هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA
T5
2019

Field Experience Specifications

Course Title:	**Field Training**
Course Code:	**STA 1497**
Program:	**Bachelor of Science in Applied Statistics**
Department:	**Mathematics and Statistics**
College:	**College of Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Field Experience Identification

1. Credit hours:	**4**
2. Level/year at which this course is offered:	**12 / 4 (last term of the program).**
3. Dates and times allocation of field experience activities.	• Number of weeks: **(12) week** • Number of days: **(36) day** • Number of hours: **(180) hour**
4. Pre-requisites to join field experience (if any)**:**	**Student must have completed a minimum number of 160 credit hours.**

B. Learning Outcomes, and Training and Assessment Methods

1. Field Experience Learning Outcomes

	CLOs	*Aligned-PLOs*
1	**Knowledge and Understanding** **At the end of the field experience, the student is able:**	
1.1	**To demonstrate knowledge of the context of the professional career before graduation.**	**K1, K2**
1.2	**To demonstrate an understanding of a range of professional interests in related fields of Mathematics program.**	**K1, K2**
1.3	**To label all opportunities for learning, development and mentoring throughout the duration of the training.**	**K1, K2**
2	**Skills:**	
2.1	**To apply what has been learned in classroom to real-world situations.**	**S1**
2.2	**To develop new skills by becoming accustomed to critical and innovative for problem solving, thinking analysis and making practical decisions with confidence and rigor.**	**S1, S2**
2.3	**To communicate proficiently oral and written information in a manner that reflects professional social work skills.**	**S4, S5**
2.4	**To operate with the various pressures that he/she may face in the labor market.**	**S1, S2**
2.5	**To test the theoretical learning in practical situations by accomplishing the tasks assigned during the internship period.**	**S3**
3	**Values:**	
3.1	**To develop discipline, self, and social responsibility.**	**V1, V3**
3.2	**To apply ethic principles of the profession.**	**V1, V2**
3.3	**To enhance integrity and honesty.**	**V1**

2.Alignment of Learning Outcomes with Training Activities and Assessment Methods

Code	Learning Outcomes	Training Methods/Activities	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	To demonstrate knowledge of the context of the professional career before graduation.	Participation with the field supervisor at workplace.	Discussion Specific rubric
1.2	To demonstrate an understanding of a range of professional interests in related fields of Mathematics program.	Subject-based study essays, Written short or long answer and short or long report.	Rubric of evaluation
1.3	To label all opportunities for learning, development and mentoring throughout the duration of the training.	Oral test Presentation Written report	Evaluate student's Discussion
2.0	**Skills**		
2.1	To apply what has been learned in classroom to real-world situations.	Workplace performance, Oral Presentations	Portfolio, Student's diary/journal.
2.2	To develop new skills by becoming accustomed to critical and innovative for problem solving, thinking analysis and making practical decisions with confidence and rigor.	Written research questions/ Reflection	Student portfolio
2.3	To communicate proficiently oral and written information in a manner that reflects professional social work skills.	Written tasks Discussion	Evaluation of Report and mails.
2.4	To operate with the various pressures that he/she may face in the labor market.	participation with the field supervisor at workplace	Direct observation
2.5	To test the theoretical learning in practical situations by accomplishing the tasks assigned during the training period.	participation with the field supervisor at workplace	Direct observation
3.0	**Values**		
3.1	To develop discipline, self, and social responsibility.	Discussion, behavior	Portfolio and direct observation

Code	Learning Outcomes	Training Methods/Activities	Assessment Methods
3.2		Discussion, behavior	Direct observation portfolio
3.3	To enhance integrity and honesty.	Discussion, behavior	Direct observation

3. Field Experience Learning Outcomes Assessment

a. Students Assessment Timetable

#	Assessment task*	Assessment timing (Week)	Percentage of Total Assessment Score
1	Orientation session attendance.	First week	5% by the teaching staff advisor.
2	Site Visit	About Week 4 & week 8	10% by the teaching staff advisor.
3	Appreciation on student's performance (using supervisor's reports and student's weekly)	During the 12 weeks of the training.	10% by the teaching staff advisor.
4	Week log of activities	Weekly	10% by the teaching staff advisor and 5% by training advisor.
5	Demonstrate Learning Outcomes.	During the 12 weeks of the training.	50% by training advisor.
6	Student Field Performance Appraisal	Between Week 12 and week 13.	10% by student.

***Assessment task** (i.e., Practical test, oral test, presentation, group project, essay, etc.)

b. Assessment Responsibilities

#	Category	Assessment Responsibility
1	**Teaching Staff**	The teaching staff supervisor assesses: • the attendance and participation of the student in the orientation session (weekly Log of Work Activities), • the performance during the field visit, • student's performance by using supervisor's reports and student's weekly, which express the application of student's knowledge to actual practice.
2	**Field Supervisor**	The field supervisor assesses overall performance and progress of the student during the training.
3	**Others** (specify)	N.A.

C. Field Experience Administration

1. Field Experience Locations

a. Field Experience Locations Requirements

Suggested Field Experience Locations	*General Requirements **	*Special Requirements***
• General Authority for Statistics • Capital Market Authority • General Organization for Social Insurance • The Zakat, Tax and Customs Authority (ZATCA) • Saud Central Bank • Maaden • Saudi Aramco • KACST • Public School • Private School	• The workplace must be registered and approved by the competent Saudi instances. • Legal status as determined by the law in Saudi Arabia. • Efficiency and safety.	The field experience location activities must be appropriate and consistent with the mission of Imam university and the requirements for field experience learning outcomes.

*Ex: provides information technology ,equipment ,laboratories ,halls ,housing ,learning sources ,clinics etc.
**Ex: Criteria of the training institution or related to the specialization, such as: safety standards, dealing with patients in medical specialties, etc.

b. Decision-making procedures for identifying appropriate locations for field experience

Before starting the process for field experience, the college should state a range of partnerships with potential training organizations that may provide high-level training opportunities. The list of partnerships should be available in college of science website. These partnerships should be based on requirements listed above. The college should communicate the present document (including qualifications and responsibilities) to the training organization to ensure skills requirements to determine an appropriate field supervisor.

2. Supervisory Staff

a. Selection of Supervisory Staff

Selection Items	*Field Supervisor*	*Teaching Staff*
Qualifications	**A permanent member of the training organization.**	**A member of the teaching staff at the department of Mathematics and Statistic (is assigned authority and responsibility of supervising and evaluating the overall components of the field experience according the present specifications document.**
Selection Criteria	**Depending to the training organization criteria.**	▪ **Ability to supervise a team, to establish priorities and manage competing deadlines for self and others.** ▪ **Experience in the supervision and leadership of staff.** ▪ **Well-developed oral and written communication skills.** ▪ **Ability to build and maintain effective working relationships and act with diplomacy and discretion when dealing with sensitive and confidential issues** ▪ **Ability to develop effective social and professional networks.**

b. Qualification and Training of Supervisory Staff

(Including the procedures and activities used to qualify and train the supervisory staff on supervising operations, implementing training activities, the follow-up and evaluation of students, etc.)

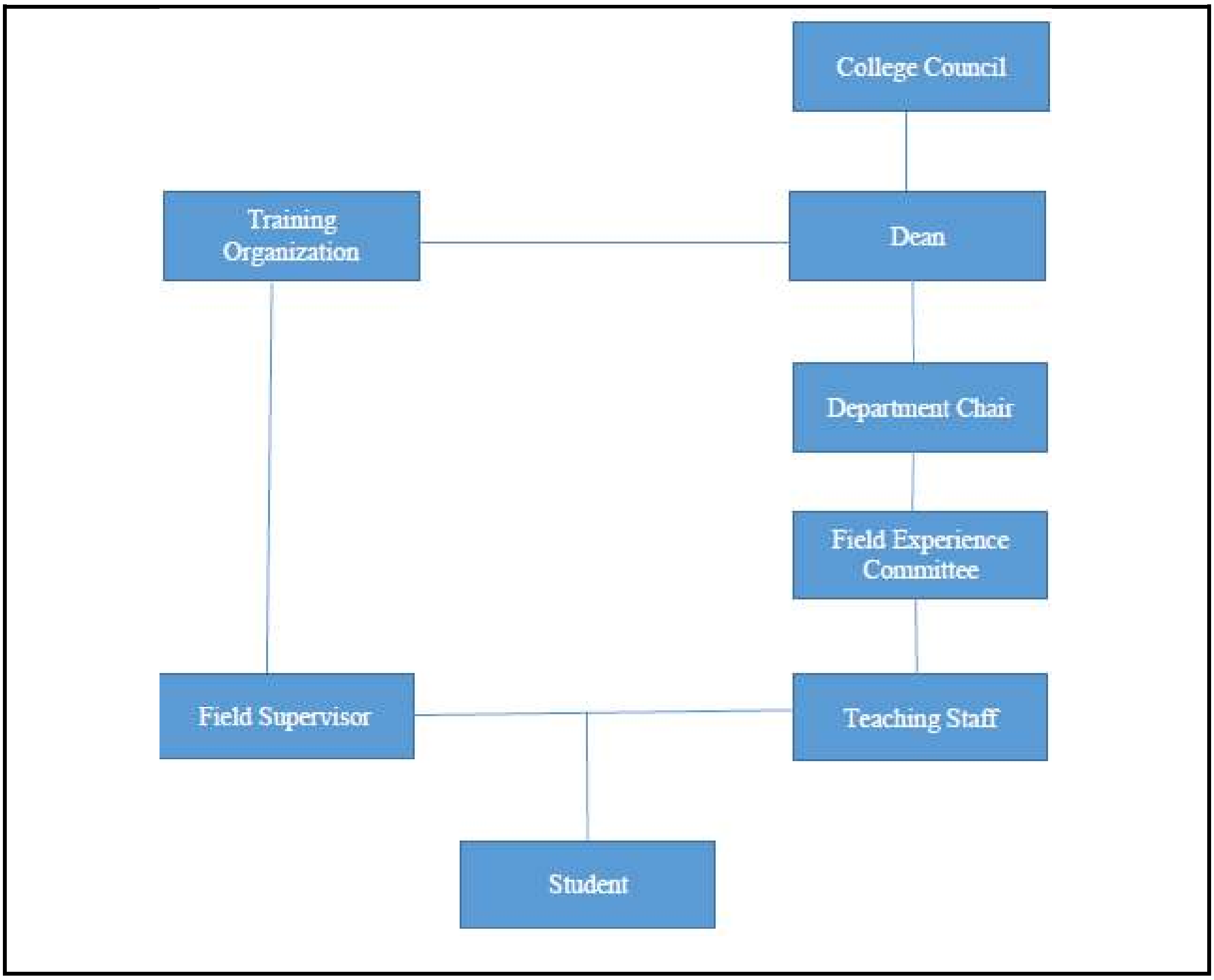
The field supervisor is able for supervising, training and evaluating the student throughout the training period., including the follow-up and monitoring. He should notify the corresponding teaching staff of any concerns or problems. In addition, s/he the following key skills and qualifications:

- **Scientific academic path.**
- **Leadership and team management skills.**
- **Attention to detail and problem-solving skills.**
- **Written and verbal communication skills.**
- **Advanced expertise in a specific training organization activities.**
- **Deep knowledge of training organization policies.**

3. Responsibilities

a. Field Experience Flowchart for Responsibility

including units, departments, and committees responsible for field experience, as evidenced by the relations between them.



b. Distribution of Responsibilities for Field Experience Activities

Activity	*Department or College*	*Teaching Staff*	*Student*	*Training Organization*	*Field Supervisor*
Selection of a field experience site	☑		☑		
Selection of supervisory staff	☑				
Provision of the required equipment				☑	
Provision of learning resources				☑	
Ensuring the safety of the site				☑	
Commuting to and from the field experience site		☑	☑		☑

Activity	*Department or College*	*Teaching Staff*	*Student*	*Training Organization*	*Field Supervisor*
Provision of support and guidance		☑			☑
Implementation of training activities (duties, reports, projects, ...)		☑			☑
Follow up on student training activities		☑			☑
Adjusting attendance and leave		☑			☑
Assessment of learning outcomes		☑			☑
Evaluating the quality of field experience	☑	☑	☑	☑	☑
Others (specify)					

4. Field Experience Implementation

a. Supervision and Follow-up Mechanism

The mechanism used for supervision and follow-up student is essentially based on:

- **follow-up forms**
- **Interview follow-up**
- **Student portfolio**
- **Daily attendance record.**
- **Evaluation rubric**

b. Student Support and Guidance Activities

- **Session of orientation, necessary documentations (forms and rubrics, and guide manual).**
- **The workplace is expected to provide documents for student training (including internal policy manuals, electronic sources).**
- **The workspace is expected to provide also appropriate desk gadgets including printer/internet access with appropriate electronic devices and software.**

5. Safety and Risk Management

Potential Risks	*Safety Actions*	*Risk Management Procedures*
Potential Risks depend on the workspace and production activities of the training organization. Potential sources of harm and hazards should be identified. This issue should be discussed with Training Organization before starting the training • **Harassment.** • **Personal identity.** • **Travel.** • **Physical Hazards.** • **Biological Hazards.** • **Chemical Hazards**	Basic safety rules and tips that need to be followed at the worksite. Safety guidelines must be established and maintained: safety procedures for laboratory investigations and field trips should be implemented. **In the following some safety actions should followed by the student** • **Identify potential risks. Talk to your teaching staff supervisor and field supervisor about specific risks related to your field.** • **Understand guidelines and expectations form the university and employer perspectives.** • **Know the numbers for emergency services at internship location and program into your mobile phone where appropriate.** • **Inform your faculty supervisor or internship advisor of any concern immediately.** • **Respect yourself and others.** • **Consider carefully what you post online about yourself. It is not advised to post your phone number, address, class schedule, or where you are.** • **Make sure you have directions and secured transportation to and from the site.** • **Make sure someone has your contact information at the site. Also, leave site information with a roommate or a friend.**	• **Respecting the last updated version of the booklet "Implementation of Risk Management and Safety Culture" published by The Ministry of Labor and Social development.** • **providing an understanding of how to deal with different types of work-training in order to help reduce exposure risks.** • **Offering short risk management training at the beginning of training.** **Should an incident occur:** • **Contact the teaching staff supervisor or local police if assistance needed.** • **Be sure to document all facts such as date, time, persons involved, and the situation as you observed it.** • **Inform your internship advisor or teaching staff supervisor immediately.**

G. Training Quality Evaluation

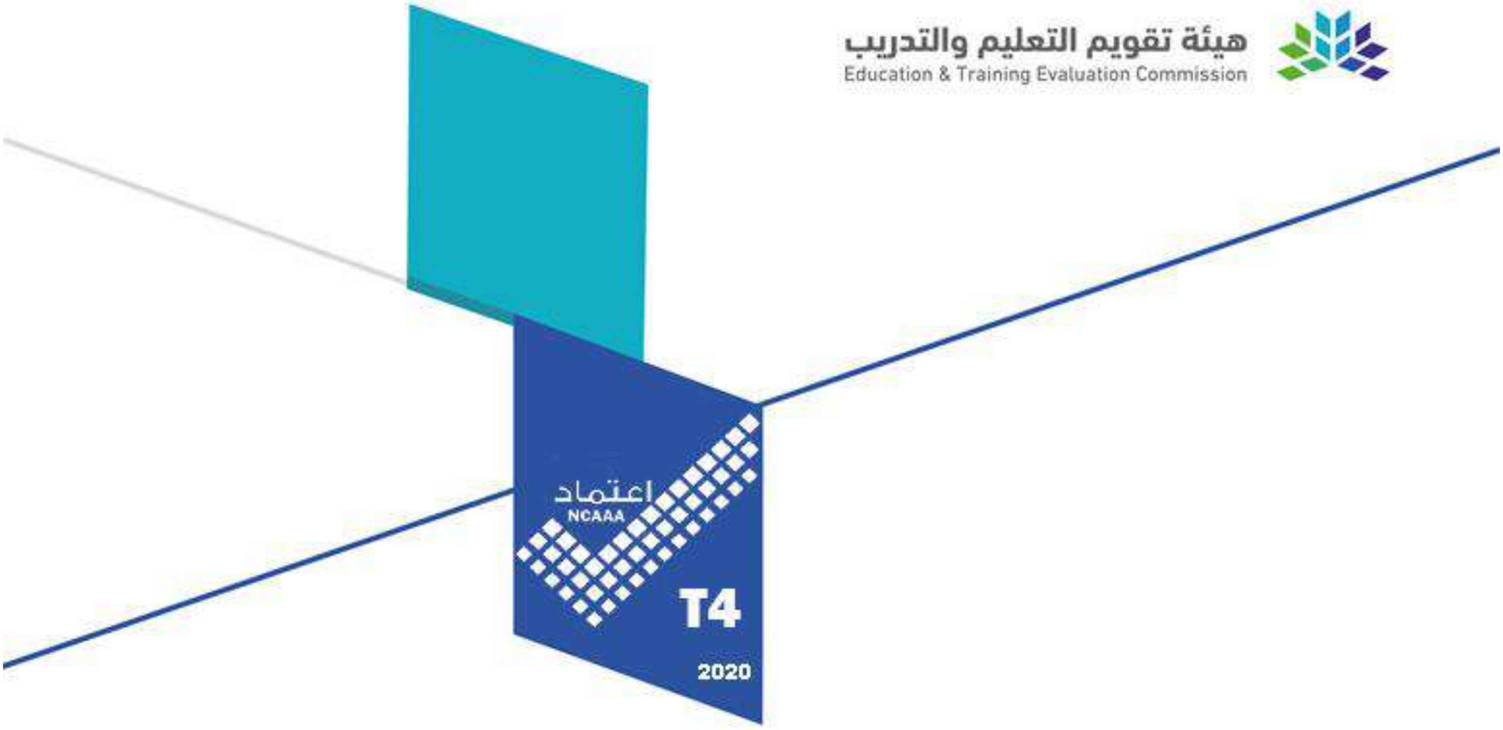
Evaluation Areas/Issues	*Evaluators*	*Evaluation Methods*
Student performance, effectiveness, and efficiency	**Field Supervisor**	**Direct and Indirect**
• **Quality of learning resources.** • **Effectiveness of Training and assessment.** • **Student performance**	**Teaching staff**	**Indirect**
Evaluation of the field Experience (workspace, Quality of learning resources, supervisory, achievements, skills, behavior, time)	**Student**	**Indirect**

Evaluation areas (e.g., Effectiveness of Training and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Supervisory Staff, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

E. Specification Approval Data

Council / Committee	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
Reference No.	**11/1444**
Date	**22/04/1444 (16/11/2022)**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission



Course Specifications

Course Title:	**Probability & Statistics 1**
Course Code:	**STA 1101**
Program:	**Bachelor of Science in Applied Statistics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours: **4 (3 Lectures, 0 Lab, 2 Tutorial)**	
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐	
3. Level/year at which this course is offered: **Level 3 / Year 1**	
4. Pre-requisites for this course (if any):	**MAT 1102**
5. Co-requisites for this course (if any):	**None**

6. Mode of Instruction (mark all that apply)

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

7. Contact Hours (based on academic semester)

No	*Activity*	*Contact Hours*
1	**Lecture**	**36**
2	**Laboratory/Studio**	**0**
3	**Tutorial**	**24**
4	**Others** (specify)	**0**
	Total	**60**

B. Course Objectives and Learning Outcomes

1. Course Description

This course describes the most important ideas, theoretical results, and examples of descriptive statistics, counting, random variables probability distributions. The course includes the essential fundamentals of these topics. The emphasis is on calculations, and some applications are mentioned. The use of statistical packages is essential during this course.

2. Course Main Objective
• Describe discrete data graphically and compute measures of centrality and dispersion. • Compute probabilities by modeling sample spaces and applying rules of permutations and combinations, additive and multiplicative laws and conditional probability. • Construct the probability distribution of a random variable, based on a real-world situation, and use it to compute expectation and variance. • Compute probabilities based on practical situations using the discrete and continuous distributions.

3. Course Learning Outcomes

	CLOs	*Aligned-PLOs*
1	**Knowledge and Understanding:**	
1.1	**To state the various measures of central tendency and dispersion.**	**K1, K2**
1.2	**To outline basic probability concepts and techniques of counting for the calculation of probabilities.**	**K1, K2**
1.2	**To define and reproduce some special probability distributions.**	**K1, K2**
2	**Skills:**	
2.1	**To summarize data using tables and charts.**	**S1, S2, S5**
2.2	**To compute descriptive summary measures for a population and the coefficient of correlation.**	**S2, S3, S5**
2.3	**To compute probabilities from the binomial, geometric, Poisson, and hypergeometric distributions.**	**S3, S4**
2.4	**To calculate probability mass functions, the expected value and variance for discrete random variables.**	**S1, S2, S3**
3	**Values:**	
3.1	**To defend the formulated conclusions.**	**V1, V2**
3.2	**To operate meaningfully and productively with others.**	**V1, V3**

C. Course Content

No	*List of Topics*	*Contact Hours*
1	**The Nature of Probability and Statistics:** Descriptive and inferential Statistics; Variables and Type of Data; Data Collection and Sampling Techniques; Observations and Experimental Studies.	**4**
2	**Frequency Distributions and Graphs:** Organizing Data; Histograms, Frequency Polygons, and Ogives; Other Types of Graphs.	**12**
3	**Data Description:** Measures of Central tendency; Measure of Variation; Measure of Positions; Exploratory Data Analysis.	**12**

No	List of Topics	Contact Hours
4	**Counting Rules and Probability:** Counting Rules; Sample Space and Probability; The Additional Rules for Probability; The Multiplication Rules and Conditional Probability. Probability and Counting Rules.	**11**
5	**Discrete Probability Distributions:** A Discrete Random Variable; Probability distribution; Mean, Variance, Standard Deviation and Expectation; The Binomial Distribution; The Poisson Distribution; The Hyper-Geometric Distribution, The Geometric Distribution; The Negative Binomial Distribution.	**11**
6	**Continuous Random Variables and Probability Distributions:** Continuous Random variables; Probability Distribution and Probability Density Function; Cumulative Distribution Function; Mean and Variance of a Continuous Random Variable; Uniform Distribution; The Normal Distribution.	**10**
Total		**60**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding:**		
1.1	**To state the various measures of central tendency and dispersion.**	**Use of statistical software, Lecturing, Interactive learning.**	**Lab Exam, Assignments, Practical exam**
1.2	**To outline basic probability concepts and techniques of counting for the calculation of probabilities.**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**
1.3	**To define and reproduce some special probability distributions.**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**
2.0	**Skills**		
2.1	**To summarize data using tables and charts.**	**Use of statistical software, Lecturing, Interactive learning.**	**Lab Exam, Assignments, Practical exam**

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.2	To compute descriptive summary measures for a population and the coefficient of correlation.	Use of statistical software, Lecturing, Interactive learning.	Lab Exam, Assignments, Practical exam
2.3	To compute probabilities from the binomial, geometric, Poisson, and hypergeometric distributions.	Lecturing, Interactive learning.	Assignments, Practical exam
2.4	To calculate probability mass functions, the expected value and variance for discrete random variables.	Lecturing, Interactive learning.	Assignments, Practical exam
3.0	**Values**		
3.1	To defend the formulated conclusions.	Interactive learning, Group interaction, Problem solving.	Lab Exam, Practical exam
3.2	To operate meaningfully and productively with others.	Group interaction, Problem solving.	Assignments and Mini-projects

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homeworks, Quizzes, Mini-projects	During the semester	20%
2	First Midterm	Week 4-5	20%
3	Second Midterm	Week 7-8	20%
4	Final Exam	Week 13	40%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

- There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.
- All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	***Elementary Statistics: A Step By Step Approach,*** 10th Edition, Allan Bluman, Mc Graw Hill, 2018. ISBN13: 9781259755330 **(Main Reference).**
Essential References Materials	1. ***Elementary Statistics***, 14th edition; Mario F. Triola, Pearson, 2021. 2. ***Introduction to Probability and Statistics;*** 14th Edition, W. Mendenhall, R. J. Beaver, Barbara M. Beaver, Duxbury Press, 2013. 3. ***Applied Probability and Statistics in Engineering***, 4th Edition, William W. Hines, Douglas C. Montgomery, David M. Goldsman, Connie M. Borror, John Wiley & Sons Inc, 2003. 4. ***Probability and Statistics for Engineering and the Sciences***, 9th Edition, Jay L. Devore, Brooks/Cole, Cengage Learning, 2016. 5. ***Data Analysis with Microsoft Excel,*** 3rd Edition, Kenneth N. Berk, Patrick Carey, Duxbury Press, 2010.
Electronic Materials	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	*Resources*
Accommodation *(Classrooms, laboratories, demonstration rooms/labs, etc.)*	▪ **Each classroom should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources *(AV, data show, Smart Board, software, etc.)*	**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**
Other Resources *(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)*	**See Attached File**

G. Course Quality Evaluation

Evaluation Areas/Issues	*Evaluators*	*Evaluation Methods*

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment, Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
Extent of achievement of course learning outcomes, Quality of learning resources	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**

Evaluation areas *(e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)*
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
Reference No.	**11/1444**
Date	**22/04/1444 (16/11/2022)**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA
T4
2020

Course Specifications

Course Title:	Probability & Statistics (2)
Course Code:	STA 1102
Program:	Bachelor of Science in Applied Statistics
Department:	Mathematics and Statistics
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University

Table of Contents

A. Course Identification

1. Credit hours:	5 (4 Lectures, 0 Lab, 2 Tutorial)
2. Course type	
a. University ☐ College ☐ Department ✓ Others ☐	
b. Required ✓ Elective ☐	
3. Level/year at which this course is offered:	Level 5 / Year 2
4. Pre-requisites for this course (if any):	STA 1101
5. Co-requisites for this course (if any):	MAT 1203

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	72	100%
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	48
2	Laboratory/Studio	0
3	Tutorial	24
4	**Others** (specify)	0
	Total	72

B. Course Objectives and Learning Outcomes

1. Course Description

This is a calculus-based course. Upon successful completion of this course, the students are introduced to the theory of continuous random variables and their probability distributions. They will understand the concept of test hypothesis for the one sample and two samples and apply the common test hypothesis procedures. They are introduced to the correlation and linear regression.

2. Course Main Objective

- To teach students some important scientific concepts of statistics.
- To let students be familiar with distributions of continuous random variable.
- To expose students to concepts of Expectation and moments.
- To let students, learn and use some tests of hypothesis.
- To let student, learn and use linear regression.

