Chair: Tracy Christofero | **GC#6: Course Addition**

Request for Graduate Course Addition

1. Prepare one paper copy with all signatures and supporting material and forward to the Graduate Council Chair.
2. E-mail one identical PDF copy to the Graduate Council Chair. If attachments included, please merge into a single file.
3. ***The Graduate Council cannot process this application until it has received both the PDF copy and the signed hard copy.***

College: COS | Dept/Division: MATHEMATICS | Alpha Designator/Number: MTH 570 | (•) Graded ( ) CR/NC

Contact Person: Dr. Alfred Akinsete | Phone: 3046966010

NEW COURSE DATA:

New Course Title: Applied Survival Analysis

Alpha Designator/Number: MTH 570

Title Abbreviation: Applied Survival Analysis

(Limit of 25 characters and spaces)

Course Catalog Description: (Limit of 30 words)

Survival and hazard functions, parametric and non-parametric methods, models and inferences for survival data, proportional hazard, and regression diagnosis. (PR. MTH 545, or permission)

AAA

Co-requisite(s): NONE | First Term to be Offered: Fall 2015

Prerequisite(s): MTH 545, or permission | Credit Hours: 3

AAA

Course(s) being deleted in place of this addition (*must submit course deletion form*): NONE

Signatures: if disapproved at any level, do not sign. Return to previous signer with recommendation attached.

Dept. Chair/Division Head	Date 1-27-15
Registrar 270501	Date 1/27/15
College Curriculum Chair	Date 1/28/15
Graduate Council Chair	Date

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College: COS | Department/Division: MATHEMATICS | Alpha Designator/Number: MTH 570

Provide complete information regarding the new course addition for each topic listed below. Before routing this form, a complete syllabus also must be attached addressing the items listed on the first page of this form.

1. FACULTY: Identify by name the faculty in your department/division who may teach this course.

Drs. Laura Adkins, Raid Al-Aqtash, Alfred Akinsete, Avishek Mallick, Gerald Rubin

2. DUPLICATION: If a question of possible duplication occurs, attach a copy of the correspondence sent to the appropriate department(s) describing the proposal. Enter "***Not Applicable***" if not applicable.

Not Applicable

3. REQUIRED COURSE: If this course will be required by another deparment(s), identify it/them by name. Enter "***Not Applicable***" if not applicable.

Not Applicable

4. AGREEMENTS: If there are any agreements required to provide clinical experiences, attach the details and the signed agreement. Enter "***Not Applicable***" if not applicable.

Not Applicable

5. ADDITIONAL RESOURCE REQUIREMENTS: If your department requires additional faculty, equipment, or specialized materials to teach this course, attach an estimate of the time and money required to secure these items. (Note: Approval of this form does not imply approval for additional resources.) Enter "***Not Applicable***" if not applicable.

Not Applicable

6. COURSE OBJECTIVES: (May be submitted as a separate document)

- Understand the basic foundational theory of survival analysis and identify characteristics of survival data.
- Define and understand the relationship between the survival function, distribution function, hazard function, relative hazard, and cumulative hazard function.
- Summarize and interpret univariate analyses of survival data using the Kaplan-Meier estimator.
- Perform and interpret two-sample analyses of survival data using common statistical procedures such as the logrank test.
- Formulate research questions involving survival data as regression problems and fit the parametric regression model and the proportional hazards model to survival data and assess the scientific significance, precision, and interpretation of regression coefficients

7. COURSE OUTLINE (May be submitted as a separate document)

Introduction to Survival Analysis. Definitions and examples of survival and hazard functions and the relationship between them. Discussion of common parametric models for survival data. KM Chapters: 1 and 2

Discussion of censoring and truncation, likelihood construction and the development of maximum likelihood. KM Chapter: 3.

Nonparametric inferences for survival and hazard functions based on single sample data, Kaplan-Meier estimate, Nelson Aalen estimate. Nonparametric methods for testing equality of survival/hazard curves. Computer assisted analysis of survival data. KM Chapters: 4, 6 and 7.

Proportional hazards model including discussion of partial likelihood, large sample inferences, and time dependent covariates. Discussion of computer package implementation of the analysis of data, etc. KM Chapter: 8.

Methods for determining parametric and nonparametric model adequacy including calculation of various kinds of residuals, determination of various plotting techniques, embedding a selected model into a larger model for testing. Regression diagnostics. KM Chapter: 11.

