

SOUTHEAST MISSOURI STATE UNIVERSITY

Department (s): Physics and Engineering Physics

Course No. EP 400/600

Revision: _____ New: Summer 2013

Title of Course: Bioengineering Laboratory: Flow Cytometry

- I. **Catalog Description and Credit Hours of Course:** Principles of flow cytometer, principles of fluorescence, data analysis, common protocols, cell viability and reactive oxygen species (ROS) assay in presence of smart nanostructures, and comparative analysis with live dead assay (2 credit hour: 1 credit hour lecture, 1 credit hour lab)
- II. **Prerequisite(s):** PH 120 or PH 230 and CH 185 and Living Systems (apart from FN 235 – Nutrition for Health) and permission of the instructor [Equivalent of the aforementioned prerequisites may be considered based on previously completed similar course-work sequences]
- III. **Purposes or Objectives of the Course:**
 - A. To understand basic principles of fluorescence labeling, detection, flow cytometry and their potential applications in various fields of biomedical engineering.
 - B. To learn various laboratory techniques associated with sample preparation for flow cytometry, staining of cells and fluorescence detection.
 - C. To develop an understanding of interaction between smart nanostructures and mammalian cells.
- IV. **Student Learning Outcomes**
 - A. Students will be able to demonstrate an ability to design laboratory experiments to characterize biological effects of the nanostructures.
 - B. Students will be able to demonstrate a familiarity with fundamental issues associated with sample preparation for flow cytometry analysis, cell apoptosis and reactive oxygen species assays and fluorescence detection.
 - C. Students will be able to demonstrate an ability to assemble and analyze experimentally-derived results.
- V. **Expectations of Students:**
 - A. Students are expected to attend all laboratory activities and complete all assignments on time.
 - B. Students are expected to maintain a laboratory notebook detailing all analyses and results from those analyses.

- C. Students are expected to perform satisfactorily on all laboratory assignments, individual projects, and other activities.
- D. Graduate Students will have extended individual projects which will include additional experimentation, and greater depth of analysis.

**VI. Laboratory Content or Outline (indicate number of hours per unit or section):
[Lecture 15 hrs; Laboratory 30 hrs]**

Topic	Clock Hours
Introduction to flow cytometry	2 (lec)
Optics and detection	2 (lec)
Signal Processing	2 (lec)
Electrostatic cell sorting	2 (lec)
Principles of Fluorescence	1 (lec)
Maximal absorbance and maximal emission, FRET based detection	2 (lec)
Selection of fluorochromes	2 (lab)
Data Analysis – Gates and Regions	2 (lab)
Single and two parameter histograms	1 (lab)
Intracellular Antigens	2 (lec)
Common Protocols – sample preparation	4 (lab)
Methods – preparation of cells	4 (lab)
Immunofluorescence staining of cells	2 (lab)
Nanocarrier delivery to PC12 cells	2 (lab)
Cell viability evaluation with PI staining kit	3 (lab)
Cell apoptosis evaluation Annexin V FITC Apoptosis detection kit	3 (lab)
Reactive oxygen species detection with ROS detection kit	3 (lab)
Live dead Assay and compative analysis with flow cytometry measurement	4 (lab)
Final Presentation, Concluding Remarks, Certification	2 (lec)

VII. Textbook(s) and/or Other Required Materials or Equipment:

In addition to standard word processing software, students must have routine access to high-speed internet, Microsoft Excel or equivalent spreadsheet software, and NIH Image J (available free of cost) software. Manuals (including access of CFlow software) and handouts containing detail description of the experimental procedure will be supplied to each student. No textbook required.

VIII. Basis for Student Evaluation:

<u>Undergraduates</u>		<u>Graduate Students</u>	
Daily assignments	70 %	Daily assignments	60 %
Laboratory Notebook	20 %	Laboratory Notebook	20 %
Quiz and		Special Assignments	10 %
Final Presentation	10 %	Quiz and	
		Final presentation	10 %

Grading Scale

Undergraduates
90% - 100% = A
80% - 89% = B
70% - 79% = C
60% - 69% = D

Graduate Students
90% - 100% = A
80% - 89% = B
70% - 79% = C

The weight of the evaluation criteria may vary according to each instructor and will be communicated at the beginning of the course.

Graduate students scoring below 70% will earn a failing grade.

Academic Policy Statement:

Students will be expected to abide by the University Policy for Academic Honesty regarding plagiarism and academic honesty. Refer to:

<http://www6.semo.edu/judaffairs/code.html>

Student with Disabilities Statement:

If a student has a special need addressed by the Americans with Disabilities Act (ADA) and requires materials in an alternative format, please notify the instructor at the beginning of the course. Reasonable efforts will be made to accommodate special needs.