3. Course Learning Outcomes

	CLOs	Aligned-PLOs
1	**Knowledge and Understanding**	
1.1	**To define and outline the theory of continuous random variables and their probability distributions.**	**K1, K2**
1.2	**To outline the procedures of hypothesis testing.**	**K1, K2**
1.3	**To state the method of least squares to estimate the parameters in a linear regression model.**	**K1, K2**
2	**Skills:**	
2.1	**To estimate probabilities from cumulative distribution functions and cumulative distribution functions from probability density functions, and the reverse.**	**S1**
2.2	**To use and evaluate test hypotheses for the one and two samples.**	**S1, S2**
2.3	**To predict the future by using the linear regression model.**	**S3, S4**
2.4	**To design and formulate hypothesis testing problems that will be solved using Excel.**	**S3, S5**
2.5	**To interpret the output of the statistical software of the test hypothesis of a given data set.**	**S4, S5**
3	**Values:**	
3.1	**To work individually and defend the formulated conclusions.**	**V1, V2**
3.2	**To work in groups.**	**V1, V3**

C. Course Content

No	List of Topics	Contact Hours
1	**Continuous Random Variables and Probability Distributions:** Continuous Random variables. Probability Distribution and Probability Density Function. Cumulative Distribution Function. Mean and Variance of a Continuous Random Variable Moments. Moment Generating functions.	**11**
2	**Some Examples of Continuous Probability Distributions:** Uniform Distribution. The Normal Distribution and its Approximations to the Binomial and Poisson Distributions; Gamma and Exponential Distributions. Chi-Square Distribution. t-Distribution. F-distribution.	**13**
3	**Tests of Hypothesis for one Sample:** Steps in Hypothesis Testing-Traditional Method. z-Test for the Mean; t Test for the Mean. z-Test for the Proportion. Chi-Square Test for a Variance or Standard Deviation.	**16**
4	**Tests of Hypothesis for Two Samples:** Testing the Difference Between Two Means of Independent Samples. Testing the Difference Between	**16**

No	List of Topics	Contact Hours
	Two Means of Dependent Samples. Testing the Difference Between Two Proportions. Testing the Difference Between Two Variances.	
5	**Correlation and Linear Regression:** Scatter Plots and Correlation. Line of Best Fit; Determination of the Regression Line Fit Equation.	**16**
Total		**72**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	Knowledge and Understanding		
1.1	**To define and outline the theory of continuous random variables and their probability distributions.**	**Lectures, Classroom discussions.**	**Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments**
1.2	**To outline the procedures of hypothesis testing.**	**Lectures, Classroom discussions.**	**Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments**
1.3	**To state the method of least squares to estimate the parameters in a linear regression model.**	**Lectures, Classroom discussions.**	**Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments**
2.0	Skills		
2.1	**To estimate probabilities from cumulative distribution functions and cumulative distribution functions from probability density functions, and the reverse.**	**Lectures, Classroom discussions.**	**Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments**
2.2	**To use and evaluate test hypotheses for the one and two samples.**	**Lectures, Classroom discussions, Individual or group work**	**Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments**

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.3	To predict the future by using the linear regression model.	Lectures, Individual or group work, Classroom discussions.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
2.4	To design and formulate hypothesis testing problems that will be solved using Excel.	Use of statistical software, Lecturing, Interactive learning.	Lab Exam, Assignments, Practical exam
2.5	To interpret the output of the statistical software of the test hypothesis of a given data set.	Use of statistical software, Lecturing, Interactive learning.	Lab Exam, Assignments, Practical exam
3.0	Values		
3.1	To work individually and defend the formulated conclusions.	Interactive learning, Group interaction, Problem solving.	Lab Exam, Practical exam
3.2	To work in groups.	Group interaction, Problem solving.	Assignments and Mini-projects

2. Assessment Tasks for Students

#	*Assessment task**	*Week Due*	*Percentage of Total Assessment Score*
1	Homeworks, Quizzes, Mini-projects	During the semester	20%
2	First Midterm	Week 4-5	20%
3	Second Midterm	Week 7-8	20%
4	Final Exam	Week 13	40%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

- There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.
- All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	***Probability & Statistics for Engineers & Scientists***, 9th Edition, R. Walpole, R. Myers, S. Myers, K. Ye, Pearson Education International, 2012. ISBN 9780321629111. **(Main Reference).**
Essential References Materials	**1.** ***Elementary Statistics***, 14th edition; Mario F. Triola, Pearson, 2021. **2.** ***Introduction to Probability and Statistics;*** 14th Edition, W. Mendenhall, R. J. Beaver, Barbara M. Beaver, Duxbury Press, 2013. ISBN-13: 9781133103752. **3.** ***Mathematical Statistics with Applications,*** 7th Edition, D. Wackerly, W. Mendenhall, R.L. Scheaffer, Brooks/Cole-Cengage Learning, 2008. ISBN-13: 9780495385080. **4.** ***Elementary Statistics: A Step by Step Approach*****;** Bluman, Allan. G.; McGraw Hill, 8th Edition, 2012. **5.** ***Probability and Statistics in Engineering***, 4th Edition, William W. Hines, Douglas C. Montgomery, David M. Goldsman, Connie M. Borror, John Wiley & Sons Inc, 2003. ISBN: 9780471240877. **6.** ***Introduction to Mathematical Statistics*****,** 6th Edition, Robert V. Hogg, Joseph McKean, Allen T. Craig, Prentice Hall, 2005.
Electronic Materials	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	*Resources*
Accommodation *(Classrooms, laboratories, demonstration rooms/labs, etc.)*	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources *(AV, data show, Smart Board, software, etc.)*	**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**
Other Resources *(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)*	**See the attached file**

G. Course Quality Evaluation

Evaluation Areas/Issues	*Evaluators*	*Evaluation Methods*
Effectiveness of teaching and assessment, Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
Extent of achievement of course learning outcomes, Quality of learning resources	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**

Evaluation areas *(e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)*

Evaluators *(Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)*

Assessment Methods *(Direct, Indirect)*

H. Specification Approval Data

Council / Committee	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
Reference No.	**11/1444**
Date	**22/04/1444 (16/11/2022)**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	**Mathematical Statistics**
Course Code:	**STA 1203**
Program:	**Bachelor of Science in Applied Statistics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours:	**4 (3 Lectures, 0 Lab, 2 Tutorial)**
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐	
3. Level/year at which this course is offered:	**Level 6 / Year 2**
4. Pre-requisites for this course (if any):	**STA 1202**
5. Co-requisites for this course (if any):	**None**

6. Mode of Instruction (mark all that apply)

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

7. Contact Hours (based on academic semester)

No	*Activity*	*Contact Hours*
1	**Lecture**	**36**
2	**Laboratory/Studio**	**0**
3	**Tutorial**	**24**
4	**Others** (specify)	**0**
	Total	**60**

B. Course Objectives and Learning Outcomes

1. Course Description

This course describes the most important ideas, theoretical results, and examples of bivariate probability distributions, sampling distributions and the CLT, functions of random variables, parameter estimations and hypothesis testing. The course includes the essential fundamentals of these topics. The emphasis is on calculations, and some applications are mentioned.

2. Course Main Objective

- **Use joint probability mass functions and joint probability density functions to calculate probabilities;**
- **Calculate means and variances for linear combinations of random variables.**
- **Determine the distribution of a general function of a random variable;**
- **Calculate moment generating functions and use the functions to determine moments and distributions;**
- **Understand the central limit theorem;**
- **Know how to compute and explain the precision with which a parameter is estimated;**
- **Construct confidence intervals on the mean, variance, standard deviation and population proportion.**
- **To teach students techniques of estimations.**

3. Course Learning Outcomes

	CLOs	*Aligned-PLOs*
1	**Knowledge and Understanding:**	
1.1	**To define the moment generating function, the joint probability mass functions, and joint probability density functions.**	**K1, K2**
1.2	**To reproduce the confidence intervals on the mean, variance, standard deviation and on a population proportion.**	**K1, K2**
2	**Skills:**	
2.1	**To explain the importance of central limit theorem**	**S1, S2**
2.2	**To calculate means and variances for linear combinations of random variables.**	**S4**
2.3	**To construct confidence intervals on the appropriate case.**	**S2, S3**
2.4	**To explain important properties of point estimators, including bias, variance, and mean square error**	**S5**
2.5	**To construct point estimators using the method of moments and the method of maximum likelihood.**	**S3**
3	**Values:**	
3.1	**To defend the formulated conclusions individually.**	**V1, V2**
3.2	**To operate meaningfully and productively with others.**	**V1, V3**

C. Course Content

No	List of Topics	Contact Hours
1	**Bivariate Probability Distribution:** Two Discrete Random Variables, Two Continuous Random Variables, Covariance and Correlation, Bivariate Normal Distribution, Linear Combinations of Random Variables.	**6**
2	**Sampling distributions and the central limit theorem:** Sampling distributions, Sampling Distributions of the Means, The chi-square distribution, The t distribution, The F distribution.	**6**
3	**Functions of Random Variables:** Finding the probability distribution of a function of random variable. The method of distribution function, The method of transformations, Using the Moment-Generating Functions	**8**
4	**Sampling Distributions and The Central Limit Theorem:** Sampling Distributions related to the Normal Distribution; The Central Limit Theorem; A proof of the Central Limit Theorem.	**8**
5	**Estimation: Point estimation:** The Bias and Mean Square Error of Point Estimation; Some Common Point Estimators; Evaluating The goodness of a Point Estimator.	**8**
6	**Confidence Interval Estimation:** Confidence interval for the Mean when σ is Known: Confidence interval for the Mean when σ is Unknown. Confidence Interval and Sample Sizes for Proportions. Confidence Intervals for Variance And standard Deviations.	**15**
7	**Properties of Point Estimators and Methods of Estimation:** Relative Efficiency. Consistency. Sufficiency. Rao-Blackwell Theorem and Minimum Variance Estimation. The Method of Moments. The Method of Maximum Likelihood.	**9**
Total		**60**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**To define the moment generating function, the joint probability mass functions, and joint probability density functions.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Lab Assignments, Short Quizzes**
1.2	**To reproduce the confidence intervals on the mean, variance, standard deviation and on a population proportion.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Lab Assignments, Short Quizzes**

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.0	**Skills**		
2.1	Explain the importance of central limit theorem	Lecturing, Interactive learning.	Participations, Short Quizzes
2.2	Calculate means and variances for linear combinations of random variables and calculate probabilities for linear combinations of normally distributed random variables	Lecturing, Interactive learning.	Participations, Short Quizzes
2.3	Construct confidence intervals on the appropriate case.	Lecturing, Interactive learning.	Participations, Short Quizzes
2.4	To explain important properties of point estimators, including bias, variance, and mean square error	Use of statistical software, Lecturing, Interactive learning.	Lab Exam, Participations, Short Quizzes
2.5	To construct point estimators using the method of moments and the method of maximum likelihood.	Lecturing, Interactive learning.	Participations, Short Quizzes
3.0	**Values**		
3.1	To defend the formulated conclusions individually.	Interactive learning, Group interaction, Problem solving.	Lab Exam, Practical exam
3.2	To operate meaningfully and productively with others.	Group interaction, Problem solving.	Assignments and Mini-projects

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homeworks, Quizzes, Mini-projects	During the semester	20%
2	First Midterm	Week 4-5	20%
3	Second Midterm	Week 7-8	20%
4	Final Exam	Week 13	40%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice: • **There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.** • **All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.**

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	***Probability & Statistics for Engineers & Scientists,*** 9th Edition, R. Walpole, R. Myers, S. Myers, K. Ye, Pearson Education International, 2012. ISBN 9780321629111. **(Main Reference).** ***Introduction to Mathematical Statistics,*** 6th Edition, Robert V. Hogg, Joseph McKean, Allen T. Craig, Prentice Hall, 2005. **(Main Reference).**
Essential References Materials	**1.** ***Mathematical Statistics with Applications,*** 7th Edition, D. Wackerly, W. Mendenhall, R.L. Scheaffer, Brooks/Cole-Cengage Learning, 2008. ISBN-13: 9780495385080. **2.** ***Probability and Statistics in Engineering***, 4th Edition, William W. Hines, Douglas C. Montgomery, David M. Goldsman, Connie M. Borror, John Wiley & Sons Inc, 2003. ISBN: 9780471240877. **3.** ***Introduction to Mathematical Statistics***, 6th Edition, Robert V. Hogg, Joseph McKean, Allen T. Craig, Prentice Hall, 2005.
Electronic Materials	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	***Resources***
Accommodation *(Classrooms, laboratories, demonstration rooms/labs, etc.)*	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection (Equipped with Microsoft Excel and SPSS).**

Item	*Resources*
Technology Resources *(AV, data show, Smart Board, software, etc.)*	**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**
Other Resources *(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)*	**See the attached file**

G. Course Quality Evaluation

Evaluation Areas/Issues	*Evaluators*	*Evaluation Methods*
Effectiveness of teaching and assessment, Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
Extent of achievement of course learning outcomes, Quality of learning resources	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
Reference No.	**11/1444**
Date	**22/04/1444 (16/11/2022)**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA
T4
2020

Course Specifications

Course Title:	**Nonparametric Statistics**
Course Code:	**STA 1261**
Program:	**Bachelor of Science in Applied Statistics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours:	**5 (4 Lectures, 1 Lab, 1 Tutorial)**
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐	
3. Level/year at which this course is offered:	**Level 6 / Year 2**
4. Pre-requisites for this course (if any)**:**	**STA 1202**
5. Co-requisites for this course (if any)**:**	**None**

6. Mode of Instruction (mark all that apply)

No	*Mode of Instruction*	*Contact Hours*	*Percentage*
1	**Traditional classroom**	**72**	**100%**
2	**Blended**		
3	**E-learning**		
4	**Distance learning**		
5	**Other**		

7. Contact Hours (based on academic semester)

No	*Activity*	*Contact Hours*
1	**Lecture**	**48**
2	**Laboratory/Studio**	**12**
3	**Tutorial**	**12**
4	**Others** (specify)	**0**
	Total	**72**

B. Course Objectives and Learning Outcomes

1. Course Description

This course aims at introducing the nonparametric techniques in statistical analysis and the use of these techniques in a variety of disciplines. Nonparametric statistics essentially refer to the so-called smoothing procedures for curve estimation, in contrast to traditional nonparametric methods such as rank-based tests. This course covers tests for single samples and for paired samples, k-sample method, paired comparisons and blocked designs, tests for trends and association, and multivariate tests.

2. Course Main Objective
The objective of this course to learn students to choose the appropriate statistical test for a given set of data, to compute basic parametric and nonparametric statistics, to interpret the results of descriptive and inferential statistical analyses, to describe correlations between two variables (e.g., negative, positive, none), and to use a statistical software program to develop a spreadsheet, to calculate the main statistic and to interpret the result.

3. Course Learning Outcomes

	CLOs	*Aligned-PLOs*
1	**Knowledge and Understanding**	
1.1	**To recognize when not to use a nonparametric method.**	**K1, K2**
1.2	**To define different nonparametric methods in estimation, testing, model fitting, and in analyses.**	**K1, K2**
2	**Skills:**	
2.1	**To formulate, test and interpret various hypothesis tests for location, scale, and independence problems.**	**S1, S2**
2.2	**To summarize data using both graphical and numerical methods for use in nonparametric statistical methods.**	**S1, S2**
2.3	**To use statistical methods, including nonparametric bootstrapping, to construct and interpret interval estimators for population medians and other population parameters based on rank-based methods.**	**S3, S4, S5**
2.4	**To produce and interpret statistics and graphs, using nonparametric density estimation and nonparametric function estimation techniques.**	**S5, S3, S4**
2.5	**To explain the relationship between parametric tests and nonparametric tests**	**S1, S3**
3	**Values:**	
3.1	**To employ ethical concepts and rules to determine viable alternatives in any given situation.**	**V1, V2**
3.2	**To operate meaningfully and productively with others.**	**V1, V3**

C. Course Content

No	*List of Topics*	*Contact Hours*
1	**Review of Probability & Basic Inference:** Counting Techniques, Random Variables, Sampling Distributions, Hypothesis Tests	**4**
2	**One-Sample Methods:** Confidence Intervals and Tests on the Median, Estimating the Population CDF & Percentiles, Type I Error and Power	**7**

No	List of Topics	Contact Hours
3	**Two-Sample Methods:** Permutation Tests, Wilcoxon Rank-Sum Test, Mann-Whitney Test, Large Sample Approximations.	**7**
4	***k*-Sample Methods:** *k*-Sample Permutation Tests, Kruskal-Wallis, Multiple Comparisons, Ordered Alternatives	**8**
5	**Paired Comparisons & Blocked Designs:** Sign Test & Signed Rank Tests, Permutation Test for a Randomized Complete Block Design " Friedman's Test, Cochran's Q, Kendall's W".	**10**
6	**Tests for Association:** Spearman Rank Correlation, Kendall's Tau, Permutation Tests for Contingency Tables, Fisher's Exact for a 2x2 Table.	**12**
7	**Multivariate Tests:** Two-Sample Multivariate Permutation Tests. Two-Sample Multivariate Rank Tests. Multivariate Paired Comparisons. Multivariate Rank Tests for Paired Comparisons. Multiresponse Categorical Data.	**12**
8	**Nonparametric Bootstrap Methods:** The Basic Bootstrap Method. Bootstrap Intervals for Location-Scale Models. BCA and Other Bootstrap Intervals. Correlation and Regression. Two-Sample Inference. Bootstrap Sampling from Several Populations. Bootstrap Sampling for Multiple Regression.	**12**
Total		**72**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**To recognize when not to use a nonparametric method.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Lab Assignments, Short Quizzes**
1.2	**To define different nonparametric methods in estimation, testing, model fitting, and in analyses.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Lab Assignments, Short Quizzes**
2.0	**Skills**		
2.1	**To formulate, test and interpret various hypothesis tests for location, scale, and independence problems.**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.2	To summarize data using both graphical and numerical methods for use in nonparametric statistical methods.	Lecturing, Interactive learning.	Assignments, Practical exam
2.3	To use statistical methods, including nonparametric bootstrapping, to construct and interpret interval estimators for population medians and other population parameters based on rank-based methods.	Use of statistical software, Lecturing, Interactive learning.	Lab Exam, Participations, Short Quizzes
2.4	To produce and interpret statistics and graphs, using nonparametric density estimation and nonparametric function estimation techniques.	Use of statistical software, Lecturing, Interactive learning.	Lab Exam, Participations, Short Quizzes
2.5	To explain the relationship between parametric tests and nonparametric tests	Lecturing, Interactive learning.	Assignments, Practical exam
3.0	**Values**		
3.1	To employ ethical concepts and rules to determine viable alternatives in any given situation.	Interactive learning, Group interaction, Problem solving.	Lab Exam, Practical exam, Assignments
3.2	To operate meaningfully and productively with others.	Group interaction, Problem solving.	Assignments and Mini-projects

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homeworks, Quizzes, Mini-projects	During the term	20%
2	First Midterm	Week 4-5	20%
3	Second Midterm (lab Exam)	Week 7-8	20%
4	Final Exam	Week 13	40%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice: • **There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.** • **All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.**

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	**An Introduction to Modern Nonparametric Statistics,** 1st Edition; James J. Higgins, Duxbury Press, 2004. ISBN-13: 9780534387754. (Main Reference)
Essential References Materials	1- **Nonparametric Statistics for Non-Statisticians: A Step-by-Step Approach,** Gregory W. Corder, Dale I. Foreman, Willey, 2011. 2- **Applied Nonparametric Statistical Methods, 4th Edition;** P. Sprent, Nigel C. Smeeton, Chapman & Hall/CRC Texts in Statistical Science, 2007.
Electronic Materials	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	*Resources*
Accommodation *(Classrooms, laboratories, demonstration rooms/labs, etc.)*	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources *(AV, data show, Smart Board, software, etc.)*	**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**
Other Resources *(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)*	▪ **See the attached file**

G. Course Quality Evaluation

Evaluation Areas/Issues	*Evaluators*	*Evaluation Methods*
Effectiveness of teaching and assessment, Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
Extent of achievement of course learning outcomes, Quality of learning resources	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
Reference No.	**11/1444**
Date	**22/04/1444 (16/11/2022)**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA
T4
2020

Course Specifications

Course Title:	**Introduction to Regression**
Course Code:	**STA 1321**
Program:	**Bachelor of Science in Applied Statistics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours:	**4 (3 Lectures, 0 Lab, 2 Tutorial)**
2. Course type	
a. University ☐ College ☐ Department ✓ Others ☐	
b. Required ✓ Elective ☐	
3. Level/year at which this course is offered:	**Level 7 / Year 3**
4. Pre-requisites for this course (if any):	**STA 1203**
5. Co-requisites for this course (if any):	**None**

6. Mode of Instruction (mark all that apply)

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

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	**36**
2	**Laboratory/Studio**	**0**
3	**Tutorial**	**24**
4	**Others** (specify)	**0**
	Total	**60**

B. Course Objectives and Learning Outcomes

1. Course Description

In statistics, linear regression is a fundamental technique to approach linearly of statistical modelling, in which we aim to model a response variable using one or more explanatory variables. This course covers the broad class of linear regression models, which are widely used in practice by using basic example data set. The course aims to teach how to formulate such models and fit them to data, how to make predictions with associated measures of uncertainty, and how to select appropriate explanatory variables. Both theory and practical aspects are covered, including the use of computer software for regression.

2. Course Main Objective

Regression analysis consists of a collection of techniques used to explore and understand the relationship between variables and is perhaps the most widely-used and most useful of all the techniques in modern Statistics. The objectives of this course are:

- **to help student to have a firm understanding of the underlying theory;**
- **to learn the tools needed to carry out the statistical regression analysis in a variety of applications;**
- **to provide student with facility and experience in regression model building, evaluation, and analysis using a modern computer approach.**

3. Course Learning Outcomes

	CLOs After successful completion of the course, students will able to:	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**To outline the concept of linear regression model and properties of model parameters for prediction purposes.**	**K1, K2**
1.2	**To define regression analysis and its limitations.**	**K1, K2**
2	**Skills:**	
2.1	**To summarize and explain the general procedures of statistical inference for linear regression models.**	**S1, S2**
2.2	**To differentiate the situation where linear regression is appropriate**	**S2**
2.3	**To interpret estimates and diagnostic statistics.**	**S3, S4**
2.4	**To construct and fit linear regression models with the appropriate software.**	**S5**
2.5	**To design and implement advanced methods in regression analysis for applications.**	**S2, S3**
3	**Values:**	
3.1	**To employ ethical concepts and rules to determine viable alternatives in any given situation.**	**V1, V2**
3.2	**To show findings and discuss the results with others.**	**V1, V3**

C. Course Content

No	*List of Topics*	*Contact Hours*
1	**Introduction to Regression Analysis:** Regression Models. Formal uses of regression analysis. The data base.	**7**
2	**The Simple Linear Regression Model:** The model description; Assumption and interpretation of model parameters; Last square formulation; Partitioning total variability; Test of hypothesis on a slope and intercept; Quality of fitted model; Confidence interval on mean	**13**

No	*List of Topics*	*Contact Hours*
	response and prediction intervals; A look at a residual.	
3	**The Multiple Linear Regression Model:** Model description and assumptions; Estimation; Properties of the least square estimators; Various hypotheses tests; Multicollinearity in multiple data; Quality of fit and prediction.	**16**
4	**Selection of Variables:** Contribution of a variable in the model; Forward selection and backward elimination; Stepwise procedure; All possible subsets and other techniques of selection variables.	**12**
5	**Statistical diagnostics:** Analysis of residual; Diagnostic plots; Detection of outliers; Influence diagnostics.	**12**
Total		**60**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	*Course Learning Outcomes*	*Teaching Strategies*	*Assessment Methods*
1.0	**Knowledge and Understanding**		
1.1	**To outline the concept of linear regression model and properties of model parameters for prediction purposes.**	• **Using lectures to introduce the subjects of the course's materials.** • **Using examples to demonstrate the introduced methodologies.** • **Discussion within lectures/tutorials/lab sessions.** • **Letting students to raise questions regarding the homework and lectures every week.**	• **Continuous Assessment (assignments, test, and mini-project).** • **Final Examination**
1.2	**To define regression analysis and its limitations.**	**Discussion within lectures/tutorials Letting students to raise questions regarding the homework and lectures every week.**	**Continuous Assessment (assignments, test, and mini-project), Final Examination**
2.0	**Skills**		
2.1	**To summarize and explain the general procedures of statistical inference for linear regression models.**	• **Lectures to introduce the subjects of the course's materials.** • **Using examples to demonstrate the introduced**	• **Continuous Assessment (assignments, test, and mini-project).** **Final Exam**

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
		methodologies. • Discussion within lectures/tutorials/lab sessions. • Letting students to raise questions regarding the homework and lectures every week.	
2.2	To differentiate the situation where linear regression is appropriate	Using programming assignments, to allow students to apply the methodologies learnt in the lecture and to solidify their understanding of the statistical procedures.	• Continuous Assessment (assignments, test, and mini-project). • Final Exam
2.3	To interpret estimates and diagnostic statistics	Using programming assignments, to allow students to apply the methodologies learnt in the lecture and to solidify their understanding of the statistical procedures.	• Lab exams and reports • and mini-project). • Homeworks • Final exam.
2.4	To construct and fit linear regression models with the appropriate software.	Using programming assignments, to allow students to apply the methodologies learnt in the lecture and to solidify their understanding of the statistical procedures.	Lab exams and reports, Continuous Assessment (assignments, test, and mini-project). , Final exam.
2.5	To carry out calculations orally and mentally.	Open discussion at classroom. Letting students to raise questions regarding the homework and lectures every week.	Written assignment and written final exam. Presentation of mini-projects.
3.0	**Values**		
3.1	To employ ethical concepts and rules to determine viable alternatives in any given situation.	Open discussion at classroom.	Participation, Lab assignments, Mini-project(s)
3.2	To show findings and discuss the results with others.	Small team tasks, Open discussion at classroom.	Lab assignments, Mini-project(s)

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Homeworks, Quizzes, Mini-projects**	**During the semester**	**20%**
2	**First Midterm**	**Week 4-5**	**20%**
3	**Second Midterm**	**Week 7-8**	**20%**
4	**Final Exam**	**Week 13**	**40%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

- **There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.**
- **All students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.**

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	***Classical and Modern Regression with Applications*;** 2nd Edition, Raymond H. Myers, Duxbury Classic, 2000. ISBN-13: 978-0534380168. **(Main Reference)**
Essential References Materials	1. ***Regression analysis by example,*** 5th Edition, Samprit Chatterjee and Alis S. Hadi, Wiley Series in Probability and Statistics, 2012. 2. ***Applied Regression,*** 4th Edition, Sanford Weisberg, Wiley Series in Probability and Statistics, 2013. 3. ***Applied Regression Analysis and Multivariable Methods,*** 5th Edition, D. G. Kleinbaum, L. L. Kupper, A. Nizam, and E. S. Rosenberg, Cengage Learning, 2013. 4. ***Introduction to Linear Regression Analysis*, 5th Edition;** Douglas C. Montgomery, Elizabeth A. Peck, and G. Geoffrey Vining, Wiley Series in Probability and Statistics, 2012.
Electronic Materials	**Regression Analysis, Theory, Methods and Applications**, A Sen and M. Srivastava, Springer-Verlag, 1990. (it can be download from IMAMU domain)
Other Learning Materials	• **Online Linear Regression Calculator** • **linear regression** **(**UC Business Analytics R Programming Guide)

2. Facilities Required

Item	*Resources*
Accommodation *(Classrooms, laboratories, demonstration rooms/labs, etc.)*	▪ **Each of the class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources *(AV, data show, Smart Board, software, etc.)*	**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**
Other Resources *(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)*	**See the attached file**

G. Course Quality Evaluation

Evaluation Areas/Issues	*Evaluators*	*Evaluation Methods*
Effectiveness of teaching and assessment, Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
Extent of achievement of course learning outcomes, Quality of learning resources	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
Reference No.	**11/1444**
Date	**22/04/1444 (16/11/2022)**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA
T4
2020

Course Specifications

Course Title:	**Time Series Analysis**
Course Code:	**STA 1322**
Program:	**Bachelor of Science in Applied Statistics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours:	**4 (3 Lectures, 0 Lab, 2 Tutorial)**
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐	
3. Level/year at which this course is offered:	**Level 9 / Year 3**
4. Pre-requisites for this course (if any)**:**	**STA 1321**
5. Co-requisites for this course (if any)**:**	**None**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	36
2	Laboratory/Studio	0
3	Tutorial	24
4	**Others** (specify)	0
	Total	**60**

B. Course Objectives and Learning Outcomes

1. Course Description In statistics, time series is a fundamental technique to study model building strategies. The course introduces the general concept of time series and their stochastic processes, regression methods, residual analysis, models for stationary time series, autoregressive processes, models for nonstationary time series, ARIMA models, specifications of simulated time series, parameter estimations, moment, last square and maximum likelihood estimations.
2. Course Main Objective At the end of this course, the student will be able to compute and interpret a correlogram and a sample spectrum, derive the properties of ARMA and state-space models, and choose an appropriate ARIMA model for a given set of data and fit the model using an appropriate package.

