UNIVERSITY OF CINCINNATI
DEPARTMENT OF BIOMEDICAL ENGINEERING,
SCHOOL OF ENERGY, ENVIRONMENTAL, BIOLOGICAL, MEDICAL ENGINEERING
AND
DEPARTMENT OF ENVIRONMENTAL HEALTH
DIVISION OF BIOSTATISTICS AND EPIDEMIOLOGY
DIVISION OF PUBLIC HEALTH SCIENCES

Course number:	20 BME 4061 20 BME 7061 26 BE 7061 26 PH 7061 Spring 2020
Course name:	BIOSTATISTICS IN RESEARCH
Pre-requisite:	Engineering Statistics, Introduction to Statistics, Introduction to Biostatistics (20BME3060), or Equivalent
No. of credits:	3
Faculty:	M B RAO
Office:	247 KETTERING LAB & 501 ERC
Phone No.:	558-3602
e-mail address:	marepalli.rao@uc.edu
Class hours:	11:00 – 12:20 Tuesdays and Thursdays
Lecture Room:	Baldwin 755
Office hours:	10:00-11:00 Tuesdays and Thursdays 501 ERC + 13:00-14:00 Tuesdays and Thursdays 247 Kettering Lab + By appointment
TA:	To be announced

COURSE DESCRIPTION:
Design of Experiments. Orthogonal arrays. Basics of Statistical Inference: Two-sample t-test; Correlation; Non-parametrics. Diagnostic tests. Sensitivity and Specificity. ROC Curves and Sample Size. Logistic and Polytomous Regression. R package. Data mining techniques. Classification trees and random forests. Odds Ratios. Risk Ratios. Contingency Tables. Analysis of Variance. Repeated

Measures. Analysis of Variance. Poisson Regression. Linear Regression.

COURSE OBJECTIVES:
The main objective of this course is to present the basic methodology used in the analysis of data arising from biological, engineering, and medical research. One of the highlights of the course is the presentation of examples culled from current research. Once the student completes this course successfully, he/she should be able to analyze a broad range of data coming from biological, engineering, and medical fields.

REFERENCES
Gerald van Belle, Lloyd D Fisher, Patrick J Heagerty, and Thomas Lumley – Biostatistics – A Methodology for Health Sciences, John Wiley and Sons, New York, 2004.

Bernard Rosner – Fundamentals of Biostatistics – Eighth Edition, Cenage Learning, 2016

INSTRUCTIONAL METHODS:
1. Lectures
2. Discussion of research problems
3. Presentation of some topical case-studies

EXAMINATIONS:

<u>For those taking the class 20 BME 4061</u>:

1. Mid-term examination (30%):	Thursday, March 26, 2020 11:00 – 12:20 Baldwin 755
2. Final examination (30%):	Last Week of Classes - Thursday, 2020 11:00 – 12:20 Baldwin 755
3. Home work (40%):	One homework sheet every week

<u>For those taking the class 20 BME 7061</u>:

1. Mid-term examination (30%):	Thursday, March 26, 2020 11:00 – 12:20 Baldwin 755

2. Final examination (30%):	Last Week of Classes – Thursday, 2020 11:00 – 12:20 Baldwin 755
3. Home work (30%):	One homework sheet every week
4. Project (10%)	A data analysis project will be assigned in the eleventh week of the course.

<u>For those taking the class 26 BE 7061 or 26 PH 7061</u>:

1. Mid-term examination (30%):	Thursday, March 26, 2020 11:00 – 12:20 Baldwin 755
2. Final examination (30%):	Last Week of Classes – Thursday, 2020 11:00 – 12:20 Baldwin 755
3. Home work (30%):	One homework sheet every week
4. Project (10%)	A data analysis project will be assigned in the eleventh week of the course.

Typically, the homework will be given once a week. It is due the following week on the same day the homework was given. I want to protect the teaching assistant who will grade your homework. Late submissions are tolerated for up to two days. One-day late submission means losing 20% of the points allocated for the homework. Two-day late submission means losing 40% of the points. However, you can drop one home work (supposedly the one with the lowest score) in the final grade. You are required to upload your homework on canopy.

GRADES

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

COURSE OUTLINE

1. Statistical problems in biomedical research + R	1 week
2. Design of Experiments; Orthogonal arrays	1 week
3. Sensitivity, Specificity, and ROC curves	2 weeks
3. Logistic Regression	2 weeks

4. Diagnostic tests based on several biomarkers 1 week
4. Polytomous Regression 1 week
5. Classification trees 1 week
6. Random forests 1 week
7. Analysis of Count Data 1 week
    a. Binomial Regression
    b. Poisson Regression
8. Analysis of Contingency tables 1 week
    a. Two-way contingency tables
    b. Trends in a 2xk table
    c. Loglinear models
9. Analysis of variance 1 week
    a. Balanced data
    b. Repeated measures data
    c. Unbalanced data
    d. Checking the assumptions
    e. Binomial data and transformations
10. Linear Regression 1 week

The order of presentation may not follow the route presented above. I may not be able to cover all the topics. I may include a topic or two suggested by the students.

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