8. SAMPLE TEXT(S) WITH AUTHOR(S) AND PUBLICATION DATES (May be submitted as a separate document)

Title : Survival Analysis: Techniques for Censored and Truncated Data, 2nd edition.
Author : John P. Klein and Melvin L. Moschberger
ISBN-10 : 038795399X
ISBN-13 : 978-0387953991
Publisher : Springer, New York, NY.
Year : 2003

9. EXAMPLE OF INSTRUCTIONAL METHODS (Lecture, lab, internship)

LECTURES

10. EXAMPLE EVALUATION METHODS (CHAPTER, MIDTERM, FINAL, PROJECTS, ETC.)

HOMEWORK, MIDTERM EXAM, PROJECTS and FINAL EXAM

11. ADDITIONAL GRADUATE REQUIREMENTS IF LISTED AS AN UNDERGRADUATE/GRADUATE COURSE

Additional topics, more homework and challenging problems, additional project works, and additional and more rigorous examination questions.

12. PROVIDE COMPLETE BIBLIOGRAPHY (May be submitted as a separate document)

D. Hosmer, S. Lemeshow, and S. May (2008). Applied Survival Analysis: Regression Modeling of Time to Event Data, Wiley.

J.D. Kalbfleisch and R.L. Prentice (2002). The Statistical Analysis of Failure Time Data, Wiley.

J.F. Lawless (1982). Statistical Models and Methods for Lifetime Data, Wiley. (this is a more technical reference)

T.M. Therneau and P.M. Grambsch (2000). Modeling Survival Data: Extending the Cox Model, Springer.

X. Liu (2012). Survival Analysis: Models and Applications, Wiley.

E. T. Lee and J. W. Wang (2003). Statistical Methods for Survival Data Analysis, Wiley.

Request for Graduate Course Addition - Page 5

Please insert in the text box below your course summary information for the Graduate Council agenda. Please enter the information exactly in this way (including headings):

Department:
Course Number and Title:
Catalog Description:
Prerequisites:
First Term Offered:
Credit Hours:

Department: MATHEMATICS

Course Number and Title: MTH 570 APPLIED SURVIVAL ANALYSIS

Catalog Description: Survival and hazard functions, parametric and non-parametric methods, models and inferences for survival data, proportional hazard, and regression diagnosis. (PR. MTH 545, or permission)

Prerequisites: MTH 545, or permission

First Term Offered: Fall 2015

Credit Hours: 3

MARSHALL UNIVERSITY
DEPARTMENT OF MATHEMATICS
STUDENT INFORMATION SHEET AND SYLLABUS

Course Title/Number	MTH 570 – Applied Survival Analysis
Section	TBD
CRN	TBD
Semester/Year	TBD
Days/Time	TBD
Location	TBD
Instructor	TBD
Office	TBD
Phone ext.	TBD
E-Mail	TBD
Office/Hours	TBD
University Policies	By enrolling in this course, you agree to the University Policies listed below. Please read the full text of each policy be going to www.marshall.edu/academic-affairs and clicking on "Marshall University Policies." Or, you can access the policies directly by going to http://www.marshall.edu/academic-affairs/?page_id=802 Academic Dishonesty/ Excused Absence Policy for Undergraduates/ Computing Services Acceptable Use/ Inclement Weather/ Dead Week/ Students with Disabilities/ Academic Forgiveness/ Academic Probation and Suspension/ Academic Rights and Responsibilities of Students/ Affirmative Action/ Sexual Harassment

Course Description and Overview

Statistical methods for analyzing survival data from cohort studies. Topics include introduction to the hazard and survival functions, censoring mechanisms, parametric and non-parametric estimation methods, the Kaplan-Meier estimator, methods for estimating patient survival (life table and Kaplan-Meier methods), comparing survival between patient subgroups (log-rank test), modeling survival (primarily Poisson regression, the Cox proportional hazards model and accelerated failure time models), efficient sampling designs and discrete survival models.

This course will provide an introduction to the principles and methods for the analysis of time-to-event data. This type of data occurs extensively in both observational and experimental biomedical and public health studies, as well as in industrial applications. While the primary focus will be on data analysis, theoretical developments are also included for graduate students.