3. Course Learning Outcomes

	CLOs	Aligned-PLOs
1	**Knowledge and Understanding:**	
1.1	**To define the concept of time series and its decomposition in trend part and stochastic part.**	**K1, K2**
1.2	**To outline stationary and nonstationary time series and the ARIMA model.**	**K1, K2**
2	**Skills:**	
2.1	**To explain and interpret MA, AR, ARMA, ARIMA, and RW models.**	**S1, S2, S5**
2.2	**To construct nonlinear stochastic models.**	**S1, S2**
2.3	**To evaluate stationary in time series.**	**S1, S2, S3**
2.4	**To justify the fitted trend and seasonal trend to the data and communicate meaningfully and productively with others on time series analysis issues.**	**S3, S4, S5**
2.5	**To perform basic calculations and summaries of time series data.**	**S3, S5**
3	**Values:**	
3.1	**To present and defend the formulated conclusions.**	**V1, V2**
3.2	**To work in groups.**	**V1, V3**

C. Course Content

No	List of Topics	Contact Hours
1	**Fundamental Concepts:** Examples of Time Series, A Model-Building Strategy, Time Series Plots in History, Time Series and Stochastic Processes, Means, Variances, and Covariances, Stationary.	**12**
2	**Trends:** Deterministic Versus Stochastic Trends, Estimation of a Constant Mean, Regression Methods, Reliability and Efficiency of Regression Estimates, Interpreting Regression Output, Residual Analysis.	**12**
3	**Models for Stationary Time Series:** General Linear Processes, Moving Average Processes, Autoregressive Processes, The Mixed Autoregressive Moving Average Model, Invertibility.	**8**
4	**Models for Nonstationary Time Series:** Stationarity Through Differencing, ARIMA Models, Constant Terms in ARIMA Models, Other Transformations.	**12**

No	List of Topics	Contact Hours
5	**Model Specification:** Properties of the Sample Autocorrelation Function, The Partial and Extended Autocorrelation Functions, Specification of Some Simulated Time Series, Nonstationarity, Other Specification Methods, Specification of Some Actual Time Series.	**9**
6	**Parameter Estimation:** The Method of Moments, Least Squares Estimation, Maximum Likelihood and Unconditional Least Squares, Properties of the Estimates, Illustrations of Parameter Estimation, Bootstrapping ARIMA Models.	**12**
Total		**60**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**To define the concept of time series and its decomposition in trend part and stochastic part.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Lab Assignments, Practical exam**
1.2	**To outline stationary and nonstationary time series and the ARIMA model.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Lab Assignments, Practical exam**
2.0	**Skills**		
2.1	**To explain and interpret MA, AR, ARMA, ARIMA, and RW models.**	**Use of statistical software, Lecturing, Interactive learning.**	**Lab Exam, Assignments, Practical exam**
2.2	**To construct nonlinear stochastic models.**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**
2.3	**To evaluate stationary in time series.**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**
2.4	**To justify the fitted trend and seasonal trend to the data and communicate meaningfully and productively with others on time series analysis issues.**	**Use of statistical software, Lecturing, Interactive learning.**	**Lab Exam, Assignments, Practical exam**
2.5	**To perform basic calculations and summaries of time series data.**	**Use of statistical software, Lecturing, Interactive learning.**	**Lab Exam, Assignments, Practical exam**
3.0	**Values**		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
3.1	**To present and defend the formulated conclusions.**	**Interactive learning, Group interaction, Problem solving.**	**Lab Exam, Practical exam, Assignments**
3.2	**To work in groups.**	**Group interaction, Problem solving.**	**Assignments and Mini-projects**

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Homeworks, Quizzes, Mini-projects**	**During the term**	**20%**
2	**First Midterm**	**Week 4-5**	**20%**
3	**Second Midterm**	**Week 7-8**	**20%**
4	**Final Exam**	**Week 13**	**40%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

- **There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.**
- **All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.**

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	▪ ***Time Series Analysis with application in R***, Jonathan D. Cryer and Kung-Sik Chan. (2nd Edition) Springer 2008. ISBN: 978-0-387-75958-6 ▪ ***An Introduction to Time Series Analysis and Forecasting: With Applications of SAS® and SPSS, 1st Edition***, Robert Yaffee, Monnie McGee, Academic Press, 1996. ISBN: 9780127678702.
Essential References Materials	**1-** ***Introduction to Time Series and Forecasting***, Peter J. Brockwell, Richard A Davis, Springer, 2002. **2-** ***Time Series Analysis,*** James Douglas Hamilton, Princeton University Press, 1994. **3-** ***The Analysis of Time Series: An Introduction***, Chris Chatfield, Publisher: Chapman and Hall/CRC, 2003.
Electronic Materials	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	Resources
Accommodation *(Classrooms, laboratories, demonstration rooms/labs, etc.)*	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources *(AV, data show, Smart Board, software, etc.)*	**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**
Other Resources *(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)*	**See the Attached File**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment, Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
Extent of achievement of course learning outcomes, Quality of learning resources	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
Reference No.	**11/1444**
Date	**22/04/1444 (16/11/2022)**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	**Statistical Inference**
Course Code:	**STA 1331**
Program:	**Bachelor of Science in Applied Statistics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours:	**5 (4 Lectures, 0 Lab, 2 Tutorial)**

2. Course type

a. University ☐ College ☐ Department ☑ Others ☐
b. Required ☑ Elective ☐

3. Level/year at which this course is offered:	**Level 7 / Year 3**
4. Pre-requisites for this course (if any):	**STA 1203**
5. Co-requisites for this course (if any):	**None**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	**72**	**100%**
2	**Blended**		
3	**E-learning**		
4	**Distance learning**		
5	**Other**		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	**48**
2	**Laboratory/Studio**	**0**
3	**Tutorial**	**24**
4	**Others** (specify)	**0**
	Total	**72**

B. Course Objectives and Learning Outcomes

1. Course Description

In statistics, the estimation theory is fundamental in order to analyze real as well as simulated data. The course covers basic concepts of random samples, principle of data reduction, methods of finding estimators, methods of evaluating estimators, unbiased estimators, methods of finding tests, methods of evaluating tests, most powerful tests, interval estimations, confidence coefficient or level, Bayesian procedure methods of evaluating interval estimators, maximum likelihood method.

2. Course Main Objective

The objectives of this course will be to integrate mathematical statistics. Specifically, this course will further develop estimation theory (point and interval) estimation and tests of hypotheses, including hypothesis testing, information approach to hypothesis testing, uniformly most powerful and likelihood ratio tests.

3. Course Learning Outcomes

	CLOs	Aligned-PLOs
1	**Knowledge and Understanding**	
1.1	**To state the notions of point estimation and interval estimation and different methods of finding and evaluating interval estimators.**	**K1, K2**
1.2	**To define the concepts of random sample, principle of data reduction, best unbiased estimator, likelihood ratio test, and the maximum likelihood test.**	**K1, K2**
2	**Skills:**	
2.1	**To use Bayes formula to find the posterior, knows the concepts of a prior and posterior distribution, and understands the concept of a conjugate prior distribution**	**S1, S2**
2.2	**To determine properties of estimators.**	**S3**
2.3	**To choose optimal estimators.**	**S3, S4**
2.4	**To implement methods of statistical inference for discrete data in the appropriate software.**	**S5**
3	**Values:**	
3.1	**To work individually.**	**V1, V2**
3.2	**To operate meaningfully and productively with others.**	**V1, V3**

C. Course Content

No	List of Topics	Contact Hours
1	**Introduction:** Probability distributions, Exponential Families, Locations and Scale Families. Central limit theorem.	**8**
2	**Random Sample:** Basic Concepts of Random Samples. Order Statistics. Convergence Concepts.	**8**
3	**Principles of Data Reduction:** Introduction. The Sufficiency Principle. The Likelihood Principle. The Equivariance Principle.	**10**
4	**Point Estimation:** Introduction. Methods of Finding Estimators. Methods of Evaluating Estimators. Best Unbiased Estimator or Uniform Minimum Variance Unbiased Estimator, The Cramer-Rao Inequality, Attaining the Lower Bound. The Rao-Blackwell Theorem, Characterizing Best Unbiased Estimators.	**12**

No	List of Topics	Contact Hours
5	**Hypothesis Testing:** Introduction. Methods of Finding Tests. Methods of Evaluating Test. Most Powerful Tests: The Neyman-Pearson Lemma, Karlin-Rubin Theorem, The Likelihood Ratio Test, Union and Intersection Tests.	**12**
6	**Interval Estimation:** Introduction. Methods of Finding Interval Estimators. Methods of Evaluating Interval Estimators. Confidence Coefficient or Level, Procedures based on Hypothesis Test Rejection Regions, on Pivotal Quantities, CDFs, Bayesian Procedures Methods of Evaluating Interval Estimators: Length, Optimality via Test Equivalence, Bayesian Optimality, Optimality via Loss Functions.	**12**
7	**Maximum Likelihood Methods:** Maximum Likelihood Estimation, Rao-Cramér lower Bound and Efficiency, Maximum Likelihood Test.	**10**
Total		**72**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**To state the notions of point estimation and interval estimation and different methods of finding and evaluating interval estimators.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Lab Assignments, Practical exam**
1.2	**To define the concepts of random sample, principle of data reduction, best unbiased estimator, likelihood ratio test, and the maximum likelihood test.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Lab Assignments, Practical exam**
2.0	**Skills**		
2.1	**To use Bayes formula to find the posterior, knows the concepts of a prior and posterior distribution, and understands the concept of a conjugate prior distribution**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**
2.2	**To determine properties of estimators.**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**
2.3	**To choose optimal estimators.**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.4	To implement methods of statistical inference for discrete data in the appropriate software.	Use of statistical software, Lecturing, Interactive learning.	Lab Exam, Assignments, Practical exam
3.0	Values		
3.1	To work individually.	Interactive learning, Group interaction, Problem solving.	Lab Exam, Practical exam, Assignments
3.2	To operate meaningfully and productively with others.	Group interaction, Problem solving.	Assignments and Mini-projects

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homeworks, Quizzes, Mini-projects	During the term	20%
2	First Midterm	Week 4-5	20%
3	Second Midterm	Week 7-8	20%
4	Final Exam	Week 13	40%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

- There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.
- All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	**Statistical Inference,** Roger L. Berger, George Casella, Duxbury Press, 2001.
Essential References Materials	1- ***Introduction to Probability and Statistics***, William Mendenhall, Robert J. Beaver, Barbara M. Beaver, Duxbury Press (Thomson Brooks), 2006. 2- ***Mathematical Statistics with Applications***, Richard L. Scheaffer, Dennis D. Wackerly, William Mendenhall, Duxbury Press (Thomson Brooks), 2007.
Electronic Materials	None
Other Learning Materials	None

2. Facilities Required

Item	Resources
Accommodation *(Classrooms, laboratories, demonstration rooms/labs, etc.)*	▪ **Each classroom should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources *(AV, data show, Smart Board, software, etc.)*	**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**
Other Resources *(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)*	**See the attached file**

G. Course Quality Evaluation

Evaluation Areas/Issues	*Evaluators*	*Evaluation Methods*
Effectiveness of teaching and assessment, Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
Extent of achievement of course learning outcomes, Quality of learning resources	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**

Evaluation areas *(e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)*
Evaluators *(Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)*
Assessment Methods *(Direct, Indirect)*

H. Specification Approval Data

Council / Committee	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
Reference No.	**11/1444**
Date	**22/04/1444 (16/11/2022)**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

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T4
2020

Course Specifications

Course Title:	**Sampling Methods**
Course Code:	**STA 1332**
Program:	**Bachelor of Science in Applied Statistics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours:	**4 (3 Lectures, 0 Lab, 2 Tutorial)**
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐	
3. Level/year at which this course is offered:	**Level 8 / Year 3**
4. Pre-requisites for this course (if any)**:**	**STA 1331**
5. Co-requisites for this course (if any)**:**	**None**

6. Mode of Instruction (mark all that apply)

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

7. Contact Hours (based on academic semester)

No	*Activity*	*Contact Hours*
1	**Lecture**	**36**
2	**Laboratory/Studio**	**0**
3	**Tutorial**	**24**
4	**Others** (specify)	**0**
	Total	**60**

B. Course Objectives and Learning Outcomes

1. Course Description

In statistics, sampling methods are used to study the main stages in experimental research and the desirable properties and the criteria of optimality of experimental designs. The course covers the concept of sampling, the type of probability sampling, the systematic sampling, the ratio estimation, the regression estimation, the theory of stratified sampling, the cluster sampling with equal probability, and sampling with unequal probabilities.

2. Course Main Objective

This course will introduce students to determine the probability that a sampling unit is included in a SRS (Simple Probability Samples) of size *n*, distinguish between equal probability and unequal probability samples, compare the precision of SRS, ratio and regression estimators, and identify the similarities and differences between the Systematic and Cluster Sampling approaches.

3. Course Learning Outcomes

	CLOs	*Aligned-PLOs*
1	**Knowledge and Understanding:**	
1.1	**To outline the need for randomness, the desirability of stratification in sampling, and the aspects of the nature and design of trials.**	**K1, K2**
1.2	**To define the type of probability samples, the ratio and regressions estimations, the stratified sampling, and sampling with unequal probabilities.**	**K1, K2**
2	**Skills:**	
2.1	**To appraise the Simple Random Sampling (SRS) method.**	**S1, S2**
2.2	**To differentiate the randomization theory and model-based analysis.**	**S1, S2**
2.3	**To apply Stratified Sampling method, Systematic Sampling (SS) and Cluster Sampling (CS) methods.**	**S3, S4**
2.4	**To analyze data from multi-stage surveys.**	**S3, S5**
3	**Values:**	
3.1	**To employ ethical concepts and rules to determine viable alternatives in any given situation.**	**V1, V2**
3.2	**To justify the output in a collective team environment.**	**V1, V3**

C. Course Content

No	*List of Topics*	*Contact Hours*
1	**Introduction:** Requirements of a good sample, selection Bias, measurements Bias, questionnaire design, sampling and nonsampling errors.	**6**
2	**Simple Probability Samples:** Types of probability samples, framework for probability sampling, simple random sampling, confidence intervals, sample size estimation, systematic sampling, when should a random sample be used?	**6**

No	List of Topics	Contact Hours
3	**Ratio and regression estimation:** Ratio Estimation. Regression Estimation. Estimation in Domains. Models for Ratio and Regression Estimation. Comparison.	**6**
4	**Stratified sampling:** theory of stratified sampling, sampling weights, allocation observations to strata, defining strata, post-stratification, quota sampling.	**7**
5	**Cluster sampling with equal probability:** One stage sampling, two stage cluster sampling, using weights in cluster samples.	**8**
6	**Sampling with unequal probabilities:** Sampling one primary sampling unit, one stage sampling with replacement, two-stage sampling with replacement, unequal probability without replacement.	**10**
7	**Complex Surveys:** Assembling Design Components. Sampling Weights. Estimating a Distribution Function. Plotting Data from a Complex Survey. Design Effects. The National Crime Victimization Survey. Sampling and Experiment Design.	**9**
8	**Nonresponse:** Effects of Ignoring Nonresponse. Designing Surveys to Reduce Nonsampling Errors. Callbacks and Two-Phase Sampling. Mechanisms for Nonresponse. Weighting Methods for Nonresponse. Imputation. Parametric Models for Nonresponse. What Is an Acceptable Response Rate?	**8**
Total		**60**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding:**		
1.1	**To outline the need for randomness, the desirability of stratification in sampling, and the aspects of the nature and design of trials.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Lab Assignments, Practical exam**
1.2	**To define the type of probability samples, the ratio and regressions estimations, the stratified sampling, and sampling with unequal probabilities.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Practical exam**
2.0	**Skills**		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.1	**To appraise the Simple Random Sampling (SRS) method.**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**
2.2	**To differentiate the randomization theory and model-based analysis.**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**
2.3	**To apply Stratified Sampling method, Systematic Sampling (SS) and Cluster Sampling (CS) methods.**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**
2.4	**To analyze data from multi-stage surveys.**	**Use of statistical software, Lecturing, Interactive learning.**	**Lab Exam, Assignments, Practical exam**
3.0	**Values**		
3.1	**To employ ethical concepts and rules to determine viable alternatives in any given situation.**	**Interactive learning, Group interaction, Problem solving.**	**Lab Exam, Practical exam, Assignments**
3.2	**To justify the output in a collective team environment.**	**Group interaction, Problem solving.**	**Assignments and Mini-projects**

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Homeworks, Quizzes, Mini-projects**	**During the term**	**20%**
2	**First Midterm**	**Week 4-5**	**20%**
3	**Second Midterm**	**Week 7-8**	**20%**
4	**Final Exam**	**Week 13**	**40%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

- **There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.**
- **All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.**

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	***Sampling: Design and Analysis***, 1st Edition, Sharon S. Lohr, Duxbury Press, 1999. ISBN-13: 9780534353612
Essential References Materials	1- ***Sampling Techniques,*** 3rd Edition, William G. Cochran, John Wiley and Sons, Inc., 1977. ISBN-13: 9780471162407. 2- ***Model Assisted Survey Sampling***, 2nd Edition, Jan Wretman, Carl-Erik Sarndal, Bengt Swensson, Springer Verlag, Series: Springer Series in Statistics, 2003. ISBN-13: 9780387406206. **3-** ***Sampling Theory and Methods,*** 2nd Edition, S. Sampath, Alpha Science, International Ltd, 2005. ISBN-13: 9781842652145.
Electronic Materials	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	*Resources*
Accommodation *(Classrooms, laboratories, demonstration rooms/labs, etc.)*	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources *(AV, data show, Smart Board, software, etc.)*	**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**
Other Resources *(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)*	**See the attached file**

G. Course Quality Evaluation

Evaluation Areas/Issues	*Evaluators*	*Evaluation Methods*
Effectiveness of teaching and assessment, Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Extent of achievement of course learning outcomes, Quality of learning resources	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**

Evaluation areas *(e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)*

Evaluators *(Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)*

Assessment Methods *(Direct, Indirect)*

H. Specification Approval Data

Council / Committee	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
Reference No.	**11/1444**
Date	**22/04/1444 (16/11/2022)**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	Statistical Software
Course Code:	STA 1341
Program:	Bachelor of Science in Applied Statistics
Department:	Mathematics and Statistics
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University

Table of Contents

A. Course Identification

1. Credit hours:	**3 (1 Lectures, 2 Lab, 2 Tutorial)**
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐	
3. Level/year at which this course is offered:	**Level 8 / Year 3**
4. Pre-requisites for this course (if any):	**STA 1202, CS 1249**
5. Co-requisites for this course (if any):	**None**

6. Mode of Instruction (mark all that apply)

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

7. Contact Hours (based on academic semester)

No	*Activity*	*Contact Hours*
1	**Lecture**	**12**
2	**Laboratory/Studio**	**24**
3	**Tutorial**	**24**
4	**Others** (specify)	**0**
	Total	**60**

B. Course Objectives and Learning Outcomes

1. Course Description

Students need a statistical software program to work on their data. There are several software packages available for their use (Microsoft Excel, SPSS, SAS, MINITAB, S-Plus or R-GNU,...). This lecture is dedicated to learning how to know the different screens and setup of one of the previous statistical package, open files, view and explore data, create new variables, work with do-files, make simple tables and statistics, etc...

2. Course Main Objective
By the end of this course, the students are expected to learn: • **To navigate SPSS program.** • **How to Summarize numeric data by computing descriptive statistics (e.g., mean, variance) and by creating tables and graphs in SPSS.** • **How to analyze tables, graphs and other outputs generated by SPSS.** • **How to run different statistical tests including t-test, ANOVA, Chi-square, etc.**

3. Course Learning Outcomes

	CLOs	*Aligned-PLOs*
1	**Knowledge and Understanding:**	
1.1	**To outline how to use the appropriate software packages (Microsoft Excel, IBM SPSS, R-project).**	**K1, K2**
1.2	**To record how to create a data set, create and redefine variables and observations, and combine data sets.**	**K1, K2**
2	**Skills:**	
2.1	**To combine, transform, and manipulate data sets.**	**S1, S2, S5**
2.2	**To summarize and interpret information from small to very large data sets.**	**S1, S2, S3, S5**
2.3	**To create informative graphs.**	**S3, S5**
2.4	**To analyze data using standard and advanced statistical techniques.**	**S3, S4, S5**
3	**Values:**	
3.1	**To employ ethical concepts and rules to determine viable alternatives in any given situation.**	**V1, V2**
3.2	**To show findings and discuss the results with others.**	**V1, V3**

C. Course Content

No	*List of Topics*	*Contact Hours*
1	**The Nature of SPSS:** Getting Started with SPSS for Windows. Managing Data and Files. Transforming Variables and Data Files. Missing Values. Examining and Printing Output. Using SPSS Syntax.	**8**
2	**Summarizing Data:** Summarizing Data Graphically. Measures of Central Tendency. Measures of Variability. Box-and-Whisker Plots. Standard Scores.	**12**
3	**Summarizing Multivariate Data:** Association Between Numerical Variables. Association Between Categorical Variables.	**10**
4	**Probability and Sampling Distributions:** Probability in Terms of Equally Likely Cases. Random Sampling; Random Numbers. Family of Standard Normal Distributions, Finding Probability for a Given z-Value.	**10**

No	List of Topics	Contact Hours
	Finding a z-Value for a Given Probability, Sampling from a Population, Sampling Distribution of a Sum and of a Mean, The Normal Distribution of Sample Means, The Central Limit Theorem.	
5	**Inferential Statistics:** An Interval of Plausible Values for a Mean. Testing a Hypothesis About a Mean, Conducting the Hypothesis Test, Testing Hypotheses About a Proportion. Paired Measurements. Comparison of Two Independent Means, Tests of Goodness of Fit, Chi-Square Tests of Independence, Measures of Association .	**10**
6	**Regression Analysis and Analysis of Variance:** Regression Analysis, One-Way Analysis of Variance.	**10**
Total		**60**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding:**		
1.1	**To describe the appropriate software packages (Microsoft Excel, IBM SPSS, R-project).**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Lab Assignments, Practical exam**
1.2	**To define how to access information from a variety of data sources.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Lab Assignments, Practical exam**
2.0	**Skills:**		
2.1	**To combine, transform, and manipulate data sets.**	**Use of statistical software, Lecturing, Interactive learning.**	**Lab Exam, Assignments, Practical exam**
2.2	**To summarize and interpret information from small to very large data sets.**	**Use of statistical software, Lecturing, Interactive learning.**	**Lab Exam, Assignments, Practical exam**
2.3	**To create informative graphs.**	**Use of statistical software, Lecturing, Interactive learning.**	**Lab Exam, Assignments, Practical exam**
2.4	**To analyze data using standard and advanced statistical techniques.**	**Use of statistical software, Lecturing, Interactive learning.**	**Lab Exam, Assignments, Practical exam**
3.0	**Values**		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
3.1	**To employ ethical concepts and rules to determine viable alternatives in any given situation.**	**Interactive learning, Group interaction, Problem solving.**	**Lab Exam, Practical exam, Assignments**
3.2	**To show findings and discuss the results with others.**	**Group interaction, Problem solving.**	**Assignments and Mini-projects**

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Homeworks, Quizzes, Mini projects**	**During the term**	**20%**
2	**First Midterm**	**Week 4-5**	**20%**
3	**Second Midterm (Lab Exam)**	**Week 7-8**	**20%**
4	**Final Exam**	**Week 13**	**40%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- **There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.**
- **All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.**

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	***Using SPSS For Windows Data Analysis and Graphics***, 2nd Edition, Susan B. Gerber, Kristin Voelkl Finn, Springer Verlag, 2005. (Main Reference) ISBN-13: 978-0387-40083-9 ***An Introduction to Statistical Methods and Data Analysis***, 5th Edition, R. Lyman Ott, Michael Longnecker, Duxbury Press, 2001. ISBN-13: 9780534251222.

