Lecture: 12:00-12:50PM  
Lab Demo: 1:00-1:50 PM  

COURSE FACULTY: James Lechleiter and Exing Wang  

EMAIL: lechleiter@uthscsa.edu; wange3@uthscsa.edu  
_TELEPHONE: 210-562-4043 (Lechleiter); 210-562-4062 (Wang)

COURSE DESCRIPTION AND OBJECTIVES
This course primarily focuses on the practical aspects of using optical microscopes. The course consists of 8 lectures and 8 laboratory demonstrations. The material presented at the lectures introduces basic principles of optical microscopy and its applications in biomedical research. The laboratory demos are designed to reinforce the concepts presented in the lectures and to give students hands-on experience in using various types of microscopes.

Schedule of lectures:
July 7 Geometric Optics  
July 9 Optical Contrast Methods  
July 14 Principles of Fluorescence Imaging  
July 16 Digital Detectors  
July 21 Confocal Microscopy  
July 23 Multiphoton Microscopy  
July 28 Specialized Techniques, FRET, Super-Resolution, Ca2+  
July 30 Image Analysis

Pre-requisites – None  

Semester credit hours – 1 credit hour  

Course Goals
After completing the course students are expected to:

- Understand the concept of conjugated planes and formation of transmission image. Understand bright field and commonly used contrast methods. Know how to do alignment for Kohler illumination, phase contrast, and differential interference contrast.
- Describe the mechanism of fluorescence emission and know how to align a wide-field Epi-fluorescence microscope.
- Understand how commonly used detectors, such as photomultiplier tube, CCD, CMOS, work in microscopy and why a specific type of detector is selected for a specific detection method. Understand the sources of noise and know how to improve signal to noise ratio.
- Describe how laser scanning confocal and two-photon microscope work. Understand the similarities and major differences in illumination and detection between confocal and two photon microscopy. Understand the factors that determine the spatial and temporal resolution, signal to noise ratio, photobleaching rate. Know how to optimize the instrument performance. Understand what additional considerations are required for live cell and intravital imaging.
- Understand the basic principles of specialized techniques: FRET, FRAP, TIRF, and Ca2+ imaging. Describe the fundamental principle how STORM super-resolution imaging work.
➢ Understand basic concepts in digital image processing and analysis. Know how to use arithmetic and logical operations to extract information from images. Know how to use ImageJ to do some basic image analysis.

ATTENDANCE
Students are expected to attend all lectures and lab demos.

GRADING SYSTEM FOR REGISTERED STUDENTS
Complete or Incomplete