Course Objectives and Learning outcomes

At the end of the course, students should be able to:

- **Understand** the basic foundational theory of survival analysis and identify characteristics of survival data.
- **Define** and **understand** the relationship between the survival function, distribution function, hazard function, relative hazard, and cumulative hazard function.
- **Summarize** and **interpret** univariate analyses of survival data using the Kaplan-Meier estimator.
- **Perform** and **interpret** two-sample analyses of survival data using common statistical procedures such as the logrank test.
- **Formulate** research questions involving survival data as regression problems and **fit** the parametric regression model and the proportional hazards model to survival data and assess the scientific significance, precision, and interpretation of regression coefficients
- **Use** graphical methods and other methods to **assess** the adequacy of fitted models and **propose** alternate solutions when common assumptions are violated
- **Incorporate** time-dependent covariates in the proportional hazards model and **interpret** the regression coefficients
- **Interpret** and critically **evaluate** survival analyses in biomedical or epidemiologic set up and describe survival analysis methods and results to a non-statistical audience

Required Texts

Title	: *Survival Analysis: Techniques for Censored and Truncated Data, 2nd edition.*
Author	: John P. Klein and Melvin L. Moschberger [KM]
ISBN-10	: 038795399X
ISBN-13	: 978-0387953991
Publisher	: Springer, New York, NY.
Year	: 2003

Additional references

- D. Hosmer, S. Lemeshow, and S. May (2008). Applied Survival Analysis: Regression Modeling of Time to Event Data, Wiley.
- J.D. Kalbfleisch and R.L. Prentice (2002). The Statistical Analysis of Failure Time Data, Wiley.
- J.F. Lawless (1982). Statistical Models and Methods for Lifetime Data, Wiley. (this is a more technical reference)
- T.M. Therneau and P.M. Grambsch (2000). Modeling Survival Data: Extending the Cox Model, Springer.
- X. Liu (2012). Survival Analysis: Models and Applications, Wiley.
- E. T. Lee and J. W. Wang (2003). Statistical Methods for Survival Data Analysis, Wiley.

Additional Requirements: Software/Computing

The R and SAS statistical packages shall be used for demonstration of some topics in class. It is recommended that both R and SAS be used for homework assignments and exams. R is free software that can be downloaded from the web at http://www.r-project.org/. It can be installed/compiled on Windows, Mac, and Linux/UNIX machines. You are encouraged to use the Computer Lab in SH532. In addition, the SAS software is installed on those computers for those of you who would like to use SAS.

Academic Dishonesty: Plagiarism and/or Cheating

Note that plagiarism (the submission as one's own work of any oral, graphic, or written material wholly or in part created by another), is a form of academic dishonesty. Sanctions for academic dishonesty shall be imposed in accordance with university's guidelines on such matter. Also note that in a case where a student is suspected to have cheated, the student may be asked to re-take the test. And where the student is found or confirmed to have cheated, a zero grade will be awarded to the student.

You may wish to refer to other university policies concerning academic dishonesty at, http://www.marshall.edu/wpmu/academic-affairs/policies/#AcademicDishonesty

Attendance Policy

Students are expected to attend all scheduled classes. It is the student's responsibility to find out what was discussed in a missed class. Although, attendance records will not be used to compute grades (except possibly in borderline cases), however, missing class can be expected to significantly reduce your chances of success. Note also that it is the student's responsibility to present approved notice of any absence that would be excused under the terms and regulations stipulated by the university.

Student behavior

Students are advised to turn their cell phones and other noise generating devices off prior to entering the class. In the case where a student awaits any emergency call, the noise should be restricted and made personal. And in this case, I should be notified as soon as the student enters the class. Food items, apart from water or soft drink, are not allowed in the class. The reading of newspapers and other unrelated materials while the class is in session is prohibited. Please ensure that other students are respected.

Grading Policy and Exam dates

The final grade will be based on the following components:

Homework	25%
2 Regular Exams	30% (15% each)
Final Project	25%
Final Examination	20% (Comprehensive)
Total	**100%**

The semester grade will be based on the percentage of the total possible points, using the following scale.

90 -100% -- A
80 - 89% -- B
70 - 79% -- C
60 - 69% -- D
00 - 59% -- F

Topics covered

- Introduction to Survival Analysis. Definitions and examples of survival and hazard functions and the relationship between them. Discussion of common parametric models for survival data. KM Chapters: 1 and 2

- Discussion of censoring and truncation, likelihood construction and the development of maximum likelihood. KM Chapter: 3.

- Nonparametric inferences for survival and hazard functions based on single sample data, Kaplan-Meier estimate, Nelson Aalen estimate. Nonparametric methods for testing equality of survival/hazard curves. Computer assisted analysis of survival data. KM Chapters: 4, 6 and 7.

- Proportional hazards model including discussion of partial likelihood, large sample inferences, and time dependent covariates. Discussion of computer package implementation of the analysis of data, etc. KM Chapter: 8.

- Methods for determining parametric and nonparametric model adequacy including calculation of various kinds of residuals, determination of various plotting techniques, embedding a selected model into a larger model for testing. Regression diagnostics. KM Chapter: 11.