Essential References Materials	**1-** ***Discovering Statistics Using IBM SPSS Statistics***, 4th Edition, Andy Field, SAGE, 2013. **2-** ***SPSS for Starters***, Ton J. Cleophas, Aeilko H. Zwinderman, Springer Verlag, 2010. **3-** ***Statistics and Probability for Engineering Applications: With Microsoft Excel***, William J. Decoursey, Newnes, 2003. **4-** **Applied Statistics and the SAS Programming Language**, 5th Edition, R. Cody, J. K. Smith, Prentice Hall, 2006. **5-** ***Doing Data Analysis with MINITAB™ 14***, 2nd Edition, Robert H. Carver Duxbury Press, 2004.
Electronic Materials	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	*Resources*
Accommodation *(Classrooms, laboratories, demonstration rooms/labs, etc.)*	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources *(AV, data show, Smart Board, software, etc.)*	**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**
Other Resources *(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)*	**See the Attached File**

G. Course Quality Evaluation

Evaluation Areas/Issues	*Evaluators*	*Evaluation Methods*
Effectiveness of teaching and assessment, Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**

Evaluation Areas/Issues	*Evaluators*	*Evaluation Methods*
Extent of achievement of course learning outcomes, Quality of learning resources.	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
Reference No.	**11/1444**
Date	**22/04/1444 (16/11/2022)**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA
T4
2020

Course Specifications

Course Title:	**Introduction to Stochastic Processes**
Course Code:	**STA 1351**
Program:	**Bachelor of Science in Applied Statistics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours:	**4 (3 Lectures, 0 Lab, 2 Tutorial)**
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐	
3. Level/year at which this course is offered:	**Level 9 / Year 3**
4. Pre-requisites for this course (if any):	**STA 1202, MAT 1223**
5. Co-requisites for this course (if any):	**None**

6. Mode of Instruction (mark all that apply)

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

7. Contact Hours (based on academic semester)

No	*Activity*	*Contact Hours*
1	**Lecture**	**36**
2	**Laboratory/Studio**	**00**
3	**Tutorial**	**24**
4	**Others** (specify)	**0**
	Total	**60**

B. Course Objectives and Learning Outcomes

1. Course Description

Markov chains are used to model many phenomena which arise in some statistical problems. The course covers an introduction to probability theory, conditional probability, and conditional expectation. Moreover, discrete time Markov chains are introduced, as well as branching processes, time reversible Markov chains, and hidden Markov chains. Then exponential distributions and the Poisson processes are defined. Finally, Continuous time Markov chains are introduced as well as their transition probability function.

2. Course Main Objective **The course introduces students to the basic theory of probability, enable students to assimilate properties of stochastic processes. learn how to build Markov chain in discrete and continuous time and learn how to use Markov chain in modelling.**

3. Course Learning Outcomes

	CLOs	*Aligned-PLOs*
1	**Knowledge and Understanding**	
1.1	**To describe the basics of stochastic modeling of real-world systems related to the physical sciences, computer science, and (possibly) finance.**	**K1, K2**
1.2	**To define exponential distribution to model arrival times, the Poisson process, and outline its application to continuous time Markov chains**	**K1, K2**
1.3	**To state the concept of conditional probability, Markov chain, Branching process, Poisson process, and Birth and Death process.**	**K1, K2**
2	**Skills:**	
2.1	**To use probability and matrix theory to solve stochastic models.**	**S1, S2**
2.2	**To evaluate stochastic process problems mathematically and using software.**	**S1, S2, S5**
2.3	**To assess how sensitive stochastic models are to changes that might occur in model variables.**	**S2, S3, S4**
2.4	**To interpret and explain the solution for a stochastic process application.**	**S3, S4**
3	**Values:**	
3.1	**To work individually.**	**V1, V2**
3.2	**To show findings and discuss the results with others.**	**V1, V3**

C. Course Content

No	*List of Topics*	*Contact Hours*
1	**Basic probability:** Random variable, Limit Theorems, Stochastic Processes.	**7**
2	**Conditional Probability and Conditional Expectation:** Introduction, The Discrete Case, The Continuous Case, Computing Expectations by Conditioning, Computing Probabilities by Conditioning, Some Applications, An Identity for Compound Random Variables.	**12**

No	List of Topics	Contact Hours
3	**Markov Chains:** Introduction, Chapman–Kolmogorov Equations, Classification of States, Limiting Probabilities, Some Applications, Mean Time Spent in Transient States, Branching Processes, Time Reversible Markov Chains, Markov Chain Monte Carlo Methods, Markov Decision Processes, Hidden Markov Chains.	**13**
4	**The Exponential Distribution and the Poisson Process:** Introduction, The Exponential Distribution, The Poisson Process, Generalizations of the Poisson Process.	**10**
5	**Continuous-Time Markov Chains:** Introduction, Continuous-Time Markov Chains, Birth and Death Processes, The Transition Probability Function $P_{ij}(t)$, Limiting Probabilities.	**9**
6	**Renewal Theory and Its Applications:** Introduction. Distribution of $N(t)$. Limit Theorems and Their Applications. Renewal Reward Processes. Regenerative Processes. Semi-Markov Processes. The Inspection Paradox. Computing the Renewal Function. Applications to Patterns. The Insurance Ruin Problem.	**9**
Total		**60**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**To describe the basics of stochastic modeling of real-world systems related to the physical sciences, computer science, and (possibly) finance.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Assignments, Practical exam**
1.2	**To define exponential distribution to model arrival times, the Poisson process, and outline its application to continuous time Markov chains**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Lab Assignments, Practical exam**
1.3	**To state the concept of conditional probability, Markov chain, Branching process, Poisson process, and Birth and Death process.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Assignments, Practical exam**
2.0	**Skills**		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.1	To use probability and matrix theory to solve stochastic models.	Lecturing, Interactive learning.	Assignments, Practical exam
2.2	To evaluate stochastic process problems mathematically and using software.	Use of statistical software, Lecturing, Interactive learning.	Lab Exam, Assignments, Practical exam
2.3	To assess how sensitive stochastic models are to changes that might occur in model variables.	Lecturing, Interactive learning.	Assignments, Practical exam
2.4	To interpret and explain the solution for a stochastic process application.	Lecturing, Interactive learning, Use of statistical software.	Assignments, Practical exam, Lab Assignments.
3.0	**Values**		
3.1	To work individually.	Interactive learning, Group interaction, Problem solving.	Practical exam, Assignments
3.2	To show findings and discuss the results with others.	Group interaction, Problem solving.	Assignments and Mini-projects

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homeworks, Quizzes, Mini-projects	During the term	20%
2	First Midterm	Week 4-5	20%
3	Second Midterm	Week 7-8	20%
4	Final Exam	Week 13	40%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

- There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.
- All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	• ***Introduction to Probability Models,*** S. Ross, 11th Edition, Academic Press, 2014. ISBN: 9780123756862 (Main Reference). • ***Introduction to Stochastic Processes With R,*** Robert P. Dobrow, John Wiley & Sons, Inc, 2016. (Main Reference)
Essential References Materials	**1.** ***An Introduction to Stochastic Modeling,*** M. A. Pinsky and S. Karlin, 4th Edition, Academic Press Elsevier, 2011. **2.** ***Introduction to Probability,*** D. Bertsekas and J. Tsitsiklis, 2nd Edition; Athena Scientific, 2008. **3.** ***Fundamentals of Probability with Stochastic Processes,*** 3rd Edition; Saeed Ghahramani, Prentice Hall, 2004.
Electronic Materials	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	*Resources*
Accommodation *(Classrooms, laboratories, demonstration rooms/labs, etc.)*	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources *(AV, data show, Smart Board, software, etc.)*	**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**
Other Resources *(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)*	**See the Attached File**

G. Course Quality Evaluation

Evaluation Areas/Issues	*Evaluators*	*Evaluation Methods*
Effectiveness of teaching and assessment, Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
Extent of achievement of course learning outcomes, Quality of learning resources	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**

Evaluation areas *(e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)*

Evaluators *(Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)*

Assessment Methods *(Direct, Indirect)*

H. Specification Approval Data

Council / Committee	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
Reference No.	**11/1444**
Date	**22/04/1444 (16/11/2022)**

Course Specifications

Course Title:	Categorical Data Analysis
Course Code:	STA 1363
Program:	Bachelor of Science in Applied Statistics
Department:	Mathematics and Statistics
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University

Table of Contents

A. Course Identification

1. Credit hours:	**4 (3 Lectures, 1 Lab, 1 Tutorial)**
2. Course type **a.** University ☐ College ☐ Department ✓ Others ☐ **b.** Required ✓ Elective ☐	
3. Level/year at which this course is offered:	**Level 9 / Year 3**
4. Pre-requisites for this course (if any):	**STA 1331**
5. Co-requisites for this course (if any):	**None**

6. Mode of Instruction (mark all that apply)

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

7. Contact Hours (based on academic semester)

No	*Activity*	*Contact Hours*
1	**Lecture**	**36**
2	**Laboratory/Studio**	**12**
3	**Tutorial**	**12**
4	**Others** (specify)	**0**
	Total	**60**

B. Course Objectives and Learning Outcomes

1. Course Description

This course surveys theory and methods for the analysis of categorical response and count data. The course begins with an overview of likelihood-based inference for categorical data analysis. Methods for describing and analyzing contingency tables are surveyed. These include loglinear modeling of association structures, the Cochran-Mantel-Haenszel approach to detecting conditional association, and

multinomial-Poisson homogeneous modeling. Dichotomous response models such as the logistic regression model will be described and applied in several settings including cohort and case-control studies. Poisson regression models will be used to analyze rate data from event history studies. Ordinal and polytomous response models such as the cumulative and multinomial logit models will also be introduced. Time permitting, these regression models will be adapted and extended to accommodate longitudinal data

2. Course Main Objective

The aim of this course is to demonstrate students both theoretical rationale and important applications of categorical data analysis methods; provide students with skills to either conduct their own research using categorical data analysis or to be able to replicate existing research using these methods.

3. Course Learning Outcomes

	CLOs After successful completion of the course, students will able:	*Aligned PLOs*
1	**Knowledge and Understanding:**	
1.1	To describe the basic theoretical models for categorical data.	K1, K2
1.2	To outline the differences between linear models and logistic and loglinear models.	K1, K2
2	**Skills:**	
2.1	To explain the designs of contingency tables and the appropriate measures of association and statistical tests.	S1, S2
2.2	To use the appropriate statistical package for analyzing real data sets.	S4, S5
2.3	To analyze dependent categorical data models using both classical approaches and mixed effects models.	S3
2.4	To develop models for binary, polytomous and multivariate categorical responses, interpret results regardless of model parameterization, and diagnose model fits.	S2, S3, S4
2.5	To interpret the results in practical examples.	S3, S4, S5
3	**Values:**	
3.1	To interpret model results properly and draw conclusions in case studies.	V1, V2
3.2	To justify the output in a collective team environment.	V1, V3

C. Course Content

No	*List of Topics*	*Contact Hours*
1	**Distributions and Inference for Categorical Data:** Categorical response data, Distributions for categorical data, Statistical inference for categorical data, Statistical inference for binomial parameters, Statistical inference for	12

No	List of Topics	Contact Hours
	multinomial parameters.	
2	**Describing Contingency Tables:** Probability Structure for Contingency Tables, Comparing Two Proportions, Partial Association in Stratified 2 x 2 tables, Extensions for I x J Tables.	**12**
3	**Inference for Contingency Tables:** Confidence Intervals for Association Parameters, Testing Independence in Two- Way Contingency Tables, Following-Up Chi-Squared Tests, Two-Way Tables with Ordered Classifications, Small- Sample Tests of Independence, Small-Sample Confidence Intervals for 2 x 2 Tables.	**12**
4	**Generalized Linear Models:** Generalized Linear Model, Generalized Linear Models for Binary Data, Generalized Linear Models for Counts, Moments and Likelihood for Generalized Linear Models, Inference for Generalized Linear Models, Fitting Generalized Linear Models.	**12**
5	**Logistic Regression:** Interpreting Parameters in Logistic Regression, Inference for Logistic Regression, Logit Models with Categorical Predictors, Multiple Logistic Regression, Fitting Logistic Regression Models.	**12**
	Total	**60**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**To describe the basic theoretical models for categorical data.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Lab Assignments, Practical exam**
1.3	**To outline the differences between linear models and logistic and loglinear models.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Lab Assignments, Practical exam**
2.0	**Skills**		
2.1	**To explain the designs of contingency tables and the appropriate measures of association and statistical tests.**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**
2.2	**To use the appropriate statistical package for analyzing real data sets.**	**Use of statistical software, Lecturing, Interactive learning.**	**Lab Exam, Assignments, Practical exam**

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.3	To analyze dependent categorical data models using both classical approaches and mixed effects models.	Lecturing, Interactive learning.	Assignments, Practical exam
2.4	To develop models for binary, polytomous and multivariate categorical responses, interpret results regardless of model parameterization, and diagnose model fits.	Lecturing, Interactive learning.	Assignments, Practical exam
2.5	To interpret the results in practical examples.	Use of statistical software, Lecturing, Interactive learning.	Lab Exam, Assignments, Practical exam
3.0	**Values**		
3.1	To interpret model results properly and draw conclusions in case studies.	Interactive learning, Group interaction, Problem solving.	Lab Exam, Practical exam, Assignments
3.2	To justify the output in a collective team environment.	Group interaction, Problem solving.	Assignments and Mini-projects

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homeworks, Quizzes, Mini-projects	During the semester	20%
2	First Midterm	Week 4-5	20%
3	Second Midterm (Lab Exam)	Week 7-8	20%
4	Final Exam	Week 13	40%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.
- All students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	***An Introduction to Categorical Data Analysis***, 2nd Edition, Alan Agresti, Wiley-Interscience, 2007. **ISBN-13: 9780471226185.**
Essential References Materials	1. ***Statistical Analysis of Categorical Data***, Chris J. Lloyd, Wiley-Interscience, 1999. ISBN-13: 780471290087. 2. ***The Statistical Analysis of Discrete Data***, Thomas J. Santner, Diane E. Duff, Springer-Verlag, 1990. 3. ***Generalized Linear Models***, P. Mc Cullagh, J. Nelder, Chapman & Hall, 1989.
Electronic Materials	**http://www.statsoft.com/textbook/stathome.html** **- http://mathworld.wolfram.com/**
Other Learning Materials	**None**

2. Facilities Required

Item	*Resources*
Accommodation *(Classrooms, laboratories, demonstration rooms/labs, etc.)*	▪ **Each of the class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources *(AV, data show, Smart Board, software, etc.)*	**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**
Other Resources *(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)*	**See the Attached File**

G. Course Quality Evaluation

Evaluation Areas/Issues	*Evaluators*	*Evaluation Methods*
Effectiveness of teaching and assessment, Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**

Evaluation Areas/Issues	*Evaluators*	*Evaluation Methods*
Extent of achievement of course learning outcomes, Quality of learning resources	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**

Evaluation areas *(e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)*
Evaluators *(Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)*
Assessment Methods *(Direct, Indirect)*

H. Specification Approval Data

Council / Committee	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
Reference No.	**11/1444**
Date	**22/04/1444 (16/11/2022)**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA
T4
2020

Course Specifications

Course Title:	Introduction to Econometrics
Course Code:	STA 1423
Program:	Bachelor of Science in Applied Statistics
Department:	Mathematics and Statistics
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University

Table of Contents

A. Course Identification

1. Credit hours:	**4 (3 Lectures, 1 Lab, 1 Tutorial)**

2. Course type

a. University ☐ College ☐ Department ✓ Others ☐

b. Required ☐ Elective ✓

3. Level/year at which this course is offered:	**Level 10 or Level 11 / Year 4**
4. Pre-requisites for this course (if any):	**STA 1322**
5. Co-requisites for this course (if any):	**None**

6. Mode of Instruction (mark all that apply)

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

7. Contact Hours (based on academic semester)

No	*Activity*	*Contact Hours*
1	**Lecture**	**36**
2	**Laboratory/Studio**	**12**
3	**Tutorial**	**12**
4	**Others** (specify)	**0**
	Total	**60**

B. Course Objectives and Learning Outcomes

1. Course Description

This course covers the statistical tools needed to understand empirical economic research and to plan and execute independent research projects. Topics include statistical inference, regression, generalized least squares, instrumental variables, simultaneous equations models, and evaluation of government policies and programs.

2. Course Main Objective
▪ **Give students theoretical and practical background on the use of statistical models in the econometrics.** ▪ **Student knows how to build or construct the economic model and economic relations.** ▪ **Discuss the concept of dummy variables and general form of multi-regression model.** ▪ **Econometrics problems and how to remedy it.**

3. Course Learning Outcomes

	CLOs	*Aligned-PLOs*
1	**Knowledge and Understanding**	
1.1	**To state simple and multiple linear regression models.**	**K1, K2**
1.2	**To outline the nature and the results of heteroscedasticity**	**K1, K2**
1.3	**To define basic concepts in time series econometrics.**	**K1, K2**
2	**Skills:**	
2.1	**To compute elasticities empirically and make an interval estimation.**	**S1, S2**
2.2	**To apply the methods for adding more flexibility to the regression model.**	**S1, S2**
2.3	**To generate forecasts by using regression results and propose other analyzing methods when the regression analysis is not enough.**	**S3, S4**
2.4	**To explain the nature of dynamic econometric models.**	**S2, S4**
2.5	**To evaluate the output created by the software.**	**S4, S5**
3	**Values:**	
3.1	**To apply ethical concepts and rules to determine viable alternatives in any given situation.**	**V1, V2**
3.2	**To operate meaningfully and productively with others.**	**V1, V3**

C. Course Content

No	*List of Topics*	*Contact Hours*
1	**Introduction:** Review of multiple regression models. Interpretation of Ordinary least squares (OLS). Obtaining OLS estimates. The mean and variance of OLS.	**4**

No	List of Topics	Contact Hours
2	**Nonlinear models:** Linearity and nonlinearity. Logarithmic transformations. Models with quadratic and interactive models. Nonlinear regression.	**5**
3	**Dummy variables:** Illustration, Extension to more than two categories and to multiple set. Slope dummy variables. Chow test.	**5**
4	**Specification of regression variables:** Model specification. Effect of omitting a variable. Effect of including a variable. Proxy variables. Testing a linear restriction, Getting the most out of the residuals.	**5**
5	**Heteroscedasticity:** Heteroscedasticity and implications. Detection. Remedies.	**6**
6	**Stochastic Regressors and Measurement Errors:** Assumptions for models. Finite sample properties. Asymptotic properties. Measurement errors. Instrumental variables.	**9**
7	**Simultaneous Equations Estimation:** Models. Bias. Instrumental variables estimation.	**8**
8	**Models Using Time Series Data:** Assumptions. Static models. Models with lagged explanatory variables. Models with a lagged dependent variable. Properties of estimators. Simultaneous equations models.	**9**
9	**Autocorrelation:** Definition and consequences. Detection of autocorrelation. Fitting a model subject. Model specification.	**9**
Total		**60**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**To state simple and multiple linear regression models.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Lab Assignments, Practical exam**
1.2	**To outline the nature and the results of heteroscedasticity**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Assignments, Practical exam**
1.3	**To define basic concepts in time series econometrics.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Lab Assignments, Practical exam**
2.0	**Skills**		
2.1	**To compute elasticities empirically and make an interval estimation.**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.2	To apply the methods for adding more flexibility to the regression model.	Lecturing, Interactive learning.	Assignments, Practical exam
2.3	To generate forecasts by using regression results and propose other analyzing methods when the regression analysis is not enough.	Lecturing, Interactive learning.	Assignments, Practical exam
2.4	To explain the nature of dynamic econometric models.	Lecturing, Interactive learning.	Assignments, Practical exam
2.5	To evaluate the output created by the software.	Use of statistical software, Lecturing, Interactive learning.	Lab Exam, Assignments, Practical exam
3.0	**Values**		
3.1	To apply ethical concepts and rules to determine viable alternatives in any given situation.	Interactive learning, Group interaction, Problem solving.	Lab Exam, Practical exam, Assignments
3.2	To operate meaningfully and productively with others.	Group interaction, Problem solving.	Assignments and Mini-projects

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homeworks, Quizzes, Mini-projects	During the term	20%
2	First Midterm	Week 4-5	20%
3	Second Midterm (Lab Exam)	Week 7-8	20%
4	Final Exam	Week 13	40%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

- There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.
- All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	***Introduction to Econometrics*;** 5th Edition, Christopher Dougherty, Oxford Press, 2016. ISBN: 9780199676828 (Main Reference)
Essential References Materials	1- ***Introduction to Econometrics***, 3rd Edition, James H. Stock, Mark W. Watson, Addison-Wesley Series in Economics, 2010. 2- ***Introductory Econometrics: A Modern Approach***, Jeffrey M. Wooldridge, Pearson, 2008 3- ***Econometric Methods,*** 4th Edition, J. Johnston and John DiNardo, McGraw-Hill, 1997. 4- ***Econometric,*** R. J. Wonnacott and T. H. Wonnacott, 2nd Edition, John Wiley, Wiley Series in Probability and Statistics - Applied Probability and Statistics Section, 1979.
Electronic Materials	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	*Resources*
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**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**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	**See the Attached File**

G. Course Quality Evaluation

Evaluation Areas/Issues	*Evaluators*	*Evaluation Methods*
Effectiveness of teaching and assessment, Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
Extent of achievement of course learning outcomes, Quality of learning resources	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
Reference No.	**11/1444**
Date	**22/04/1444 (16/11/2022)**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

Course Specifications

Course Title:	Analysis of Variance
Course Code:	STA 1425
Program:	Bachelor of Science in Applied Statistics
Department:	Mathematics and Statistics
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University

Table of Contents

A. Course Identification

1. Credit hours:	**5 (4 Lectures, 1 Lab, 1 Tutorial)**
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐	
3. Level/year at which this course is offered:	**Level 10 / Year 4**
4. Pre-requisites for this course (if any)**:**	**STA 1321**
5. Co-requisites for this course (if any)**:**	**None**

6. Mode of Instruction (mark all that apply)

No	*Mode of Instruction*	*Contact Hours*	*Percentage*
1	**Traditional classroom**	**72**	**100%**
2	**Blended**		
3	**E-learning**		
4	**Distance learning**		
5	**Other**		

7. Contact Hours (based on academic semester)

No	*Activity*	*Contact Hours*
1	**Lecture**	**48**
2	**Laboratory/Studio**	**12**
3	**Tutorial**	**12**
4	**Others** (specify)	**0**
	Total	**72**

B. Course Objectives and Learning Outcomes

1. Course Description

The course covers the concepts of experimental design, single factor experiment, analysis of variance rationale, randomized complete block design, ANOVA rationale, factorial experiment, fixed model, random model, mixed model, EMS rules, the pseudo-F-test, and repeatability and reproducibility for a Measurement System.

2. Course Main Objective

This course will introduce students:

- To know how the statistical procedures in this course (ANOVA, Correlation, and Multiple Regression) are related to other statistical procedures (Chi square, Discriminant Analysis, t-test and Canonical Analysis).
- To know the type of data required to do the statistical procedures of this course (correlation, multiple regression, ANOVA).

3. Course Learning Outcomes

	CLOs	*Aligned-PLOs*
1	**Knowledge and Understanding**	
1.1	To define the problem and plan experiment.	K1, K2
1.2	To list the main assumptions of ANOVA, and how to identify violations of the assumptions of ANOVA.	K1, K2
1.3	To outline the components of a two-way ANOVA table and the meaning of sums of squares for rows, columns, and interaction in terms of cell, marginal, and expected means.	K1, K2
2	**Skills:**	
2.1	To analyze and interpret experiments involving multi-group and factorial designs	S1, S2
2.2	To explain analysis of variance (ANOVA) models including conditions and assumptions.	S2, S3
2.3	To justify an appropriate ANOVA model for a given experimental design.	S3, S4
2.4	To use the statistical software to carry out the ANOVA analysis.	S3, S5
3	**Values:**	
3.1	To employ ethical concepts and rules to determine viable alternatives in any given situation.	V1, V2
3.2	To show findings and discuss the results with others.	V1, V3

C. Course Content

No	*List of Topics*	*Contact Hours*
1	**The Experiment, the Design, and the Analysis:** Introduction to Experimental Design. The Experiment. The Design. The Analysis. Examples.	**12**

No	*List of Topics*	*Contact Hours*
2	**Single-Factor Experiments with No Restrictions on Randomization:** Introduction. Analysis of Variance Rationale. After ANOVA--What? Tests on Means. Confidence Limits on Means. Components of Variance. Checking the Model.	**16**
3	**Single-Factor Experiments:** Randomized Block and Latin Square Designs: Introduction. Randomized Complete Block Design. ANOVA Rationale. Missing Values. Latin Squares. Interpretations. Assessing the Model. Graeco-Latin Squares. Extensions.	**16**
4	**Factorial Experiments: Introduction. Factorial Experiments:** An Example. Interpretations. The Model and Its Assessment. ANOVA Rationale. One Observation Per Treatment.	**14**
5	**Fixed, Random, and Mixed Models:** Introduction. Single-Factor Models. Two-Factor Models. EMS Rules. EMS Derivations. The Pseudo-F Test. Expected Mean Squares Via Statistical Computing Packages. Repeatability and Reproducibility for a Measurement System.	**14**
Total		**72**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	*Course Learning Outcomes*	*Teaching Strategies*	*Assessment Methods*
1.0	**Knowledge and Understanding:**		
1.1	**To define the problem and plan experiment.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Assignments, Practical exam**
1.2	**To list the main assumptions of ANOVA, and how to identify violations of the assumptions of ANOVA.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Assignments, Practical exam**
1.3	**To outline the components of a two-way ANOVA table and the meaning of sums of squares for rows, columns, and interaction in terms of cell, marginal, and expected means.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Lab Assignments, Practical exam**
2.0	**Skills**		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.1	To analyze and interpret experiments involving multi-group and factorial designs	Lecturing, Interactive learning.	Assignments, Practical exam
2.2	To explain analysis of variance (ANOVA) models including conditions and assumptions.	Lecturing, Interactive learning.	Assignments, Practical exam
2.3	To justify an appropriate ANOVA model for a given experimental design	Lecturing, Interactive learning.	Assignments, Practical exam
2.4	To use the statistical software to carry out the ANOVA analysis.	Use of statistical software, Lecturing, Interactive learning.	Lab Exam, Assignments, Practical exam
3.0	**Values**		
3.1	To employ ethical concepts and rules to determine viable alternatives in any given situation.	Interactive learning, Group interaction, Problem solving.	Lab Exam, Practical exam, Assignments
3.2	To show findings and discuss the results with others.	Group interaction, Problem solving.	Assignments and Mini-projects

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homeworks, Quizzes, Mini-projects	During the term	20%
2	First Midterm	Week 4-5	20%
3	Second Midterm (Lab Exam)	Week 7-8	20%
4	Final Exam	Week 13	40%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.
- All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	***Fundamental Concepts in the Design of Experiments***, 5th Edition, Charles R. Hicks, Kenneth V. Turner, Oxford University Press, 1999. ISBN-13: 9780195122732. ***A Student's Guide to Analysis of Variance***; Maxwell Roberts, Riccardo Russo, Routledge, Taylor & Francis Group, 1999. ISBN-13: 9780415165655.
Essential References Materials	**1-** ***Design and Analysis of Experiments***; 7th Edition, Douglas C. Montgomery, John Wiley & Sons Inc, 2005. ISBN-13: 9780470169902. **2-** ***Applied Linear Statistical Models***; 5th Edition, Chris J. Nachtsheim, Kutner, Chris Nachtsheim, John Neter, Mike Kutner, William Li, McGraw-Hill College, 2005. ISBN-13: 9780073108742. **3-** ***A First Course in Design and Analysis of Experiments***; 1st Edition, Gary W. Oehlert, W H Freeman & Co, 2000. ISBN-13: 9780716735106.
Electronic Materials	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	*Resources*
Accommodation *(Classrooms, laboratories, demonstration rooms/labs, etc.)*	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources *(AV, data show, Smart Board, software, etc.)*	**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**

Item	Resources
Other Resources *(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)*	**See the Attached File**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment, Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
Extent of achievement of course learning outcomes, Quality of learning resources	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**

Evaluation areas *(e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)*

Evaluators *(Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)*

Assessment Methods *(Direct, Indirect)*

H. Specification Approval Data

Council / Committee	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
Reference No.	**11/1444**
Date	**22/04/1444 (16/11/2022)**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
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2020

Course Specifications

Course Title:	**Experimental Design**
Course Code:	**STA 1426**
Program:	**Bachelor of Science in Applied Statistics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours:	**4 (3 Lectures, 1 Lab, 1 Tutorial)**
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐	
3. Level/year at which this course is offered:	**Level 11 / Year 4**
4. Pre-requisites for this course (if any)**:**	**STA 1425**
5. Co-requisites for this course (if any)**:**	**None**

6. Mode of Instruction (mark all that apply)

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

7. Contact Hours (based on academic semester)

No	*Activity*	*Contact Hours*
1	**Lecture**	**36**
2	**Laboratory/Studio**	**12**
3	**Tutorial**	**12**
4	**Others** (specify)	**0**
	Total	**60**

B. Course Objectives and Learning Outcomes

1. Course Description

A study of the design and analysis of experiments. A model-based approach examines both theoretical and practical issues associated with experimentation. Topics include randomized block designs, Latin-square designs, linear mixed models, split-plot designs, response surface methodology, mixture models and fractional 2^k experiments are studied. Applications of experimental planning and analysis of variance play a prominent part. The course content is valuable when planning and carrying through experiments.

