Course Specification
(Bachelor)

Course Title:	**Survival analysis**
Course Code:	**STA 1434**
Program:	**Bachelor of Science in Applied Statistics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	**2024 – V1**
Last Revision Date:	**2 October 2024**

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours:					
3 (2 Lectures, 1 Lab, 1 Tutorial)					
2. Course type:					
A.	☐University	☐College	☒ Program	☐Track	☐Others
B.	☐ Required		☒ Elective		
3. Level/year at which this course is offered:					
Level 7 / Year 4					
4. Course General Description:					
Introduction to the theory and methods of survival analysis, including modeling time-to-event data, methods for the treatment of censoring (including the right/left censoring and double censoring), and the Cox proportional hazard models and their extensions.					
5. Pre-requirements for this course (if any)**:**					
STA 1325					
6. Co-requisites for this course (if any)**:**					
None					
7. Course Main Objective(s):					
This course introduces basic concepts and methods for analyzing survival time data obtained from following individuals until occurrence of an event or their loss to follow-up. We will begin this course from describing the characteristics of survival (time-to-event data) and building the link between distribution, survival, and hazard functions. After that, we will cover Kaplan-Meier (a nonparametric method), Cox Proportional Hazard model (a semi-parametric approach) and the Log-rank test (two-sample test technique). During the class, students will also learn how to use SPSS or R to analyze survival data.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	**60**	**%100**
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	30
2.	Laboratory/Studio	15
3.	Field	0
4.	Tutorial	15
5.	Others (specify)	0
Total		60

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	To list the key features of survival data and different types of censoring and truncation.	K1, K2	Lectures, problem solving, Classroom discussions	Direct: Regular Exams, Assignments, Practical exam
1.2	To define hazard and other basic concepts of survival analysis.	K1, K3	Lectures, problem solving, Classroom discussions	Direct: Regular Exams, Assignments, Practical exam
2.0	Skills			
2.1	To utilize non-parametric methods such as the Kaplan-Meier estimator and the log-rank test to analyze survival data.	S1, S2	Self-study Real-life problems	Direct: Participations Short Quizzes
2.2	To apply the Cox proportional hazards model to examine the effect of covariates on survival	S1, S3	Real-life problems	Direct: Short Quizzes
2.3	To calculate residuals and influence for survival models and assess whether the proportional hazards assumption is justified.	S1, S5	Self-study	Direct: Participations
2.4	To solve theoretical problems related to survival analysis	S1, S4	Self-study Real-life problems	
2.5	To use the computer statistical package to analyze survival data and interpret the output.	S3, S5	Self-study Real-life problems	Direct: Regular Exams Participation Short Quizzes
3.0	Values, autonomy, and responsibility			
3.1	To employ ethical concepts and rules to determine viable alternatives in any given situation.	V1, V2	Personal questions Group Discussions	Direct: Assignments, Mini projects

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
3.2	**To operate meaningfully and productively with others.**	**V1, V3**	**Teamwork and class discussions.**	**Direct:** Assignments, Mini projects

C. Course Content

No	List of Topics	Contact Hours
1.	**Introduction to Survival Analysis:** What is survival analysis? Censored data. Terminology and notation in survival data analysis (e.g., survivor function and hazard function). Goals of survival analysis. Basic data layout for computer and understanding analysis. Descriptive measures of survival experience. Math models in survival analysis.	**10**
2.	**Kaplan–Meier Survival Curves and the Log–Rank Test:** An example of Kaplan–Meier (KM) curves. General features of KM curves. Alternatives to the log–rank test. Compute KM probabilities of survival, given survival time and failure status information on a sample of subjects. Interpret a graph of KM curves that compare two groups. Draw conclusions as to whether or not two survival curves are the same based on computer results that provide a log–rank test and/or an alternative test.	**14**
3.	**The Cox Proportional Hazards Model (CPHM) and Its Characteristics:** A computer example using the CPHM. The formula for the CPHM. Why the CPHM is popular. Maximum Likelihood Estimation (MLE) of the CPHM.	**12**
4.	**Computing the hazard ratio:** Adjusted survival curves using the CPHM. The meaning of the PH assumption. The Cox likelihood.	**12**
5.	**Evaluating the Proportional Hazards Assumption:** Checking the PH assumption: Overview. Graphical approach 1: log–log plots. Graphical approach 2: observed versus expected plots. The goodness-of-fit (GOF) testing approach. Assessing the PH assumption using time-dependent covariate.	**12**
Total		**60**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Homeworks, Quizzes, Mini-projects**	**During the term**	**10%**
2.	**First Midterm**	**Week 5-6**	**25%**
3.	**Second Midterm (lab Exam)**	**Week 10-11**	**25%**
4.	**Final Exam**	**Week 15**	**40%**

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	***Statistical Methods for Survival Data Analysis*, 3rd Edition, E. T. Lee and J. W. Wang, Wiley Series in Probability and Statistics, 2013. ISBN:9780471369974.**
Supportive References	**1- *Applied survival analysis: regression modeling of time to event data*, 2nd Edition, David W. Hosmer Jr., Stanley Lemeshow, Susanne May, Wiley-Interscience , 2008.** **2- *Survival Analysis: Techniques for Censored and Truncated Data*, 2nd Edition, Joen P. Klein and Melvin L. Moeschberger, Springer-Verlag, New York, NY., 2005.** **3- *Analysis of Survival Data*, D.R. Cox and D. Oakes, Chapman and Hall, 1984.**
Electronic Materials	**Course Website: Learning Management Systems (Blackboard)**
Other Learning Materials	**None**

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology equipment (projector, smart board, software)	**The rooms should be equipped with data show and Smart Board.** **All computers should be equipped with the following software:** ▪ **Microsoft Excel** ▪ **IBM SPSS** ▪ **R-Project** ▪ **MATLAB**

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	**Student and teaching staff**	**Surveys and Questionnaires**
Effectiveness of Students assessment	**Course Coordinator**	**Peer Reviews**
Quality of learning resources	**Students and teaching staff**	**Classroom Observations**
The extent to which CLOs have been achieved	**Student Representatives**	**Student Performance Evaluations (exams, projects)** **CLOs Excel sheet.**

Assessment Areas/Issues	Assessor	Assessment Methods
Other	None	

Assessors (Students, Faculty, Program Leaders, Peer Reviewers, Others (specify)
Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL
REFERENCE NO.	8/1446
DATE	(08/10/2024) 05/04/1446