

# Stat 136 (Bayesian Statistics)

## Course Outline

### Course Information

*Course Code:* Stat 136

*Course Title:* Bayesian Statistics

*Pre-requisite:* Stat 131 (Mathematical Statistics III)

*Credit:* 3.0 units

*Semester Offered:* Second Semester

*Number of Contact Hours per Week:* 2 hours lecture (9-11 W) and 3 hours laboratory (8-11 Th) per week

*Course Description:* Elements of Bayesian inference; assessment of prior, likelihood, and posterior distributions; Bayesian estimation and hypothesis testing; predictive distribution and asymptotics; Bayesian hierarchical models; introduction to Empirical Bayes

### Course Outcomes

1. Differentiate Bayesian and classical/frequentist inference;
2. Perform Bayesian inference for the parameter(s) of discrete distributions;
3. Perform Bayesian inference for the parameter(s) of continuous distributions; and
4. Bayesian regression, and Markov Chain Monte Carlo, hierarchical Bayes, and empirical Bayes models

### Topical Outline

#### Module 1. Bayesian inference for the parameter(s) of discrete distributions

1. Introduction to bayesian statistics
2. Bayesian inference for a binomial proportion using a discrete prior
3. Bayesian inference for a binomial proportion using a continuous prior
4. Bayesian inference for the Poisson mean

## **Module 2. Bayesian inference for the parameter(s) of continuous distributions**

1. Bayesian inference for the mean of a normal distribution
2. Bayesian inference on difference between two means
3. Bayesian inference on difference between two proportions
4. Bayesian inference for the variance and standard deviation

## **Module 3. Bayesian inference for simple linear regression; Markov Chain Monte Carlo; and hierarchical and empirical Bayes**

1. Bayesian approach to simple linear regression
2. Markov Chain Monte Carlo
3. Introduction to hierarchical models and empirical Bayes

## **References**

1. Johnson, A. A., M. Q. Ott, and M. Dogucu (2022). Bayes Rules! An Introduction to Applied Bayesian Modeling. CRC Press Taylor & Francis Group, LLC
2. Albert, J. and Hu, J. (2020). Probability and Bayesian Modeling. CRC Press Taylor & Francis Group, LLC
3. Bolstad, W. M. and Curran, J. M. (2017). Introduction to Bayesian Statistics, 3rd edition. John Wiley & Sons, Inc.
4. Gelman, A., et al (2013). Bayesian Data Analysis, 3rd edition. Chapman and Hall/CRC.
5. Puza, B. (2015). Bayesian Methods for Data Analysis. ANU eView. Australian National University. Available at <http://eview.anu.edu.au>.
6. <https://statswithr.github.io/book/>
7. <https://www.stat.columbia.edu/~gelman/book/>

## **Course Requirements and Grading System**

1. Quizzes (15%)
2. Problem Sets (25%)
3. Long Examinations (60%)

<b>Grading System (% Passing: 60 %)</b>			
Range	Grade	Range	Grade
98-100	1.00	53-59	3.25
95-97	1.25	46-52	3.50
90-94	1.50	39-45	3.75
85-89	1.75	32-38	4.00
80-84	2.00	25-31	4.25
75-79	2.25	18-24	4.50
70-74	2.50	11-17	4.75
65-69	2.75	0-10	5.00
60-64	3.00		