2. Course Main Objective
To introduce the basic principles and methods of statistical design of experiments. The significances of effects of various factors on a given response are determined under uncertainty using statistical principles.

3. Course Learning Outcomes

	CLOs	*Aligned-PLOs*
1	**Knowledge and Understanding**	
1.1	**To describe some of the factors affecting reproducibility and external validity.**	**K1, K2**
1.2	**To list the different types of formal experimental designs.**	**K1, K2**
2	**Skills:**	
2.1	**To develop techniques of problem solving.**	**S1, S2**
2.2	**To differentiate the type of experiment.**	**S2, S3**
2.3	**To design and analyze factorial experiments for investigating multiple factors.**	**S3, S4**
2.4	**To choose statistical analysis of experimental solutions.**	**S3, S5**
3	**Values:**	
3.1	**To interpret model results properly and draw conclusions in case studies.**	**V1, V2**
3.2	**To show findings and discuss the results with others.**	**V1, V3**

C. Course Content

No	*List of Topics*	*Contact Hours*
1	**Introduction:** Strategy of Experimentation. Some typical Applications of experimental Design. Basic principle. Guidelines for design experiments.	**5**
2	**Simple Comparative Experiments:** Basic Statistical concept; Sampling and Sampling Distribution; Inference about the Difference in Means; Randomized Design; Paired Comparison Designs.	**11**
3	**Randomized Blocks, Latin Square, and Related Designs:** Complete Block Design; The Latin Block Design; The Greco Latin Design.	**11**
4	**Introduction to Factorial Designs:** Basic Definitions and Principles; The Advantage of Factorials; The Two-Factor Factorial Design; The General Factorial Design; Fitting Response Curves and Surfaces.	**11**
5	**The 2^k Factorial Design:** The 2^2 Design. The 2^3 Design.	**11**

No	List of Topics	Contact Hours
6	**Design with Random factors:** The Random effect Model; The Two Factor Factorial with Random Effect; The Two Factor Mixed Model.	**11**
Total		**60**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**To describe some of the factors affecting reproducibility and external validity.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Lab Assignments, Practical exam**
1.2	**To list the different types of formal experimental designs.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Lab Assignments, Practical exam**
2.0	**Skills**		
2.1	**To develop techniques of problem solving.**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**
2.2	**To differentiate the type of experiment.**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**
2.3	**To design and analyze factorial experiments for investigating multiple factors.**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**
2.4	**To choose statistical analysis of experimental solutions.**	**Use of statistical software, Lecturing, Interactive learning.**	**Lab Exam, Assignments, Practical exam**
3.0	**Values**		
3.1	**To interpret model results properly and draw conclusions in case studies.**	**Interactive learning, Group interaction, Problem solving.**	**Lab Exam, Practical exam, Assignments**
3.2	**To show findings and discuss the results with others.**	**Group interaction, Problem solving.**	**Assignments and Mini-projects**

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Homeworks, Quizzes, Mini projects**	**During the term**	**20%**

#	*Assessment task**	*Week Due*	*Percentage of Total Assessment Score*
2	**First Midterm**	**Week 4-5**	**20%**
3	**Second Midterm (Lab Exam)**	**Week 7-8**	**20%**
4	**Final Exam**	**Week 13**	**40%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- **There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.**
- **All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.**

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	***Design and Analysis of Experiments***, 8th Edition, D.C. Montgomery, John Wiley & Sons, 2013. ISBN 978-1-118-14692-7.
Essential References Materials	**1-** ***Experiments with Mixtures***, 2nd Edition, J.A. Cornell, John Wiley & Sons, 1990. **2- Experiments: Planning, Analysis, and Optimization,** 2nd Edition, C. F. Jeff Wu, Michael S. Hamada, John Wiley & Sons, 2009. **3- Statistical Analysis of Designed Experiments, 3rd Edition, Springer-Verlag, 2009.**
Electronic Materials	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	*Resources*
Accommodation *(Classrooms, laboratories, demonstration rooms/labs, etc.)*	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**

Item	*Resources*
Technology Resources *(AV, data show, Smart Board, software, etc.)*	**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**
Other Resources *(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)*	**See the Attached File**

G. Course Quality Evaluation

Evaluation Areas/Issues	*Evaluators*	*Evaluation Methods*
Effectiveness of teaching and assessment, Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
Extent of achievement of course learning outcomes, Quality of learning resources	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
Reference No.	**11/1444**
Date	**22/04/1444 (16/11/2022)**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	Multivariate Analysis
Course Code:	STA 1428
Program:	Bachelor of Science in Applied Statistics
Department:	Mathematics and Statistics
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University

Table of Contents

A. Course Identification

1. Credit hours:	**5 (4 Lectures, 1 Lab, 1 Tutorial)**
2. Course type **a.** University ☐ College ☐ Department ✓ Others ☐ **b.** Required ✓ Elective ☐	
3. Level/year at which this course is offered:	**Level 11 / Year 4**
4. Pre-requisites for this course (if any)**:**	**STA 1425**
5. Co-requisites for this course (if any)**:**	**None**

6. Mode of Instruction (mark all that apply)

No	*Mode of Instruction*	*Contact Hours*	*Percentage*
1	**Traditional classroom**	**72**	**100%**
2	**Blended**		
3	**E-learning**		
4	**Distance learning**		
5	**Other**		

7. Contact Hours (based on academic semester)

No	*Activity*	*Contact Hours*
1	**Lecture**	**48**
2	**Laboratory/Studio**	**12**
3	**Tutorial**	**12**
4	**Others** (specify)	**0**
	Total	**72**

B. Course Objectives and Learning Outcomes

1. Course Description

In multivariate statistics, we analyze several variables simultaneously, without saying beforehand that one of them is of more interest than the other ones. This course introduces the basic concepts of multivariate statistics and provides an overview of the available methods. All methods will be illustrated with real data sets, using the open-source statistical software.

2. Course Main Objective
The objective of this course is to teach topics of multivariate statistics that are covers theoretical, computational, and interpretive issues of multivariate techniques using computer solution. The emphasis of the course will be on applications and use of several statistical software packages for analyzing data. Though matrix algebra is not a prerequisite, familiarity with matrix algebra and being comfortable with matrices will be a definite advantage.

3. Course Learning Outcomes

	CLOs	*Aligned PLOs*
1	**Knowledge and Understanding**	
1.1	**To outline the basic multivariate approaches.**	**K1, K2**
1.2	**To label the characteristic features of multivariate data.**	**K1, K2**
2	**Skills:**	
2.1	**To develop techniques of problem solving.**	**S1, S2**
2.2	**To use multivariate techniques appropriately, undertake multivariate hypothesis tests, and draw appropriate conclusions.**	**S1, S2, S4**
2.3	**To use statistical software to perform multivariate analyses on the collected data.**	**S3, S5**
2.4	**To use multivariate analysis to solve a real-world problem.**	**S3, S4, S5**
3	**Values:**	
3.1	**To interpret model results properly and draw conclusions in case studies.**	**V1, V2**
3.2	**To operate meaningfully and productively with others.**	**V1, V3**

C. Course Content

No	*List of Topics*	*Contact Hours*
1	**Aspects of Multivariate Analysis:** Introduction, Application of Multivariate Techniques. The organization of Data, Data Displayed and Pictorial Representations, Distance, Final Comment.	**6**
2	**Matrix Algebra and Random Vectors:** Introduction, Some Basic of Matrix and Vector Algebra, Positive Definite Matrices, A Square-Root Matrix, Random Vectors and Matrices, Mean Vectors and Covariance Matrices, Matrix inequalities and Maximization.	**9**

No	List of Topics	Contact Hours
3	**Sample Geometry and Random Sampling:** Introduction, The Geometry of the Sample, Random Samples and Expected Values of the Sample mean and Covariance Matrix, Generalized Variance, Sample Mean, Covariance, and Correlation as Matrix Operations, Sample Values of Linear Combinations Variables.	**14**
4	**The Multivariate Normal Distribution:** Introduction, The Multivariate Normal Distribution Density Function and Its Properties, Sampling from a Multivariate Normal Distribution and Maximum Likelihood Estimation, The Sampling distribution $\bar{X}$ and S, Large Sample Behavior of $\bar{X}$ and S, Assessing the Assumption of Normality, Detecting Outliers and Cleaning data. Transformations to Near Normality.	**15**
5	**Inferences About a mean Vector:** Introduction, The Plausibility of μ_0 as a Vector for a Normal Population Mean, Hotelling's T^2 and the Likelihood Ratio test, Confidence Regions and Simulations Comparisons of Component Means, Large Sample Inferences about a Population Mean Vector, Multivariate Quality Control Chart, Inferences about Mean Vectors, Difficulties Due to Time Dependence in Multivariate Observations.	**14**
6	**Comparisons of Several Multivariate Means:** Introduction, Paired Comparisons and a Repeated Measures Design, Comparing Mean Vectors from Two Populations, comparing Several Multivariate Population Means, Simultaneous Confidence intervals for Treatment Effects, Testing for Equality of Covariance Matrices, Profile Analysis, Repeated Measures Designs and Growth Curve, Perspective and a Strategy for Analyzing Multivariate Model.	**14**
	Total	**72**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**To outline the basic multivariate approaches.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Assignments, Practical exam**
1.2	**To label the characteristic features of multivariate data.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Lab Assignments, Practical exam**
2.0	**Skills**		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.1	**To develop techniques of problem solving.**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**
2.2	**To use multivariate techniques appropriately, undertake multivariate hypothesis tests, and draw appropriate conclusions.**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**
2.3	**To use statistical software to perform multivariate analyses on the collected data.**	**Use of statistical software, Lecturing, Interactive learning.**	**Lab Exam, Lab Assignments, Practical exam**
2.4	**To use multivariate analysis to solve a real-world problem.**	**Use of statistical software, Lecturing, Interactive learning.**	**Lab Exam, Lab Assignments, Practical exam**
3.0	**Values**		
3.1	**To interpret model results properly and draw conclusions in case studies.**	**Interactive learning, Group interaction, Problem solving.**	**Lab Exam, Practical exam, Assignments**
3.2	**To operate meaningfully and productively with others.**	**Group interaction, Problem solving.**	**Assignments and Mini-projects**

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Homeworks, Quizzes, Mini-projects**	**During the term**	**20%**
2	**First Midterm**	**Week 4-5**	**20%**
3	**Second Midterm (Lab Exam)**	**Week 7-8**	**20%**
4	**Final Exam**	**Week 13**	**40%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

- **There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.**
- **All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.**

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	***Applied Multivariate Statistical Analysis***; 6th edition, Richard, A. Johnson and Dean, W. Wichern; Pearson Prentice Hall., 2007.
Essential References Materials	**1.** ***Multivariate Statistical Methods: A Primer***; 3rd edition, B.F.J. Manly, Chapman & Hall/CRC, 2005. **2.** ***Methods of Multivariate Analysis***; 2nd Edition, Alvin C. Rencher, J. Wiley, 2003. **3.** ***Applied Regression Analysis and Multivariable Methods***; 5th Edition, D. G. Kleinbaum, L. L. Kupper, A. Nizam, and E. S. Rosenberg, Cengage Learning, (5th Edition), 2013.
Electronic Materials	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	*Resources*
Accommodation *(Classrooms, laboratories, demonstration rooms/labs, etc.)*	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources *(AV, data show, Smart Board, software, etc.)*	**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**
Other Resources *(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)*	**See the Attached File**

G. Course Quality Evaluation

Evaluation Areas/Issues	*Evaluators*	*Evaluation Methods*
Effectiveness of teaching and assessment, Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**

Evaluation Areas/Issues	*Evaluators*	*Evaluation Methods*
Extent of achievement of course learning outcomes, Quality of learning resources	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
Reference No.	**11/1444**
Date	**22/04/1444 (16/11/2022)**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

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Course Specifications

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

Table of Contents

A. Course Identification

1. Credit hours:	**4 (3 Lectures, 1 Lab, 1 Tutorial)**
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☐ Elective ☑	
3. Level/year at which this course is offered:	**Level 10/ Year 4**
4. Pre-requisites for this course (if any):	**STA 1331**
5. Co-requisites for this course (if any):	**None**

6. Mode of Instruction (mark all that apply)

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

7. Contact Hours (based on academic semester)

No	*Activity*	*Contact Hours*
1	**Lecture**	**36**
2	**Laboratory/Studio**	**12**
3	**Tutorial**	**12**
4	**Others** (specify)	**0**
	Total	**60**

B. Course Objectives and Learning Outcomes

1. Course 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.

2. Course Main Objective

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.

3. Course Learning Outcomes

	CLOs	*Aligned-PLOs*
1	**Knowledge and Understanding**	
1.1	**To list the key features of survival data and different types of censoring and truncation.**	**K1, K2**
1.2	**To define hazard and other basic concepts of survival analysis.**	**K1, K2**
2	**Skills:**	
2.1	**To Use non-parametric methods such as the Kaplan-Meier estimator and the log-rank test to analyze survival data.**	**S1, S2**
2.2	**To use the Cox proportional hazards model to examine the effect of covariates on survival**	**S1, S3**
2.3	**Calculate residuals and influence for survival models and assess whether the proportional hazards assumption is justified.**	**S1, S5**
2.4	**Solve theoretical problems related to survival analysis**	**S1, S4**
2.5	**Use the computer statistical package to analyze survival data and interpret the output.**	**S3, S5**
3	**Values:**	
3.1	**To employ ethical concepts and rules to determine viable alternatives in any given situation.**	**V1, V2**
3.2	**To operate meaningfully and productively with others.**	**V1, V3**

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**

No	*List of Topics*	*Contact Hours*
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. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	*Course Learning Outcomes*	*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.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Lab Assignments, Practical exam**
1.2	**To define hazard and other basic concepts of survival analysis.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Assignments, Practical exam**
2.0	**Skills**		
2.1	**To Use non-parametric methods such as the Kaplan-Meier estimator and the log-rank test to analyze survival data.**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.2	To use the Cox proportional hazards model to examine the effect of covariates on survival	Lecturing, Interactive learning.	Assignments, Practical exam
2.3	Calculate residuals and influence for survival models and assess whether the proportional hazards assumption is justified.	Use of statistical software, Lecturing, Interactive learning.	Lab Exam, Assignments, Practical exam
2.4	Solve theoretical problems related to survival analysis	Lecturing, Interactive learning.	Assignments, Practical exam
2.5	Use the computer statistical package to analyze survival data and interpret the output.	Use of statistical software, Lecturing, Interactive learning.	Lab Exam, Assignments, Practical exam
3.0	**Values**		
3.1	To employ ethical concepts and rules to determine viable alternatives in any given situation.	Interactive learning, Group interaction, Problem solving.	Lab Exam, Practical exam, Assignments
3.2	To operate meaningfully and productively with others.	Group interaction, Problem solving.	Assignments and Mini-projects

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homeworks, Quizzes, Mini-projects	During the term	20%
2	First Midterm	Week 4-5	20%
3	Second Midterm (Lab Exam)	Week 7-8	20%
4	Final Exam	Week 13	40%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

- There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.
- All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	***Statistical Methods for Survival Data Analysis,*** 3rd Edition, E. T. Lee and J. W. Wang, Wiley Series in Probability and Statistics, 2013. ISBN:9780471369974.
Essential References Materials	**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	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	*Resources*
Accommodation *(Classrooms, laboratories, demonstration rooms/labs, etc.)*	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources *(AV, data show, Smart Board, software, etc.)*	**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**
Other Resources *(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)*	**See the Attached File**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment, Quality of learning resources	Students	During the semester and at the end of the course each student will complete two evaluation forms.
Extent of achievement of course learning outcomes, Quality of learning resources	Instructor	At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.

Evaluation areas *(e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)*
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
Reference No.	**11/1444**
Date	**22/04/1444 (16/11/2022)**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

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2020

Course Specifications

Course Title:	**Reliability Theory**
Course Code:	**STA 1438**
Program:	**Bachelor of Science in Applied Statistics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours:	**4 (3 Lectures, 1 Lab, 1 Tutorial)**
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☐ Elective ☑	
3. Level/year at which this course is offered:	**Level 10 / Year 4**
4. Pre-requisites for this course (if any):	**STA 1331**
5. Co-requisites for this course (if any):	**None**

6. Mode of Instruction (mark all that apply)

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

7. Contact Hours (based on academic semester)

No	*Activity*	*Contact Hours*
1	**Lecture**	**36**
2	**Laboratory/Studio**	**12**
3	**Tutorial**	**12**
4	**Others** (specify)	**00**
	Total	**60**

B. Course Objectives and Learning Outcomes

1. Course Description

To introduce students to modern computational and theoretical techniques to assess the reliability of systems as a function of their component probabilities of failure, and to illustrate how importance measures are useful in engineering decision making. The course will explore advanced topics on system reliability and their time evolution and will provide insights into emerging numerical and analytical modeling techniques, computational complexity, load combinations, and the role of normative design standards.

2. Course Main Objective
This course provides an introduction to system modeling using both computer simulation and mathematical techniques. Emphasis will be on discrete-event simulation model development methodologies and implementation techniques. Principal methods of reliability analysis, including fault tree and reliability block diagrams; Failure Mode and Effects Analysis (FMEA); event tree construction and evaluation; reliability data collection and analysis; methods of modeling systems for reliability analysis.

3. Course Learning Outcomes

	CLOs	*Aligned-PLOs*
1	**Knowledge and Understanding**	
1.1	To tell the concepts of reliability.	K1, K2
1.2	To outline the statistical experiments leading to reliability modeling.	K1, K2
2	**Skills:**	
2.1	To apply statistical methods of reliability.	S1, S2
2.2	To appraise failure types and potential failure modes.	S4
2.3	To estimate the level of reliability and remaining life of a critical component and system at a certain point in time	S2, S3
2.4	To analyze and present the research result based on reliability process and statistical package output.	S3, S5
3	**Values:**	
3.1	To interpret model results properly and draw conclusions in case studies.	V1, V2
3.2	To work in groups.	V1, V3

C. Course Content

No	*List of Topics*	*Contact Hours*
1	**Introduction:** A Brief History; Different Approaches to Reliability Analysis; Basic Concepts; Application Areas.	4
2	**Failure Models:** Introduction; State Variable; Time to Failure; Reliability Function; Failure Rate Function; Mean Time to Failure; Mean Residual Life; The Binomial and Geometric Distributions; The Exponential Distribution; The Homogeneous Poisson Process; The Weibull Distribution; The Normal Distribution; The Lognormal Distribution; The Birnbaum-Saunders Distribution; The Inverse Gaussian Distribution; The Extreme Value Distributions. Some Families of Distributions.	12

No	List of Topics	Contact Hours
3	**Qualitative System Analysis:** Introduction; Systems and Interfaces; Functional Analysis; Fault Tree Analysis; Cause and Effect Diagrams; Bayesian Belief Networks; Event Tree Analysis; Reliability Block Diagrams; System Structure Analysis; Failures and Failure Classification.	**12**
4	**Systems of Independent Components:** Introduction; System Reliability; Nonrepairable Systems; Exact System Reliability; Redundancy; Quantitative Fault Tree Analysis.	**12**
5	**Component Importance:** Introduction; Birnbaum's Measure; Improvement Potential; Risk Achievement Worth; Risk Reduction Worth; Criticality Importance; Fussell-Vesely's Measure; Examples.	**10**
6	**Dependent Failures:** Introduction; How to Obtain Reliable Systems; Modeling of Dependent Failures; Associated Variables.	**10**
Total		**60**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding:**		
1.1	**To tell the concepts of reliability.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Assignments, Practical exam**
1.2	**To outline the statistical experiments leading to reliability modeling.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Lab Assignments, Practical exam**
2.0	**Skills**		
2.1	**To apply statistical methods of reliability.**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**
2.2	**To appraise failure types and potential failure modes.**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**
2.3	**To estimate the level of reliability and remaining life of a critical component and system at a certain point in time**	**Use of statistical software, Lecturing, Interactive learning.**	**Lab Exam, Assignments, Practical exam**
2.4	**To analyze and present the research result based on reliability process and statistical package output.**	**Use of statistical software, Lecturing, Interactive learning.**	**Lab Exam, Assignments, Practical exam**

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
3.0	**Values**		
3.1	**To interpret model results properly and draw conclusions in case studies.**	**Interactive learning, Group interaction, Problem solving.**	**Lab Exam, Practical exam, Assignments**
3.2	**To work in groups.**	**Group interaction, Problem solving.**	**Assignments and Mini-projects**

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Homeworks, Quizzes, Mini-projects**	**During the term**	**20%**
2	**First Midterm**	**Week 4-5**	**20%**
3	**Second Midterm (Lab Exam)**	**Week 7-8**	**20%**
4	**Final Exam**	**Week 13**	**40%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- **There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.**
- **All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	***System Reliability Theory: Models, Statistical Methods, and Applications***, 2nd Edition, Rausand, M., A. HØyland, John Wiley & Sons, 2003. ISBN: 9780199676828 (Main Reference)
Essential References Materials	**1-** ***Reliability: probabilistic models and statistical methods***, 2nd Edition, Larry Leemis, Prentice-Hall, 2009. **2-** ***Reliability and Risk: A Bayesian Perspective***, Nozer D. Singpurwalla, John Wiley, 2006. **3-** ***Probability Concepts in Engineering Planning and Design*: Vol. II,** Decision, Risk and Reliability, Alfredo H-S Ang and Wilson H. Tang, H. Tang, New York, NY: John Wiley & Sons, 1975.
Electronic Materials	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	*Resources*
Accommodation *(Classrooms, laboratories, demonstration rooms/labs, etc.)*	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources *(AV, data show, Smart Board, software, etc.)*	**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**
Other Resources *(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)*	▪ **See the Attached File**

G. Course Quality Evaluation

Evaluation Areas/Issues	*Evaluators*	*Evaluation Methods*
Effectiveness of teaching and assessment, Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
Extent of achievement of course learning outcomes, Quality of learning resources	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
Reference No.	**11/1444**
Date	**22/04/1444 (16/11/2022)**

هيئة تقويم التعليم والتدريب
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Course Specifications

Course Title:	Statistical Analysis with R
Course Code:	STA 1442
Program:	Bachelor of Science in Applied Statistics
Department:	Mathematics and Statistics
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University

Table of Contents

A. Course Identification

1. Credit hours:	**4 (3 Lectures, 1 Lab, 1 Tutorial)**
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☐ Elective ☑	
3. Level/year at which this course is offered:	**Level 10 or Level 11/ Year 4**
4. Pre-requisites for this course (if any):	**STA 1341**
5. Co-requisites for this course (if any):	**None**

6. Mode of Instruction (mark all that apply)

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

7. Contact Hours (based on academic semester)

No	*Activity*	*Contact Hours*
1	**Lecture**	**34**
2	**Laboratory/Studio**	**12**
3	**Tutorial**	**12**
4	**Others** (specify)	**0**
	Total	**60**

B. Course Objectives and Learning Outcomes

1. Course Description

This course is an introduction to practical applied statistics with R, a programming language and software environment for statistical computing, and with RStudio, an integrated development environment for R. Topics include introduction to R, data and programming, summarizing data, probability and statistics in R, simple and multiple linear regression, categorical predictors and interactions, model diagnostics, collinearity, variable selection and model building, selected data analyses.

2. Course Main Objective

This course gives students an opportunity to use the public domain and free software R to perform statistical computing. At the end of this course students will be able to:

- **Create and modify R data sets.**
- **Write their own R functions and use some packages in R;**
- **Create figures and plots using R.**
- **Become familiar with the major R data structures.**
- **Use R for statistical programming, computation, graphics, and modeling.**

3. Course Learning Outcomes

	CLOs	*Aligned-PLOs*
1	**Knowledge and Understanding**	
1.1	**List motivation for learning a programming language.**	**K1, K2**
1.2	**To outline critical R programming concepts.**	**K1, K2**
2	**Skills:**	
2.1	**To apply OOP concepts in R programming.**	**S4, S5**
2.2	**To explain the use of data structure and loop functions.**	**S1, S5**
2.3	**To analyze data and generate reports based on the data.**	**S3, S5**
2.4	**To apply various concepts to write programs in R.**	**S2, S5**
3	**Values:**	
3.1	**To work individually.**	**V1, V2**
3.2	**To justify the output in a collective team environment.**	**V1, V3**

C. Course Content

No	*List of Topics*	*Contact Hours*
1	**Basics:** First steps, R language essentials.	**3**
2	**The R environment:** Session management, The graphics subsystem, R programming, Data entry.	**6**
3	**Probability and distributions:** Random sampling, Probability calculations and combinatorics, Discrete distributions, Continuous distributions, The built-in distributions in R.	**7**
4	**Descriptive statistics and graphics:** Summary statistics for a single group, Graphical display of distributions, Summary statistics by groups, Graphics for grouped data, Tables, Graphical display of tables.	**12**

No	List of Topics	Contact Hours
5	**One- and two-sample tests:** One-sample t-test, Two-sample t-test, Comparison of variances, The paired t-test.	**16**
6	**Regression and correlation:** Simple linear regression, Residuals and fitted values, Prediction and confidence, Correlation.	**16**
Total		**60**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding:**		
1.1	**List motivation for learning a programming language.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Lab Assignments, Practical exam**
1.2	**To outline critical R programming concepts.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Lab Assignments, Practical exam**
2.0	**Skills**		
2.1	**To apply OOP concepts in R programming.**	**Use of statistical software, Lecturing, Interactive learning.**	**Lab Exam, Assignments, Practical exam**
2.2	**To explain the use of data structure and loop functions.**	**Use of statistical software, Lecturing, Interactive learning.**	**Lab Exam, Assignments, Practical exam**
2.3	**To analyze data and generate reports based on the data.**	**Use of statistical software, Lecturing, Interactive learning.**	**Lab Exam, Assignments, Practical exam**
2.4	**To apply various concepts to write programs in R.**	**Use of statistical software, Lecturing, Interactive learning.**	**Lab Exam, Assignments, Practical exam**
3.0	**Values**		
3.1	**To work individually.**	**Interactive learning, Group interaction, Problem solving.**	**Lab Exam, Practical exam, Assignments**
3.2	**To justify the output in a collective team environment.**	**Group interaction, Problem solving.**	**Lab assignments and Mini-projects**

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Homeworks, Quizzes, Mini-projects**	**During the term**	**20%**

#	*Assessment task**	*Week Due*	*Percentage of Total Assessment Score*
2	**First Midterm**	**Week 4-5**	**20%**
3	**Second Midterm (Lab Exam)**	**Week 7-8**	**20%**
4	**Final Exam**	**Week 13**	**40%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- **There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.**
- **All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.**

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	**1- Introductory Statistics with *R*, 2nd Edition. P. Dalgaard, Springer Verlag, 2008. ISBN: 978-0-387-79053-4 (Main Reference)** **2- An Introduction to *R*,** Notes on *R*: A Programming Environment for Data Analysis and Graphics, W. N. Venables, D.M. Smith and the R Development Core Team. Version 3.0.1 (2013-05-16). URL: http://www.cran.r-project.org/doc/manuals/R-intro.pdf. (Main Reference)
Essential References Materials	**1- *Statistics and Data Visualization Using R: The Art and Practice of Data Analysis*;** David S. Brown, SAGE Publications Inc, 2021. **2- *Probability and Statistics with R*,** 2nd Edition, Maria Dolores Ugarte, Ana F. Militino, Alan T. Arnholt, CRC Press, 2016.
Electronic Materials	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	*Resources*
Accommodation *(Classrooms, laboratories, demonstration rooms/labs, etc.)*	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources *(AV, data show, Smart Board, software, etc.)*	**The rooms should be equipped with data show and Smart Board.** **All computers should be equipped with the following software:** ▪ **R-Project**

Item	Resources
	▪ **Microsoft Excel** ▪ **IBM SPSS** ▪ **MATLAB**
Other Resources *(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)*	▪ **See the Attached File**

G. Course Quality Evaluation

Evaluation Areas/Issues	*Evaluators*	*Evaluation Methods*
Effectiveness of teaching and assessment, Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
Extent of achievement of course learning outcomes, Quality of learning resources	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**

Evaluation areas *(e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)*
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
Reference No.	**11/1444**
Date	**22/04/1444 (16/11/2022)**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA
T4
2020

Course Specifications

Course Title:	Introduction to Queueing Theory
Course Code:	STA 1452
Program:	Bachelor of Science in Applied Statistics
Department:	Mathematics and Statistics
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University

Table of Contents

A. Course Identification

1. Credit hours:	**4 (3 Lectures, 1 Lab, 1 Tutorial)**
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☐ Elective ☑	
3. Level/year at which this course is offered:	**Level 10 or Level 11 / Year 4**
4. Pre-requisites for this course (if any)**:**	**STA 1351**
5. Co-requisites for this course (if any)**:**	**None**

6. Mode of Instruction (mark all that apply)

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

7. Contact Hours (based on academic semester)

No	*Activity*	*Contact Hours*
1	**Lecture**	**36**
2	**Laboratory/Studio**	**12**
3	**Tutorial**	**12**
4	**Others** (specify)	**0**
	Total	**60**

B. Course Objectives and Learning Outcomes

1. Course Description

This course deals with the modeling and analysis of queueing systems, with applications in communications, manufacturing, computers, call centers, service industries and transportation. Topics include birth-death processes and simple Markovian queues, networks of queues and product form networks, single and multi-server queues, multi-class queueing networks, fluid models, adversarial queueing networks, heavy-traffic theory and diffusion approximations.

2. Course Main Objective
At the end of the course, the student should be able to: ▪ Understand basic principles of a queueing model. ▪ Be aware of a family of known queueing models. ▪ Compute a number of characteristics of a queueing model.

3. Course Learning Outcomes

	CLOs	Aligned-PLOs
1	**Knowledge and Understanding:**	
1.1	**To outline basics of queueing theory and network performance evaluation.**	**K1, K2**
1.2	**To outline conceptual framework for modeling and analysis of different communication networks (both circuit-switched and packet-switched).**	**K1, K2**
1.3	**To describe different characteristics of a queueing model (arrival process, service time and service capacity,...).**	**K1, K2**
2	**Skills:**	
2.1	**To develop and use models to analyze queueing phenomena and develop queueing solutions.**	**S1, S2**
2.2	**To analyze and improve queueing systems by means of simple mathematical models on the one hand, and with simulation on the other.**	**S3, S4**
2.3	**To realize that both approaches complement each other: the simulations to analyze realistic queueing systems, the mathematical models to provide intuition, insight and tests.**	**S2, S3, S4**
2.4	**To analyze and simulate realistic queueing systems.**	**S5**
3	**Values:**	
3.1	**To present and defend the formulated conclusions.**	**V1, V2**
3.2	**To operate meaningfully and productively with others.**	**V1, V3**

C. Course Content

No	*List of Topics*	*Contact Hours*
1	**System Element Models:** Probability Distributions as Models; Deterministic Distribution (D); Exponential distribution; Poisson process (M); Identification of Models Collection of Data; Tests for Stationarity; Tests for Independence; Distribution Selection.	**10**

No	*List of Topics*	*Contact Hours*
2	**Basic Concepts in Stochastic Processes**: Stochastic Process; Point, Regenerative, and Renewal Processes; Markov Process.	**9**
3	**Simple Markovian Queueing Systems:** A General Birth-and-Death Queueing Model; The Queue M/M/1; The Queue M/M/s; The Finite Queue M/M/s/K ; The Infinite-Server Queue M/M/∞; Finite-Source Queues.	**12**
4	**Other Models:** The M/M/1/1 System; Markovian Queues with Balking; Markovian Queues with Reneging; Phase-Type Machine Repair.	**12**
5	**Imbedded Markov Chain Models:** Imbedded Markov Chains; The Queue M/G/1; The Queue G/M/1.	**9**
6	**Extended Markov Models:** The Bulk Queue M(X)/M/1; The Bulk Queue M/M(X)/1.	**8**
Total		**60**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	*Course Learning Outcomes*	*Teaching Strategies*	*Assessment Methods*
1.0	**Knowledge and Understanding:**		
1.1	**To outline basics of queueing theory and network performance evaluation.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Assignments, Practical exam**
1.2	**To outline conceptual framework for modeling and analysis of different communication networks (both circuit-switched and packet-switched).**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Assignments, Practical exam**
1.3	**To describe different characteristics of a queueing model (arrival process, service time and service capacity,...).**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Lab Assignments, Practical exam**
2.0	**Skills**		
2.1	**To develop and use models to analyze queueing phenomena and develop queueing solutions.**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.2	To analyze and improve queueing systems by means of simple mathematical models on the one hand, and with simulation on the other.	Lecturing, Interactive learning.	Assignments, Practical exam
2.3	To realize that both approaches complement each other: the simulations to analyze realistic queueing systems, the mathematical models to provide intuition, insight and tests.	Lecturing, Interactive learning, Use of statistical software.	Lab Exam, Assignments, Lab assignments, Practical exam
2.4	To analyze and simulate realistic queueing systems.		
3.0	**Values**		
3.1	To present and defend the formulated conclusions.	Interactive learning, Group interaction, Problem solving.	Lab Exam, Practical exam, Assignments
3.2	To operate meaningfully and productively with others.	Group interaction, Problem solving.	Assignments and Mini-projects

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homeworks, Quizzes, Mini-projects	During the term	20%
2	First Midterm	Week 4-5	20%
3	Second Midterm (Lab Exam)	Week 7-8	20%
4	Final Exam	Week 13	40%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice: • There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems. • All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	***An Introduction to Queueing Theory: Modeling and Analysis in Applications, (Statistics for Industry and Technology)***, U. Narayan Bhat, Birkhauser Boston, 2008. ISBN 978-0-8176-8421-1 (Main Reference)
Essential References Materials	**1-** ***Queueing Networks and Markov Chains: Modeling and Performance Evaluation with Computer Science Applications, 2nd Edition***, 2nd Edition, J. Wiley, 2006. **2-** ***An introduction to Queueing theory***, 2nd Edition, R. Cooper, Elsevier North Holland, 1981. **3-** ***Fundamentals of Queueing Theory***, 4th Edition, Donald Gross, John F. Shortle, James M. Thompson, Carl M. Harris, John Wiley & Sons, 2013.
Electronic Materials	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	*Resources*
Accommodation *(Classrooms, laboratories, demonstration rooms/labs, etc.)*	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources *(AV, data show, Smart Board, software, etc.)*	**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**
Other Resources *(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)*	**See the Attached File**

G. Course Quality Evaluation

Evaluation Areas/Issues	*Evaluators*	*Evaluation Methods*
Effectiveness of teaching and assessment, Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
Extent of achievement of course learning outcomes, Quality of learning resources	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
Reference No.	**11/1444**
Date	**22/04/1444 (16/11/2022)**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

Course Specifications

Course Title:	Probability Theory
Course Code:	STA 1454
Program:	Bachelor of Science in Applied Statistics
Department:	Mathematics and Statistics
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University

Table of Contents

A. Course Identification

1. Credit hours:	**4 (3 Lectures, 1 Lab, 1 Tutorial)**
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☐ Elective ☑	
3. Level/year at which this course is offered:	**Level 10 or Level 11 / Year 4**
4. Pre-requisites for this course (if any):	**STA 1203**
5. Co-requisites for this course (if any):	**None**

6. Mode of Instruction (mark all that apply)

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

7. Contact Hours (based on academic semester)

No	*Activity*	*Contact Hours*
1	**Lecture**	**36**
2	**Laboratory/Studio**	**12**
3	**Tutorial**	**12**
4	**Others** (specify)	**0**
	Total	**60**

B. Course Objectives and Learning Outcomes

1. Course Description

The course covers the basic principles of the measure theoretical theory of probability. Topics include the axioms of probability, random variables and vectors; independence of events and variables; modes of probability convergences; laws of large numbers; characteristic function, the central limit theorem; conditional probability. Conditional expectation, and martingale.

2. Course Main Objective

At the end of this course, the student will be able to use the different type of convergence, to understand the statements of the laws of large numbers and the Central Limit Theorem, to use both limit theorems to approximate probabilities of average and sums of independent identically distributed random variables, and to understand the conditional expectation with respect to a sigma-field and to apply for martingales.

3. Course Learning Outcomes

	CLOs	*Aligned-PLOs*
1	**Knowledge and Understanding**	
1.1	To define probability measures, random variables, and their distributions in an abstract framework.	K1, K2
1.3	To list the different types of the convergence of a sequence of random variables: almost surely, in probability and in distribution.	K1
1.2	To state the independence of a family of sigma-fields or random variables.	K1, K2
2	**Skills:**	
2.1	To prove and apply the convergence of a sequence of random variables.	S1, S2
2.2	To explain the independence of a family of sigma-fields or random variables.	S4
2.3	To apply central results in probability theory on typical problems within the field.	S3, S4
2.4	To develop examples and applications of martingales.	S3, S5
3	**Values:**	
3.1	To work individually.	V1, V2
3.2	To show findings and discuss the results with others.	V1, V3

C. Course Content

No	*List of Topics*	*Contact Hours*
1	**Foundations of Probability:** Probability space and random variables, Distribution function of a random variable, Random elements, vectors and joint distributions, Expectation and moments, Inequalities for moments and probabilities.	**10**
2	**Independence:** Independent events and classes, Independent random elements, Independent random variables, Addition of independent random variables, Borel–Cantelli Lemma and zero-one law.	**10**

No	List of Topics	Contact Hours
3	**Convergence and Related Topics:** Modes of probabilistic convergence: Almost sure convergence, Convergence in probability, Convergence in order mean, convergence in distribution, Relationships between forms of convergence, Series of independent random variables, Laws of large numbers.	**13**
4	**Characteristic Functions and Central Limit Theorem:** Definition and simple properties, Characteristic function and moments, Inversion and uniqueness, Continuity theorem for characteristic functions, Some applications (Central Limit Theorem).	**13**
5	**Conditioning and Martingales:** Conditional expectation given a sigma-field, Conditional probability given a sigma-field, Definition and basic properties of martingales.	**14**
Total		**60**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding:**		
1.1	**To define probability measures, random variables, and their distributions in an abstract framework.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Assignments, Practical exam**
1.2	**To list the different types of the convergence of a sequence of random variables: almost surely, in probability and in distribution.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Assignments, Practical exam**
1.3	**To state the independence of a family of sigma-fields or random variables.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Assignments, Practical exam**
2.0	**Skills**		
2.1	**To prove and apply the convergence of a sequence of random variables.**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**
2.2	**To explain the independence of a family of sigma-fields or random variables.**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**
2.3	**To apply central results in probability theory on typical problems within the field.**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.4	**To develop examples and applications of martingales.**	**Lecturing, Interactive learning, Use of statistical software.**	**Exam, Assignments, Practical exam**
3.0	**Values**		
3.1	**To work individually.**	**Group work, problem solving, web-based work**	**Assignments and Mini projects**
3.2	**To show findings and discuss the results with others.**	**Personal questions**	**Participation, Assignments**

2. Assessment Tasks for Students

#	*Assessment task**	*Week Due*	*Percentage of Total Assessment Score*
1	**Homeworks, Quizzes, Mini projects**	**During the term**	**20%**
2	**First Midterm**	**Week 4-5**	**20%**
3	**Second Midterm**	**Week 7-8**	**20%**
4	**Final Exam**	**Week 13**	**40%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- **There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.**
- **All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.**

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	***A Basic Course in Measure and Probability: Theory for Applications***, Ross Leadbetter & All., Cambridge University Press 2014.
Essential References Materials	1- ***Probability: Theory and Examples***, Rick Durett, 5th Edition, Cambrige University Press 2014. 2- ***Probability Essentials***, Jean Jacod & Philip Protter, Second Edition, Springer Verlag 2004. **3- Probability and Stochastics,** E. Cinlar, Graduate Text in Mathematics 261, Springer-Verlag 2011.
Electronic Materials	**None.**

Other Learning Materials	None.

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	▪ Each class room should be equipped with a whiteboard and a projector. ▪ Laboratories should be equipped with computers and an internet connection.
Technology Resources (AV, data show, Smart Board, software, etc.)	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
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	See the Attached File

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment, Quality of learning resources	Students	During the semester and at the end of the course each student will complete two evaluation forms.
Extent of achievement of course learning outcomes, Quality of learning resources	Instructor	At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL
Reference No.	11/1444
Date	22/04/1444 (16/11/2022)

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

Course Specifications

Course Title:	Introduction to Bayesian Statistics
Course Code:	STA 1456
Program:	Bachelor of Science in Applied Statistics
Department:	Mathematics and Statistics
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University

Table of Contents

A. Course Identification

1. Credit hours:	**4 (3 Lectures, 1 Lab, 1 Tutorial)**
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐	
3. Level/year at which this course is offered:	**Level 10 / Year 4**
4. Pre-requisites for this course (if any)**:**	**STA 1331**
5. Co-requisites for this course (if any)**:**	**None**

6. Mode of Instruction (mark all that apply)

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

7. Contact Hours (based on academic semester)

No	*Activity*	*Contact Hours*
1	**Lecture**	**36**
2	**Laboratory/Studio**	**12**
3	**Tutorial**	**12**
4	**Others** (specify)	**0**
	Total	**60**

B. Course Objectives and Learning Outcomes

1. Course Description

The aim of the course is to introduce life scientists to Bayesian statistics. We will explore basic ideas regarding integration through simulation (Monte Carlo integration), the philosophy and strengths of Bayesian statistics, and the Markov Chain Monte Carlo (MCMC) algorithms needed to fit such models. We will focus on several real-world examples and how to transform these problems into statistical models.

2. Course Main Objective

The main goals for this course are:

- to help you gain a solid understanding of the basic Bayesian approach to inference, based on expressing all uncertainty in terms of conditional probability distributions,
- to introduce you to common practice in fitting and interpreting Bayesian models in applied problems, including hierarchical model specification and computational techniques,
- to give you practice in reading statistics articles from the literature and presenting statistical ideas to others.

3. Course Learning Outcomes

	CLOs	*Aligned PLOs*
1	**Knowledge and Understanding**	
1.1	To describe in detail the Bayesian framework for data analysis and when it can be beneficial, including its flexibility in contrast to the frequentist approach.	K1, K2
1.2	To describe single and multiparameter probability models in the Bayesian framework.	K1, K2
2	**Skills:**	
2.1	To develop, analytically describe, and implement both single and multiparameter probability models in the Bayesian framework.	S1, S2
2.2	To demonstrate in detail the role of the prior distribution in Bayesian inference and be able to articulate the usage of non-informative priors and conjugate priors.	S1, S2
2.3	To show high level Interpretation of Bayesian Analysis Results and perform Bayesian model evaluation and assessment.	S3, S4
2.4	Perform Bayesian computation using Markov chain Monte Carlo methods using the appropriate statistical package.	S3, S5
2.5	To use Bayesian Methods to solve real world problems, including forming a hypothesis, collecting and analyzing data, and reaching appropriate conclusions.	S4, S5
3	**Values:**	
3.1	To employ ethical concepts and rules to determine viable alternatives in any given situation.	V1, V2
3.2	To justify the output in a collective team environment.	V1, V3

C. Course Content

No	List of Topics	Contact Hours
1	**Review:** Discrete and continuous random variables, joint distribution, independence.	**6**
2	**One parameter models:** Binomial model, Poisson model, Exponential families and conjugate priors.	**13**
3	**Monte Carlo approximation:** Monte Carlo method, Posterior inference, Sampling from predictive distributions, Posterior predictive model checking.	**15**
4	**The normal model:** normal model, inference on the mean conditional on the variance, joint inference for the mean and variance, Bias and mean square error, Prior specification.	**14**
5	**Bivariate normal model:** bivariate normal density, Semiconjugate prior for the mean, Inverse-Wishart distribution.	**12**
Total		**60**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**To develop, analytically describe, and implement both single and multiparameter probability models in the Bayesian framework..**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Lab Assignments, Practical exam**
1.2	**To demonstrate in detail the role of the prior distribution in Bayesian inference and be able to articulate the usage of non-informative priors and conjugate priors.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Lab Assignments, Practical exam**
2.0	**Skills**		
2.1	**To develop, analytically describe, and implement both single and multiparameter probability models in the Bayesian framework.**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.2	To demonstrate in detail the role of the prior distribution in Bayesian inference and be able to articulate the usage of non-informative priors and conjugate priors.	Lecturing, Interactive learning.	Assignments, Practical exam
2.3	To show high level Interpretation of Bayesian Analysis Results and perform Bayesian model evaluation and assessment.	Lecturing, Interactive learning.	Assignments, Practical exam
2.4	Perform Bayesian computation using Markov chain Monte Carlo methods using the appropriate statistical package.	Use of statistical software, Lecturing, Interactive learning.	Lab Exam, Assignments, Practical exam
2.5	To use Bayesian Methods to solve real world problems, including forming a hypothesis, collecting and analyzing data, and reaching appropriate conclusions.	Use of statistical software, Lecturing, Interactive learning.	Lab Exam, Assignments, Practical exam
3.0	**Values**		
3.1	To employ ethical concepts and rules to determine viable alternatives in any given situation.	Interactive learning, Group interaction, Problem solving.	Lab Exam, Practical exam, Assignments
3.2	To justify the output in a collective team environment.	Group interaction, Problem solving.	Assignments and Mini-projects

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homeworks, Quizzes, Mini-projects	During the term	20%
2	First Midterm	Week 4-5	20%
3	Second Midterm (Lab Exam)	Week 7-8	20%
4	Final Exam	Week 13	40%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice: • **There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.** • **All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.**

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	***A First Course in Bayesian Statistical Methods*;** Peter D. Hoff, Springer Texts in Statistics, 2009. ISBN 978-0-387-92299-7
Essential References Materials	**1-** ***Bayesian data analysis*;** 3rd Edition, Andrew Gelman, John B. Carlin, Hal S. Stern, David B. Dunson, Aki Vehtari, Donald B. Rubin, Chapman & Hall/CRC Texts in Statistical Science, 2013. **2-** ***Bayesian Computation with R*,** Jim Albert, Springer, 2009. ISBN 978-0-387-92297-3 **3-** ***Bayesian Methods: A Social and Behavioral Sciences Approach*,** 3rd Edition, J. Gill, Chapman and Hall/CRC, 2015.
Electronic Materials	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	*Resources*
Accommodation *(Classrooms, laboratories, demonstration rooms/labs, etc.)*	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources *(AV, data show, Smart Board, software, etc.)*	**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**
Other Resources *(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)*	**See the Attached File**

G. Course Quality Evaluation

Evaluation Areas/Issues	*Evaluators*	*Evaluation Methods*
Effectiveness of teaching and assessment, Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
Extent of achievement of course learning outcomes, Quality of learning resources	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**

Evaluation areas *(e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)*

Evaluators *(Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)*

Assessment Methods *(Direct, Indirect)*

H. Specification Approval Data

Council / Committee	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
Reference No.	**11/1444**
Date	**22/04/1444 (16/11/2022)**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

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Course Specifications

Course Title:	**Demography**
Course Code:	**STA 1467**
Program:	**Bachelor of Science in Applied Statistics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours:	**4 (3 Lectures, 1 Lab, 1 Tutorial)**

2. Course type:

a. University ☐ College ☐ Department ☑ Others ☐

b. Required ☐ Elective ☑

3. Level/year at which this course is offered:	**Level 10 or Level 11 / Year 4**
4. Pre-requisites for this course (if any)**:**	**STA 1331**
5. Co-requisites for this course (if any)**:**	**None**

6. Mode of Instruction (mark all that apply)

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

7. Contact Hours (based on academic semester)

No	*Activity*	*Contact Hours*
1	**Lecture**	**36**
2	**Laboratory/Studio**	**12**
3	**Tutorial**	**12**
4	**Others** (specify)	**0**
	Total	**60**

B. Course Objectives and Learning Outcomes

1. Course 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.

2. Course Main Objective

- **Give students theoretical and practical background on the use of statistical models in the field of population statistics.**

- The student's knowledge of the statistical measures for births and Deaths.
- Students learn how to construct and use life tables.
- Understanding internal and international migration.

3. Course Learning Outcomes

	CLOs	Aligned-PLOs
1	**Knowledge and Understanding**	
1.1	To describe the basic principles of demography and the need for it.	K1, K2
1.2	To outline fertility and reproduction and methods of measuring various kinds of fertility.	K1, K2
2	**Skills:**	
2.1	To summarize the different sources of population data.	S1, S2
2.2	To explain the concepts and measures that are central to statistical demography.	S2, S4, S5
2.3	To analyze demographic data using appropriate statistical methods and software.	S3, S5
2.4	To perform simple projections of population development.	S3, S4
3	**Values:**	
3.1	To defend the formulated conclusions.	V1, V2
3.2	To operate meaningfully and productively with others.	V1, V3

C. Course Content

No	*List of Topics*	*Contact Hours*
1	**Introduction:** Some basic concepts. The nature of demographic data. Demographic statistics in practice.	**11**
2	**Population movements:** Marriage. The statistical study of fertility. Mortality characteristics. Migration and other socio-economic data. Population projection.	**16**
3	**General influences on population:** Population in history. Population today. Resources and population. Population policies. General prospects for the future.	**17**
4	**Technical analysis:** Life tables. Methods of summary and comparison. Techniques of population projection. Introduction to population mathematics. The handling of suspect or scanty data.	**16**
Total		**60**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	*Course Learning Outcomes*	*Teaching Strategies*	*Assessment Methods*
1.0	**Knowledge and Understanding**		
1.1	**To describe the basic principles of demography and the need for it.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Assignments, Practical exam**
1.2	**To outline fertility and reproduction and methods of measuring various kinds of fertility.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Assignments, Practical exam**
2.0	**Skills**		
2.1	**To summarize the different sources of population data.**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**
2.2	**To explain the concepts and measures that are central to statistical demography.**	**Lecturing, Interactive learning, Use of statistical software.**	**Assignments, Practical exam, Lab Assignments.**
2.3	**To analyze demographic data using appropriate statistical methods and software.**	**Lecturing, Interactive learning, Use of statistical software.**	**Assignments, Practical exam, Lab Assignments.**
2.4	**To perform simple projections of population development.**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**
3.0	**Values**		
3.1	**To defend the formulated conclusions.**	**Personal questions**	**Participation, Lab Assignments**
3.2	**To operate meaningfully and productively with others.**	**Team work**	**Homeworks and Mini-projects**

2. Assessment Tasks for Students

#	*Assessment task**	*Week Due*	*Percentage of Total Assessment Score*
1	**Homeworks, Quizzes, Mini-projects**	**During the term**	**20%**
2	**First Midterm**	**Week 4-5**	**20%**
3	**Second Midterm**	**Week 7-8**	**20%**
4	**Final Exam**	**Week 13**	**40%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice : • **There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.** • **All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.**

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	***Demography, 5th Edition***, Peter R. Cox, Cambridge University Press, 2009. ISBN: 9780521290203.
Essential References Materials	**1-** ***Methods and Models in Demography***, C. Newell, New York, The Guilford Press, 1988. **2-** ***Demographic Methods***, A. Hinde, Hodder Arnold Publication, 1998. **3-** ***The Demography of Health and Health care***, 2nd Edition, Louis G. Pol and Richard, Kluwer Academic Publishers, 2001.
Electronic Materials	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	*Resources*
Accommodation *(Classrooms, laboratories, demonstration rooms/labs, etc.)*	▪ **Each classroom should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources *(AV, data show, Smart Board, software, etc.)*	**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**
Other Resources *(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)*	**See the Attached File**

G. Course Quality Evaluation

Evaluation Areas/Issues	*Evaluators*	*Evaluation Methods*
Effectiveness of teaching and assessment, Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
Extent of achievement of course learning outcomes, Quality of learning resources	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**

Evaluation areas *(e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)*
Evaluators *(Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)*
Assessment Methods *(Direct, Indirect)*

H. Specification Approval Data

Council / Committee	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
Reference No.	**11/1444**
Date	**22/04/1444 (16/11/2022)**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	**Quality Control**
Course Code:	**STA 1471**
Program:	**Bachelor of Science in Applied Statistics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours:	**4 (3 Lectures, 1 Lab, 1 Tutorial)**
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☐ Elective ☑	
3. Level/year at which this course is offered:	**Level 10 or Level 11 / Year 4**
4. Pre-requisites for this course (if any):	**STA 1332**
5. Co-requisites for this course (if any):	**None**

6. Mode of Instruction (mark all that apply)

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

7. Contact Hours (based on academic semester)

No	*Activity*	*Contact Hours*
1	**Lecture**	**36**
2	**Laboratory/Studio**	**12**
3	**Tutorial**	**12**
4	**Others** (specify)	**0**
	Total	**60**

B. Course Objectives and Learning Outcomes

1. Course Description

The course will comprise a balanced blend of the statistical quality control concepts and hands-on training in the methods, standards and guidelines currently being used for industrial quality control. The course will enable the student to gain a firm grasp of statistical quality control methods and enable him/her to not only analyze and improve existing quality control processes, but also design and implement new quality control processes in industrial settings.

2. Course Main Objective

A comprehensive coverage of modern quality control techniques to include the design of statistical process control systems, acceptance sampling, and process improvement.

3. Course Learning Outcomes

	CLOs	*Aligned-PLOs*
1	**Knowledge and Understanding**	
1.1	**To define quality assurance system and total quality management.**	**K1, K2**
1.3	**To define quality costs and Statistical Quality Control.**	**K1, K2**
2	**Skills:**	
2.1	**To define quality assurance system and total quality management.**	**S3, S1**
2.2	**To explain the importance of high-performance teams to promote quality.**	**S4**
2.3	**To examine and discuss the concepts of strategic management for performance.**	**S1, S2**
2.4	**To use effective tools, techniques and statistical software for quality design and control.**	**S5**
3	**Values:**	
3.1	**To employ ethical concepts and rules to determine viable alternatives in any given situation.**	**V1, V3**
3.2	**To operate meaningfully and productively with others.**	**V1, V2**

C. Course Content

No	*List of Topics*	*Contact Hours*
1	**Quality Improvement in the Modern Business Environment:** The Meaning of Quality and Quality Improvement, Brief History of Quality Control and Improvement, Statistical Methods for Quality Control and Improvement, Management Aspects of Quality Improvement.	**9**
2	**The DMAIC process:** Overview of DMAIC, The Define Step, The Measure Step, The Analyze Step, The Improve Step, The Control Step, Examples of DMAIC.	**11**
3	**Methods and philosophy of statistical process control:** Chance and Assignable Causes of Quality Variation, Statistical Basis of the Control Chart, The Rest of the Magnificent Seven, Implementing SPC in a Quality Improvement Program, Applications of SPC.	**10**
4	**Control Charts for Variables:** Control Charts for $\bar{x}$ and R, Control Charts for $\bar{x}$ and s, The Shewhart Control Chart for Individual Measurements, Applications of Variables Control Charts.	**10**

No	*List of Topics*	*Contact Hours*
5	**Control Charts for Attributes:** The Control Chart for Fraction Nonconforming, Control Charts for Nonconformities (Defects), Choice between Attributes and Variable Control Charts.	**10**
6	**Process and Measurement System Capability Analysis:** Process and Measurement System Capability Analysis, Process Capability Ratios.	**10**
	Total	**60**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	*Course Learning Outcomes*	*Teaching Strategies*	*Assessment Methods*
1.0	**Knowledge and Understanding**		
1.1	**To define quality assurance system and total quality management.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Assignments, Practical exam**
1.2	**To define quality costs and Statistical Quality Control.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Lab Assignments, Practical exam**
2.0	**Skills**		
2.1	**To define quality assurance system and total quality management.**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**
2.2	**To define quality costs and Statistical Quality Control.**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**
2.3	**To define quality assurance system and total quality management.**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**
2.4	**To define quality costs and Statistical Quality Control.**	**Use of statistical software, Lecturing, Interactive learning.**	**Lab Exam, Assignments, Practical exam**
3.0	**Values**		
3.1	**To employ ethical concepts and rules to determine viable alternatives in any given situation.**	**Personal questions**	**Lab Assignments, Participation**
3.2	**To operate meaningfully and productively with others.**	**Team work**	**Homework and Mini-projects**

2. Assessment Tasks for Students

#	*Assessment task**	*Week Due*	*Percentage of Total Assessment Score*
1	**Homeworks, Quizzes, Mini-projects**	**During the term**	**20%**
2	**First Midterm**	**Week 4-5**	**20%**
3	**Second Midterm (Lab Exam)**	**Week 7-8**	**20%**
4	**Final Exam**	**Week 13**	**40%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

- **There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.**
- **All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.**

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	***Introduction to Statistical Quality Control, 6th Edition***, Douglas C. Montgomery, John Wiley & Sons, 2008. (Main Reference)
Essential References Materials	1. ***Statistical Quality Control, 6th Edition***, E.L. Grant and R.S. Leavenworth, McGraw-Hill, 1988. 2. ***Principles of quality control***, J. Banks, John Wiley & Sons, 1989.
Electronic Materials	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	*Resources*
Accommodation *(Classrooms, laboratories, demonstration rooms/labs, etc.)*	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**

Item	Resources
Technology Resources *(AV, data show, Smart Board, software, etc.)*	**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**
Other Resources *(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)*	**See the Attached File**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment, Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
Extent of achievement of course learning outcomes, Quality of learning resources	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
Reference No.	**11/1444**
Date	**22/04/1444 (16/11/2022)**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

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2020

Course Specifications

Course Title:	Network Analysis
Course Code:	STA 1473
Program:	Bachelor of Science in Applied Statistics
Department:	Mathematics and Statistics
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University

Table of Contents

A. Course Identification

1. Credit hours:	**4 (3 Lectures, 1 Lab, 1 Tutorial)**
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☐ Elective ☑	
3. Level/year at which this course is offered:	**Level 10 or Level 11 / Year 4**
4. Pre-requisites for this course (if any)**:**	**MAT 1253**
5. Co-requisites for this course (if any)**:**	**None**

6. Mode of Instruction (mark all that apply)

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

7. Contact Hours (based on academic semester)

No	*Activity*	*Contact Hours*
1	**Lecture**	**36**
2	**Laboratory/Studio**	**12**
3	**Tutorial**	**12**
4	**Others** (specify)	**0**
	Total	**60**

B. Course Objectives and Learning Outcomes

1. Course Description

Network flow problems form a subclass of linear programming problems with applications to transportation, logistics, manufacturing, computer science, project management, and finance, as well as a number of other domains. This course will survey some of the applications of network flows and focus on key special cases of network flow problems including the following: the shortest path problem, the maximum flow problem, the minimum cost flow problem, and the multi-commodity flow problem. We will also consider other extensions of network flow problems.

2. Course Main Objective
The objectives of this course are to learn optimization algorithms in some kinds of networks based on some metrics. This includes: algorithm design, shortest paths, maximum flows, minimum cost flows.

3. Course Learning Outcomes

	CLOs	*Aligned PLOs*
1	**Knowledge and Understanding:**	
1.1	**To describe the basic principles of network flow problems.**	**K1, K2**
1.2	**To define analysis of network flow algorithms.**	**K1, K2**
2	**Skills:**	
2.1	**To explain the state-of-the-art in the theory and practice of solving network flow problems.**	**S1, S2**
2.2	**To analyze computational complexity of network algorithms presented as pseudocode.**	**S1, S3**
2.3	**To execute the steps of several algorithms for shortest path, maximum flow, minimum-cost flow, and other network problems.**	**S4, S2**
2.4	**To use computer modeling languages and solvers to find solutions to network problems.**	**S3, S5**
3	**Values:**	
3.1	**To work individually.**	**V1, V3**
3.2	**To work in groups.**	**V1, V2**

C. Course Content

No	*List of Topics*	*Contact Hours*
1	**Graph Theory:** Paths, Trees and Cycles.	**4**
2	**Algorithm Design and Analysis:** Applications; Complexity analysis; Notation and definitions; Network representations; Search algorithms; Developing polynomial time algorithms.	**12**
3	**Basic Properties of Network Flows:** Flow decomposition properties and optimality conditions; Cycle fee and spanning tree solutions; Networks; Linear and integer programming; Network transformations.	**12**
4	**Shortest Paths:** Dijkstra's algorithm; Dial's implementation; R-Heap implementation; Label correction algorithm; All pairs shortest path algorithm.	**12**

No	List of Topics	Contact Hours
5	**Maximum Flows:** Labeling algorithm and the max-flow min-cut theorem; Decreasing the number of augmentations; Shortest augmenting path algorithm; Preflow-push algorithms; Excess-scaling algorithm.	**10**
6	**Minimum Cost Flows:** Duality and optimality conditions; Relationship to shortest path and maximum flow problems; Negative cycle algorithm; Successive shortest path algorithm; Primal dual and out of Kilter algorithms; Network Simplex algorithm.	**10**
Total		**60**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding:**		
1.1	**To describe the basic principles of network flow problems.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Assignments, Practical exam**
1.2	**To define analysis of network flow algorithms.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Lab Assignments, Practical exam**
2.0	**Skills**		
2.1	**To explain the state-of-the-art in the theory and practice of solving network flow problems.**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**
2.2	**To analyze computational complexity of network algorithms presented as pseudocode.**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**
2.3	**To execute the steps of several algorithms for shortest path, maximum flow, minimum-cost flow, and other network problems.**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**
2.4	**To use computer modeling languages and solvers to find solutions to network problems.**	**Lecturing, Interactive learning, Use of statistical software.**	**Assignments, Lab Assignments, Practical exam**
3.0	**Values**		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
3.1	**To present and defend the formulated conclusions.**	**Personal questions**	**Practical exam, Assignments**
3.2	**To work in groups.**	**Group work, problem solving, web based work**	**Lab assignment and Mini projects**

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Homeworks, Quizzes, Mini-projects**	**During the term**	**20%**
2	**First Midterm**	**Week 4-5**	**20%**
3	**Second Midterm**	**Week 7-8**	**20%**
4	**Final Exam**	**Week 13**	**40%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- **There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.**
- **All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.**

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	***Network Flows: Theory, Algorithms, and Applications***, R. K. Ahuja, T. L. Magnanti, J. B. Orlin, Prentice Hall, 1993. ISBN-10: 013617549X, ISBN-13: 9780136175490. (Main Reference)
Essential References Materials	1- ***Flows: Theory, Algorithms, and Applications***, R. K. Ahuja, T. L. Magnanti, J. B. Orlin, , Prentice Hall, 1993. ISBN-10: 013617549X, ISBN-13: 9780136175490. **2-** ***Project Planning and Control with PERT and CPM***, B. C. Punmia, K. K. Khandelwal, Laxmi Publications, 2002. **3-** ***Network Analysis, Methodological Foundations***, Ulrik Brandes, Thomas Erlebach, Springer, 2005.
Electronic Materials	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	*Resources*
Accommodation *(Classrooms, laboratories, demonstration rooms/labs, etc.)*	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources *(AV, data show, Smart Board, software, etc.)*	**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**
Other Resources *(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)*	**See the Attached File**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment, Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
Extent of achievement of course learning outcomes, Quality of learning resources	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**

Evaluation areas *(e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)*
Evaluators *(Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)*
Assessment Methods *(Direct, Indirect)*

H. Specification Approval Data

Council / Committee	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
Reference No.	**11/1444**
Date	**22/04/1444 (16/11/2022)**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	Selected Topics in Applied Statistics (1)
Course Code:	STA 1481
Program:	Bachelor of Science in Applied Statistics
Department:	Mathematics and Statistics
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University

Table of Contents

A. Course Identification

1. Credit hours:	**4 (3 Lectures, 1 Lab, 1 Tutorial)**
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☐ Elective ☑	
3. Level/year at which this course is offered:	**Level 10 or Level 11 / Year 4**
4. Pre-requisites for this course (if any):	**To be decided with respect to the delivered course.**
5. Co-requisites for this course (if any):	**None**

6. Mode of Instruction (mark all that apply)

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

7. Contact Hours (based on academic semester)

No	*Activity*	*Contact Hours*
1	**Lecture**	**33**
2	**Laboratory/Studio**	**12**
3	**Tutorial**	**12**
4	**Others** (specify)	**0**
	Total	**60**

B. Course Objectives and Learning Outcomes

1. Course Description
The selected topics course will be described before the course delivery and the approbation of department.

2. Course Main Objective

- This course is designed to enable students to study different special topics of interest, which are carefully, selected from advanced Applied Statistics which may be changed from semester to semester.
- The course covers selected topics in Applied Statistics suggested by a faculty member and approved by the chairman and the department council each time this course is offered.
- It aims the student to learn some topics which are not formally offered by the program.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding:**	
1.1	Specific to each course of study	K1, K2
2	**Skills:**	
2.1	To develop techniques of problem solving.	S1, S2
2.2	To communicate statistical theories clearly and precisely both orally and in writing.	S4
2.3	To use the appropriate statistical software to represent and analyze the data.	S2, S5
2.4	To carry out calculations orally, mentally and through statistical software.	S3, S5
3	**Values:**	
3.1	To work individually.	V1, V2
3.2	To work in groups.	V1, V3

C. Course Content

No	*List of Topics*	*Contact Hours*
1	Topics depend on the offered course	
	Total	**60**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding:**		
1.1	Specific to each course of study	Lectures, problem solving, Classroom discussions	Regular Exams, Lab Assignments, Practical exam
2.0	**Skills:**		
2.1	To develop techniques of problem solving.	Use of statistical software, Lecturing, Interactive learning.	Lab Exam, Assignments, Practical exam
2.2	To communicate statistical theories clearly and precisely both orally and in writing.	Lecturing, Interactive learning.	Assignments, Practical exam
2.3	To use the appropriate statistical software to represent and analyze the data.	Use of statistical software, Lecturing, Interactive learning.	Lab Exam, Assignments, Practical exam
2.4	To carry out calculations orally, mentally and through statistical software.	Use of statistical software, Lecturing, Interactive learning.	Lab Exam, Assignments, Practical exam
3.0	**Values:**		
3.1	To work individually.	Interactive learning, Group interaction, Problem solving.	Lab Exam, Practical exam, Assignments
3.2	To work in groups.	Group interaction, Problem solving.	Assignments and Mini-projects

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homeworks, Quizzes, Mini-projects	During the term	20%
2	First Midterm	Week 4-5	20%
3	Second Midterm (Lab Exam)	Week 7-8	20%
4	Final Exam	Week 13	40%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice : • **There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.** • **All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	**Course dependent**
Essential References Materials	**Course dependent**
Electronic Materials	
Other Learning Materials	

2. Facilities Required

Item	*Resources*
Accommodation *(Classrooms, laboratories, demonstration rooms/labs, etc.)*	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources *(AV, data show, Smart Board, software, etc.)*	**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**
Other Resources *(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)*	**See the Attached File**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment, Quality of learning resources	Students	During the semester and at the end of the course each student will complete two evaluation forms.
Extent of achievement of course learning outcomes, Quality of learning resources	Instructor	At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL
Reference No.	11/1444
Date	22/04/1444 (16/11/2022)

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

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2020

Course Specifications

Course Title:	Selected Topics in Applied Statistics (2)
Course Code:	STA 1483
Program:	Bachelor of Science in Applied Statistics
Department:	Mathematics and Statistics
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University

Table of Contents

A. Course Identification

1. Credit hours:	**4 (3 Lectures, 1 Lab, 1 Tutorial)**
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☐ Elective ☑	
3. Level/year at which this course is offered:	**Level 10 or Level 11 / Year 4**
4. Pre-requisites for this course (if any):	**Depend on the offered course**
5. Co-requisites for this course (if any):	**None**

6. Mode of Instruction (mark all that apply)

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

7. Contact Hours (based on academic semester)

No	*Activity*	*Contact Hours*
1	**Lecture**	**36**
2	**Laboratory/Studio**	**12**
3	**Tutorial**	**12**
4	**Others** (specify)	**0**
	Total	**60**

B. Course Objectives and Learning Outcomes

1. Course Description

The selected topics course will be described before the course delivery and the approbation of department.

2. Course Main Objective

- **This course is designed to enable students to study different special topics of interest, which are carefully, selected from advanced Applied Statistics which may be changed from semester to semester**
- **The course covers selected topics in Applied Statistics suggested by a faculty**

member and approved by the chairman and the department council each time this course is offered.

- It aims the student to learn some topics which are not formally offered by the program.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	Specific to each course of study	K1, K2
2	**Skills:**	
2.1	To develop techniques of problem solving.	S1, S2
2.2	To communicate statistical theories clearly and precisely both orally and in writing.	S4
2.3	To use the appropriate statistical software to represent and analyze the data.	S5
2.4	To carry out calculations orally and mentally.	S3
3	**Values:**	
3.1	To work individually.	V1, V3
3.2	To work in groups.	V1, V2

C. Course Content

No	List of Topics	Contact Hours
1	Topics depend on the offered course	
	Total	60

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	Specific to each course of study.	Lectures, problem solving, Classroom discussions	Regular Exams, Lab Assignments, Practical exam
2.0	**Skills**		
2.1	To develop techniques of problem solving.	Lecturing, Interactive learning.	Assignments, Practical exam
2.2	To communicate statistical theories clearly and precisely both orally and	Lecturing, Interactive learning.	Assignments, Practical exam

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	in writing.		
2.3	To use the appropriate statistical software to represent and analyze the data.	Use of statistical software, Lecturing, Interactive learning.	Lab Exam, Assignments, Practical exam
2.4	To carry out calculations orally and mentally.	Lecturing, Interactive learning.	Assignments, Practical exam
3.0	**Values**		
3.1	To work individually.	Interactive learning, Group interaction, Problem solving.	Lab Exam, Practical exam, Assignments
3.2	To work in groups.	Group interaction, Problem solving.	Assignments and Mini-projects

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homeworks, Quizzes, Mini-projects	During the term	20%
2	First Midterm	Week 4-5	20%
3	Second Midterm (lab Exam)	Week 7-8	20%
4	Final Exam	Week 13	40%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

- **There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.**
- **All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.**

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	Course dependent
Essential References Materials	Course dependent
Electronic Materials	
Other Learning Materials	

2. Facilities Required

Item	*Resources*
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**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**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	**See the Attached File**

G. Course Quality Evaluation

Evaluation Areas/Issues	*Evaluators*	*Evaluation Methods*
Effectiveness of teaching and assessment, Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
Extent of achievement of course learning outcomes, Quality of learning resources	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**

Evaluation areas *(e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)*
Evaluators *(Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)*
Assessment Methods *(Direct, Indirect)*

H. Specification Approval Data

Council / Committee	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
Reference No.	**11/1444**
Date	**22/04/1444 (16/11/2022)**

هيئة تقويم التعليم والتدريب
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Course Specifications

Course Title:	**Graduation Project**
Course Code:	**STA 1499**
Program:	**Bachelor of Science in Applied Statistics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours:	**4 (2 Lectures, 4 Lab, 0 Tutorial)**
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐	
3. Level/year at which this course is offered:	**Level 12 / Year 4**
4. Pre-requisites for this course (if any)**:**	**Research project course starts in the last trimester of the program study (4th year – 12th trimester).**
5. Co-requisites for this course (if any)**:**	**None**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom		
2	Blended		
3	E-learning		
4	Distance learning		
5	Other	72	100%

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	0
2	Laboratory/Studio	0
3	Tutorial	0
4	Others (specify) **Research Subject and / or Training, and Report Writing**	72
	Total	72

B. Course Objectives and Learning Outcomes

1. Course Description

This course allows students to undertake a research project on a topic of interest within the field of applied statistics and / or a training in a public or private company under the guidance of a supervisor

2. Course Main Objective

- **This course enables the student to carry out a sustained, guided, and independent study of a specific topic in applied statistics.**
- **The student is asked to develop competency in independence thinking, documentation, analyses of data, as well as presentation of results.**

- The student learns how to develop experience in report-writing, oral presentation, and visual presentation.
- The student summarizes the obtained results and / or the training by writing a report and presenting a general report of the project.

3. Course Learning Outcomes

	CLOs After successful completion of the course, students will able to:	Aligned PLOs
1	Knowledge and Understanding	
1.1	To apply knowledge and skills to a research problem and / or a training	K1, K2
1.2	To provide in-depth knowledge of currently active research areas in applied statistics	K1, K2
2	Skills:	
2.1	To acquire a skill set relevant to a specific research project and / or a training	S1, S2
2.2	To acquire experience in searching and assessing current literature.	S5
2.3	To analyze arguments in relation with their premises, assumptions, contexts, and conclusions.	S3, S4
2.4	To use Internet in searching for scientific information.	S5
3	Values:	
3.1	To communicate knowledge and skills gained in conducting a research project.	V1, V3
3.2	To comprehend information accessed through reading and discussion.	V1, V2

C. Course Content

No	*List of Topics*	*Contact Hours*
1	The student undertakes a supervised independent study in some specific topic. He/she undertakes a review of the research documentation and / or the training in an active field of Applied Statistics under the guidance a supervisor	72
	Total	72

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	*Course Learning Outcomes*	*Teaching Strategies*	*Assessment Methods*
1.0	**Knowledge and Understanding**		
1.1	To apply knowledge and skills to a research problem	Using scientific documents in connection with the project's topic. Discussion with the supervisor	Continuous Assessment of student work and progress Presentation of results
1.2	To provide in-depth knowledge of currently active research areas in applied statistics	Discussion with the supervisor. The student raises questions regarding the accessed documents.	Continuous Assessment of student work and progress Presentation of results
2.0	**Skills**		
2.1	To acquire a skill set relevant to a specific research project	Reading documents related to the project's topics. Discussion with the supervisor	Continuous Assessment of student work and progress
2.2	To acquire experience in searching and assessing current literature	Reading and exploring documents related to the project's topics.	Presentation of results
2.3	To analyze arguments, in relation to their premises, assumptions, contexts, and conclusions	Discussion with the supervisor	Continuous Assessment of student work and progress
2.4	To use Internet in searching for scientific information.	Guidance and orientation of the supervisor	Presentation of results
3.0	**Values**		
3.1	To communicate knowledge and skills gained in conducting a research project	Discussion with the supervisor	Presentation of results
3.2	To comprehend information accessed through reading and discussion	Discussion with the supervisor	Continuous Assessment of student work and progress

2. Assessment Tasks for Students

#	*Assessment task**	*Week Due*	*Percentage of Total Assessment Score*
1	First continuous evaluation (reported by the supervisor)	4th week	20%
2	Second continuous evaluation (reported by the supervisor)	8th week	30%
3	Written report in English	During the semester	50%
4	Short talk in English language (oral presentation 15 minutes)	13th week	

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

- **The student is assigned an academic advisor who provides academic and career advice as well as general counseling.**
- **The supervisor will allocate 6 office hours per week; these times will be advertised on the office door and reserved as part of his teaching schedule to help the student on any possible difficulties in conducting the research project.**

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	**The student will be guided by study notes, books, research articles, ... The use of the Internet and the local networks is highly advisable for the student to access the necessary scientific documents.** **The student will need to master some appropriate research topics and / or a training, and ultimately present his/her work in the form of a final presentation. Other appropriate learning resources are possible depending on the nature of the research project.**
Essential References Materials	**Subject dependent**
Electronic Materials	**Subject dependent**
Other Learning Materials	**Subject dependent**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	▪ **Each of the class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**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**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	**See the Attached File**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment, Quality of learning resources	**Students**	**During the semester and at the end of the project, each student will complete two evaluation forms.**
Extent of achievement of course learning outcomes, Quality of learning resources	**Instructor**	**During the semester and at the end of the project, the instructor completes two evaluation forms appraising progress in the project and identifying changes that need to be made if necessary.**

Evaluation areas *(e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)*

Evaluators *(Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)*

Assessment Methods *(Direct, Indirect)*

H. Specification Approval Data

Council / Committee	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
Reference No.	**11/1444**
Date	**22/04/1444 (16/11/2022)**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

T4 2020

Course Specifications

Course Title:	**Calculus (1)**
Course Code:	**MAT 1101**
Program:	**Bachelor of Science in Applied Mathematics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours:	**5 (4 Lectures, 0 Lab, 2 Tutorial)**
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐	
3. Level/year at which this course is offered:	**Level 1 / Year 1**
4.Pre-requisites for this course (if any)**:**	**None**
5. Co-requisites for this course (if any)**:** **None**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	72	100%
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	48
2	Laboratory/Studio	0
3	Tutorial	24
4	Others (specify)	0
	Total	72

B. Course Objectives and Learning Outcomes

1. Course Description

This course describes the most important ideas, theoretical results, and examples of limit, continuity, differentiation and its applications for functions with one variable. The course includes the essential fundamentals of these topics. The emphasis is on calculations, and some applications are mentioned.

2. Course Main Objective

Understanding basics of differentiation and integration and their applications which are essential to proceed to next courses in all programs.

3. Course Learning Outcomes

	CLOs Upon successful completion of this course, students will be able to:	Aligned-PLOs
1	Knowledge and Understanding	
1.1	Identify various types of limits of functions of one variable (graphically, numerically and algebraically)	K1, K2
1.2	Describe different techniques of differentiation and its applications.	K1, K2

CLOs Upon successful completion of this course, students will be able to:		Aligned-PLOs
2	**Skills:**	
2.1	**Use differentiation and integration to solve real world problems such as rate of change, optimization, and area problems.**	**S1, S2**
2.2	**Demonstrate the connection between area and the definite integral through Fundamental theorem of Calculus.**	**S4**
2.3	**Draw graphs of functions handily and by using CAS and online solvers.**	**S5**
2.4	**State, clearly and precisely both orally and in writing, areas and definite integrals by Riemann sums**	**S3**
3	**Values:**	
3.1	**Work individually.**	**V1, V3**
3.2	**Develop personal values and attributes such as honesty, empathy and respect for others.**	**V1, V2**

C. Course Content

No	List of Topics	Contact Hours
1	**Preliminaries:** Solving Linear Equations and Inequalities, Absolute value, Solving Inequalities Containing an Absolute Value, Equations of lines, Quadratic Equations and Inequalities, Special Product Formulas, Polynomials, Factoring Polynomials; Functions: Domain, Range, and graphs of functions, Common Functions, Composition of functions, Inverse function; Trigonometry: Unit Circle, Angles and their Measurements, Solving Equations Involving Sines and Cosines, Important Trigonometric Identities, Trigonometric Functions (Sine, Cosine, and Tangent Function), Inverses Trigonometric Functions, Exponential and Logarithmic Functions, Laws of Exponents and Logarithms.	20
2	**Limits and Continuity:** The Concept of Limit, Formal definition of limit, Limit Theorems, Limits Involving Infinity, Asymptotes, The natural number e as a limit, Continuity of functions, Operations on continuous functions, Intermediate value theorem, The Bisection Method, Formal definition of the limit.	16
3	**Differentiation:** Tangent Lines and Velocity, The Derivative, Computation of Derivatives: The Power Rule, Higher Order Derivatives, The Product and Quotient Rules, The Chain rule, Derivatives of Trigonometric Functions and their inverses, Derivatives of Exponential and Logarithmic Functions, Implicit Differentiation, The Rule Theorem, The Mean Value Theorem.	18
4	**Applications of Differentiation:** Indeterminate Forms and L'Hopital's Rule, Maxima and minima values, Monotonic functions and the first derivative test, Concavity and the second derivative test, Graphing functions.	18
Total		72

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**Identify various types of limits of functions of one variable**	**• 4 lecture hours\week**	**• Regular Exams**

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	(graphically, numerically and algebraically)	• 2 tutorial hours\week • Self-study	• Assignments • Short Quizzes
1.2	Describe different techniques of differentiation and its applications.		
2.0	Skills		
2.1	Use differentiation and integration to solve real world problems such as rate of change, optimization, and area problems.	• Self-study • Real-life problems	• Participations • Short Quizzes
2.2	Demonstrate the connection between area and the definite integral through Fundamental theorem of Calculus.	Self-study	Participations
2.3	Draw graphs of functions handily and by using CAS and online solvers.	Real-life problems	Short Quizzes
2.4	State, clearly and precisely both orally and in writing, areas and definite integrals by Riemann sums	Self-study	Participations
3.0	Values		
3.1	To work individually.	Personal questions	Participation
3.2	Develop personal values and attributes such as honesty, empathy and respect for others.	Team work and class discussions.	Homework and Mini-projects

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homeworks, Quizzes, Mini-projects	During the term	20%
2	First Midterm	Week 4-5	20%
3	Second Midterm	Week 7-8	20%
4	Final Exam	Week 13	40%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- **There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.**
- **All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	***Calculus***, 4th Edition, R. T. Smith, R. B. Minton, McGraw-Hill, 2012. **(Main Reference)**
Essential References Materials	**1.** ***Calculus***; O. Swokowski, et al, PWS Pub. Co.; 6th Edition, 1994. **2.** ***Calculus: Early Transcendentals***, 7th Edition; C. Henry Edwards, David E. Penney, Pearson Prentice Hall, 2008.

	3. ***Essential Calculus with Application***; Richard A. Silverman, Dover Publications, 1989. 4. ***Schaum's Outline of Calculus***, 6th Edition; Frank Ayres, Elliott Mendelson, McGraw-Hill, 2013.
Electronic Materials	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms should be equipped with data show and Smart Board.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	**None.**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment, Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
Extent of achievement of course learning outcomes, Quality of learning resources	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL
Reference No.	11/1444
Date	22/04/1444 (16/11/2022)

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

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Course Specifications

Course Title:	Calculus (2)
Course Code:	MAT 1102
Program:	Bachelor of Science in Applied Mathematics
Department:	Mathematics and Statistics
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University

Table of Contents

A. Course Identification

1. Credit hours:	**5 (4 Lectures, 0 Lab, 2 Tutorial)**
2. Course type **a.** University ☐ College ☐ Department ☐ Others ☐ **b.** Required ☐ Elective ☐	
3. Level/year at which this course is offered:	**Level 2 / Year 1**
4.Pre-requisites for this course (if any)**:**	**MAT 1101**
5. Co-requisites for this course (if any)**:** **None**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	72	100%
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	48
2	Laboratory/Studio	0
3	Tutorial	24
4	Others (specify)	0
	Total	72

B. Course Objectives and Learning Outcomes

1. Course Description

This course describes the most important ideas, theoretical results, and examples of integration technics, infinite series, and parametric equations. The course includes the essential fundamentals of these topics. The emphasis is on calculations, and some applications are mentioned.

2. Course Main Objective

- **To understand the meaning of definite integral as a limit of Riemann sum.**
- **To learn different techniques of integration.**
- **To understand the applications of definite integrals to physics and Engineering.**
- **To develop the basics of the calculus of infinite series, and their applications.**

3. Course Learning Outcomes

	CLOs Upon successful completion of this course, students will be able to:	Aligned-PLOs
1	**Knowledge and Understanding:**	
1.1	**Identify different techniques of integration and improper integrals.**	**K1, K2**
1.2	**List theorems and tests of convergence of sequences and series.**	**K1, K2**
2	**Skills:**	
2.1	**Use the concepts of definite integrals to solve problems involving area, volume, work, and other physical applications.**	**S1, S2**
2.2	**Apply the concepts of limits, convergence, and divergence to evaluate some classes of infinite series and/or improper integrals.**	**S4**
2.3	**Illustrate the revolution of a solid region using CAS and online solvers.**	**S5**
2.4	**State clearly and precisely both orally and in writing, Taylor or MacLaurin series to estimate the representation of functions as power series.**	**S3**
3	**Values:**	
3.1	**Shows self-reliance when working independently.**	**V1, V3**
3.2	**Develop constructive and supportive relationships with classmates.**	**V1, V2**

C. Course Content

No	List of Topics	Contact Hours
1	**Integration:** Anti-derivatives, Indefinite Integral and its properties, Sums and Sigma Notation, Partitions and Riemann sums, Area under curves and The Definite Integral, First and Second Fundamental Theorems of Calculus.	**14**
2	**Integration Techniques:** Integration by Substitution, Integration by Parts, Integration of Rational Functions Using Partial Fractions, Trigonometric Techniques of Integration, Integrals involving logarithmic, exponential, and hyperbolic functions, Improper Integrals.	**18**
3	**Applications of Definite Integrals:** Area between curves, Volumes by slicing, Volumes using Cylindrical Shells, Arc Length and Surface Area.	**10**
4	**Infinite Series:** Sequences of Real Numbers, Convergence and Divergence of Infinite Sequences, Formal definition of a convergent sequence, Infinite Series, Basic Infinite Series (geometric series, p-series, alternating series, telescoping series), Convergence Tests for Positive Series (ratio test, root test, comparison and limit comparison test, integral test), Alternating Series, Absolute and Conditional Convergence, Power Series, Differentiation ad Integration of power series, Taylor and Maclaurin Series, Convergence of Taylor series, Applications of Taylor and Maclaurin Series.	**20**
5	**Parametric equations:** Plane Curves and Parametric Equations, Calculus and Parametric Equations, Arc Length and Surface in Parametric Equations.	**10**
	Total	**72**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding:**		
1.1	Identify different techniques of integration and improper integrals.	• 4 lecture hours\week • 2 tutorial hours\week • Self-study	• Regular Exams • Assignments • Short Quizzes
1.2	List theorems and tests of convergence of sequences and series.		
2.0	**Skills**		
2.1	Use the concepts of definite integrals to solve problems involving area, volume, work, and other physical applications.	• Self-study • Real-life problems	• Participations • Short Quizzes
2.2	Apply the concepts of limits, convergence, and divergence to evaluate some classes of infinite series and/or improper integrals.	Self-study Real-life problems	Participations Short Quizzes
2.3	Illustrate the revolution of a solid region using CAS and online solvers.	Self-study Real-life problems	Participations Short Quizzes
2.4	State clearly and precisely both orally and in writing, Taylor or MacLaurin series to estimate the representation of functions as power series.	Self-study Real-life problems	Participations Short Quizzes
3.0	**Values**		
3.1	Shows self-reliance when working independently.	Class discussion	Participation
3.2	Develop constructive and supportive relationships with classmates.	Team work	Homework and Mini-projects

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Home works, Quizzes, Mini-projects	During the term	20%
2	First Midterm	Week 4-5	20%
3	Second Midterm	Week 7-8	20%
4	Final Exam	Week 13	40%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

- There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.
- All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	***Calculus,*** 4^{th} Edition; R. T. Smith, R. B. Minton, McGraw-Hill, 2012. **(Main Reference)**
Essential References Materials	1. ***Essential Calculus with Application;*** Richard A. Silverman, Dover Publications, 1989. 2. ***Calculus***; O. Swokowski, et al, PWS Pub. Co.; 6^{th} Edition, 1994. 3. ***Calculus: Early Transcendentals,*** 7^{th} Edition; C. Henry Edwards, David E. Penney, Pearson Prentice Hall, 2008. 4. ***Schaum's Outline of Calculus,*** 6^{th} Edition; Frank Ayres, Elliott Mendelson, McGraw-Hill, 2013.
Electronic Materials	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms should be equipped with data show and Smart Board.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	**None.**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment, Quality of learning resources	Students	During the semester and at the end of the course each student will complete two evaluation forms.
Extent of achievement of course learning outcomes, Quality of learning resources	Instructor	At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL
Reference No.	11/1444
Date	22/04/1444 (16/11/2022)

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA
T4
2020

Course Specifications

Course Title:	**Foundations of Mathematics**
Course Code:	**MAT 1151**
Program:	**Bachelor of Science in Applied Statistics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours:	**5 (4 Lectures, 0 Lab, 2 Tutorial)**
2. Course type	
a. University ☐ College ☐ Department ☑ Others ☐	
b. Required ☑ Elective ☐	
3. Level/year at which this course is offered:	**Level 3 / Year 1**
4.Pre-requisites for this course (if any): **None**	
5. Co-requisites for this course (if any): **None**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	72	100%
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	48
2	Laboratory/Studio	0
3	Tutorial	24
4	**Others** (specify)	0
	Total	72

B. Course Objectives and Learning Outcomes

1. Course Description

This course describes the most important ideas, theoretical results, and examples of logic, set theory, methods of proof, relations, functions and basics of algebraic structures limit. The course includes the essential fundamentals of these topics. The emphasis is on step by step reasoning and mathematical thinking.

2. Course Main Objective

- To give students the rudiments of mathematical logic and set theory.
- To introduce the important concepts of relations, functions, and binary operations.
- To expose students to some abstraction by presenting the group concept and studying some of its elementary properties. To learn about vector calculus.

3. Course Learning Outcomes

	CLOs Upon successful completion of this course, students will be able to:	Aligned-PLOs
1	**Knowledge and Understanding**	
1.1	Reproduce proofs of basic set-theoretic identities involving unions, intersections, and Cartesian products.	K1, K2
1.2	Recognize the concept of Logic including truth table logical statement, set theory ,method of proofs and basics of algebraic structures.	K1, K2
2	**Skills**	
2.1	Construct proofs using a variety of proof techniques including: direct proofs, proofs by contraposition and contradiction, proofs by mathematical induction to solve a given problem.	S1, S2
2.2	Formulate in logical the negation, converse, and contrapositive of a quantified implication, both linguistically and in Mathematical symbolic form.	S4
2.3	Analyze carefully abstract proofs to provide appropriate instances.	S5
2.4	Present proofs both orally and in written form using correct and concise English and mathematical grammar.	S3
3	**Values:**	
3.1	Aspire to improve and develop, learning from mistakes;	V1, V3
3.2	Engage in group discussions and critical interactions.	V1, V2

C. Course Content

No	List of Topics	Contact Hours
1	**Logic:** Statements, Negation, and Compound Statements, Truth Tables and Logical Equivalences, Conditional and Biconditional Statements, Open Statements and Quantifiers.	**12**
2	**Set Theory:** Sets and Subsets, Operations on Sets, Generalized Set Union and Intersection, Cartesian Product.	**9**
3	**Methods of Proofs:** Direct proof method; Contrapositive proof method; Proof by contradiction; If and only if proof; Existence proof and counterexample method; Mathematical induction and its strong version.	**15**
4	**Relations:** Binary Relations, Reflexive, Symmetric, antisymmetric, and Transitive Relations, Equivalence Relations, Equivalence Classes, and Partitions, The Order Relations.	**15**
5	**Functions:** Functions, Onto Functions, One-to-One Functions, The bijection function, Inverse of a Function, Images and Inverse Images of Sets, Denumerable and Countable Sets, Uncountable Sets.	**9**
6	**Basics of Algebraic Structures:** Binary operations; Semigroups and Groups; Subgroups and Cyclic Groups; Rings, Integral Domains and Fields.	**12**
Total		**72**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	Knowledge and Understanding		
1.1	**Reproduce proofs of basic set-theoretic identities involving unions, intersections, and Cartesian products.**	• **2 lecture hours\week** • **2 tutorial hours\week** • **Self-study**	• **Regular Exams** • **Assignments** • **Short Quizzes**
1.2	**Recognize the concept of Logic including truth table logical statement, set theory ,method of proofs and basics of algebraic structures.**	• **2 lecture hours\week** • **2 tutorial hours\week** **Self-study**	• **Regular Exams** • **Assignments** **Short Quizzes**
2.0	Skills		
2.1	**Construct proofs using a variety of proof techniques including: direct proofs, proofs by contraposition and contradiction, proofs by mathematical induction to solve a given problem.**	• **Self-study** • **Real-life problems**	• **Participations** • **Short Quizzes**

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.2	Formulate in logical the negation, converse, and contrapositive of a quantified implication, both linguistically and in Mathematical symbolic form.	Self-study Real-life problems	Participations
2.3	Analyze carefully abstract proofs to provide appropriate instances.	Self-study Real-life problems	Short Quizzes
2.4	Present proofs both orally and in written form using correct and concise English and mathematical grammar.	Self-study Real-life problems	Participations
3.0	Values		
3.1	Aspire to improve and develop, learning from mistakes;	Class discussion	Participation
3.2	Engage in group discussions and critical interactions.	Team work and class discussion.	Homework and Mini-projects

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homeworks, Quizzes, Mini-projects	During the semester	20%
2	First Midterm	Week 4-5	20%
3	Second Midterm	Week 7-8	20%
4	Final Exam	Week 13	40%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice: • There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems. • All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	1. *Introduction to Mathematical Proofs: A Transition*, C. Roberts; Champan & Hall/CRC 2010. **(Main Reference)** 2. *A Primer for Logic and Proof*, **H. P. Hirst and J. L. Hirst, webdraft, (2011-2012 Ed.), 2012.**
Essential References Materials	1. ***Mathematical Thinking & Writing: A transition to Abstract Math***, R. Maddox, Academic Press, 2002.

	2. ***Mathematical Proofs: A Transition to Advanced Mathematics***, 3rd Edition, Gary Chartrand, Albert D. Polimeni, Ping Zhang, Pearson, 2014.
Electronic Materials	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms should be equipped with data show and Smart Board.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	**None.**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment, Quality of learning resources.	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
Extent of achievement of course learning outcomes, Quality of learning resources.	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)

Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
Reference No.	**11/1444**
Date	**22/04/1444 (16/11/2022)**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAA
T4
2020

Course Specifications

Course Title:	**Calculus (3)**
Course Code:	**MAT 1203**
Program:	**Bachelor of Science in Applied Mathematics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours:	**5 (4 Lectures, 0 Lab, 2 Tutorial)**						
2. Course type							
a.	University ☐	College ☐	Department ▯	Others ☐			
b.	Required ▯	Elective ☐					
3. Level/year at which this course is offered:	**Level 4 / Year 2**						
4.Pre-requisites for this course (if any)**:**	**MAT 1102**						
5. Co-requisites for this course (if any)**:**	**None**						

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	72	100%
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	48
2	Laboratory/Studio	0
3	Tutorial	24
4	Others (specify)	0
	Total	72

B. Course Objectives and Learning Outcomes

1. Course Description

Creating a deep background of multivariable calculus and its applications which is essential to proceed to next courses.

2. Course Main Objective

- **To demonstrate ability to work with different geometries in the space.**
- **To study functions of several variables and partial differentiation.**
- **To be able to set up and compute multiple integrals in rectangular, polar, cylindrical and spherical coordinates.**
- **To master the vector operations in different coordinate systems.**

3. Course Learning Outcomes

	CLOs	Aligned-PLOs
1	**Knowledge and Understanding**	
1.1	**Describe parametric and polar curves in plane and recognize regions and quadric surfaces in space.**	**K1, K2**
1.2	**Express double and triple integrals in different coordinate systems. in rectangular, polar, cylindrical, and spherical.**	**K1, K2**
2	**Skills:**	
2.1	**Apply the computational and conceptual principles of vector calculus, including partial derivatives and multiple integrals, to the solutions of various problems**	**S1, S2**
2.2	**Interpret, clearly and precisely both orally and in writing, calculus operations on vector-valued functions including limits, derivatives, integrals, curvature, and the description of motion in plane and space.**	**S4**
2.3	**Illustrate figures in different coordinates using a CAS and some online solvers.**	**S5**
2.4	**Calculate arc length /surface/volume of regions in 2 and 3 dimensions, in Cartesian, polar, cylindrical, and spherical coordinate systems, directional derivatives, equations of tangent planes, and gradient vectors.**	**S3**
3	**Values:**	
3.1	**listen to the teacher's explanation of the Mathematics reasoning and illustration of 3D figures.**	**V1, V3**
3.2	**Show attitude of support the use of computers in learning/teaching mathematics**	**V1, V2**

C. Course Content

No	List of Topics	Contact Hours
1	**Vectors and Geometry of Space:** Vectors in Space, Dot Product, Cross Product, Equations of Lines and Planes in Space, Quadratic Surfaces in Space.	**14**
2	**Vector-Valued Functions:** Vector-Valued Functions, Calculus of Vector Functions, Motion in Space, Curvature, Tangent and Normal Vectors.	**14**
3	**Functions of several variables:** Functions of Several Variables, Limits and Continuity, Partial Derivatives, Differentiability, The Total Derivative, The Directional Derivatives and Gradient, Tangent Plane and Linear Approximation, Taylor's Theorem in Severable variables, Chain Rule, Maxima and Minima, Method of Lagrange Multipliers.	**22**
4	**Multiple Integrals:** Double Integrals in Cartesian Coordinates, Areas and Volumes, Polar Coordinates, Double Integrals in Polar Coordinates, Surface Area, Triple Integrals in Cartesian Coordinates, Cylindrical and Spherical Coordinates, Triple Integrals in Cylindrical and Spherical Coordinates, Change of Variables in Multiple Integrals.	**22**
Total		**72**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	Describe parametric and polar curves in plane and recognize regions and quadric surfaces in space.	lecture hours\week tutorial hours\week Self-study	• Regular Exams • Assignments • Short Quizzes
1.2	Express double and triple integrals in different coordinate systems. in rectangular, polar, cylindrical, and spherical.	lecture hours\week tutorial hours\week Self-study	• Regular Exams • Assignments Short Quizzes
2.0	**Skills:**		
2.1	Apply the computational and conceptual principles of vector calculus, including partial derivatives and multiple integrals, to the solutions of various problems.	• Self-study • Real-life problems	• Participations • Short Quizzes
2.2	Interpret, clearly and precisely both orally and in writing, calculus operations on vector-valued functions including limits, derivatives, integrals, curvature, and the description of motion in plane and space.	Self-study	Participations
2.3	Illustrate figures in different coordinates using a CAS and some online solvers.	Real-life problems	Short Quizzes
2.4	Calculate arc length /surface/volume of regions in 2 and 3 dimensions, in Cartesian, polar, cylindrical, and spherical coordinate systems, directional derivatives, equations of tangent planes, and gradient vectors.	Self-study	Participations
3.0	**Values:**		
3.1	listen to the teacher's explanation of the Mathematics reasoning and illustration of 3D figures.	Class discussion	Participation
3.2	Show attitude of support the use of computers in learning/teaching mathematics	Problem solving, Class discussion	Homework and Mini-projects and presentation

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Home works, Quizzes, Mini-projects	During the term	20%
2	First Midterm	Week 4-5	20%
3	Second Midterm	Week 7-8	20%
4	Final Exam	Week 13	40%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice: ● **There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.** ● **All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	▪ ***Calculus***, 4th Edition; R. T. Smith, R. B. Minton, McGraw-Hill, 2012**. (Main Reference)**
Essential References Materials	▪ ***Advanced Engineering Mathematics, 8th Edition, E. Kreyszig, John Wiley & Sons, INC, 1998.*** ▪ ***Calculus, 6th Edition, O. Swokowski, et al, PWS Pub. Co., 1994.*** ▪ ***Calculus Early Transcendentals, 7th Edition; C. Henry Edwards, David E. Penney, Prentice Hall, 2008.*** ▪ ***Calculus, 1st Edition, F. Ayres & E. Mendelson, Schaum's Outline McGraw-Hill, 1999.***
Electronic Materials	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms should be equipped with data show and Smart Board.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	**None.**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment, Quality of learning resources	Students	During the semester and at the end of the course each student will complete two evaluation forms.
Extent of achievement of course learning outcomes, Quality of learning resources	Instructor	At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL
Reference No.	11/1444
Date	22/04/1444 (16/11/2022)

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	**Linear Algebra**
Course Code:	**MAT 1223**
Program:	**Bachelor of Science in Applied Mathematics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours:	**5 (4 Lectures, 0 Lab, 2 Tutorial)**
2. Course type **a.** University ☐ College ☐ Department ☐ Others ☐ **b.** Required ☐ Elective ☐	
3. Level/year at which this course is offered:	**Level 4 / Year 2**
4.Pre-requisites for this course (if any)**:**	**MAT 1151**
5. Co-requisites for this course (if any)**:**	**None**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	72	100%
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	48
2	Laboratory/Studio	0
3	Tutorial	24
4	Others (specify)	0
	Total	72

B. Course Objectives and Learning Outcomes

1. Course Description

This course describes the most important ideas, theoretical results, and examples of matrices, vector spaces, linear transformations, eigenvalues and eigenvectors. The course includes the essential fundamentals of these topics. The emphasis is on calculations.

2. Course Main Objective

- **To provide students with a good understanding about matrices concept and methods of linear algebra**
- **To let students be familiar with basics of vector spaces and linear transformations.**
- **To connect linear algebra to other fields.**

3. Course Learning Outcomes

CLOs Upon successful completion of this course, students will be able to:		Aligned-PLOs
1	Knowledge and Understanding	
1.1	Recognize concept of concepts of linear algebra matrix and determinant and eigenvalues.	K1, K2
1.2	Identify structure and features of vector space and linear dependence and linear independence.	K1, K2
2	Skills:	
2.1	Find inverse of a square matrix by using its determinant and extension matrix to solve some world-real problems.	S1, S2
2.2	State, clearly and precisely both orally and in writing, the general solution of at most a 4×4 linear system using appropriate method of linear algebra matrix including Gaussian elimination and matrix inversion.	S4
2.3	Use CAS and online solver to manipulate matrices.	S5
2.4	Compute eigenvalues and eigenvectors of square matrix to produce the diagonalization of the matrix.	S3
3	Values:	
3.1	Work individually and in group	V1, V3
3.2	Show attitude of support the use of computers in Matrix manipulation.	V1, V2

C. Course Content

No	List of Topics	Contact Hours
1	**Matrices and Gauss Elimination:** Linear Systems and Matrices (Gauss Eliminations, Echelon & Reduced Echelon Forms, Matrix Operations, Matrix Inverses), Determinants (Minor & Cofactors, Evaluating Determinants, Cramer's Rule, Adjoints & Matrix Inverses).	20
2	**Vector Spaces:** Spaces $\mathbb{R}2$ & $\mathbb{R}3$ and their Geometry, Vector Spaces and Subspaces, Euclidean Vector Spaces $\mathbb{R}n$, Linear Dependence & Independence, Basis and Dimensions of Vector Space, Change of a Basis- Inner Products (Norms, Angle and Orthogonality).	20
3	**Linear Transformations:** Definition and Basics, The Kernel and the Image, Linear Transformation Matrix, Nonsingular Transformations and their Inverses, The Direct Sum, The Dimension Theorem.	18
4	**Eigenvalues and Eigenvectors:** Characteristic Polynomial, Eigenvalues, Eigenvectors, Diagonalization, Triangulation, Matrix Powers.	14
Total		72

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	Knowledge and Understanding		
1.1	Recognize concept of concepts of linear algebra matrix and determinant and eigenvalues.	• 4 lecture hours\week • 2 tutorial hours\week	• Regular Exams • Assignments • Short Quizzes

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
		• Self-study	
1.2	Identify structure and features of vector space and linear dependence and linear independence.	• 4 lecture hours\week • 2 tutorial hours\week Self-study	• Regular Exams • Assignments Short Quizzes
2.0	**Skills:**		
2.1	Find inverse of a square matrix by using its determinant and extension matrix to solve some world-real problems.	• Self-study • Real-life problems	• Participations • Short Quizzes
2.2	State, clearly and precisely both orally and in writing, the general solution of at most a 4×4 linear system using appropriate method of linear algebra matrix including Gaussian elimination and matrix inversion.	Regular Exams	Participations
2.3	Use CAS and online solver to manipulate matrices.	Assignments	Short Quizzes
2.4	Compute eigenvalues and eigenvectors of square matrix to produce the diagonalization of the matrix.	Short Quizzes	Participations
3.0	**Values:**		
3.1	Work individually and in group	Class activities	Individual and group coursework
3.2	Show attitude of support the use of computers in Matrix manipulation.	Class discussion	participation

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Home works, Quizzes, Mini-projects	During the term	20%
2	First Midterm	Week 4-5	20%
3	Second Midterm	Week 7-8	20%
4	Final Exam	Week 13	40%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

- There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.
- All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	▪ *Elementary Linear Algebra;* **11th Edition; H. Anton, C. Rorres, Wiley, 2014. (Main Reference)**
Essential References Materials	▪ *Linear Algebra with Application,* **5th Edition; W. K. Nicholson, McGraw- Hill, 2006.** ▪ *Linear Algebra with Application,* **4th Edition; O. Bretscher; Pearson Ed. Int., 2009.** ▪ *Linear Algebra, Schaum's Outline,* **S. Lipschutz, M. Lipson, McGraw-Hill 3rd Edition, 2000**
Electronic Materials	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms should be equipped with data show and Smart Board.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	**None.**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment, Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
Extent of achievement of course learning outcomes, Quality of learning resources	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL
Reference No.	11/1444
Date	22/04/1444 (16/11/2022)

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAA T4 2020

Course Specifications

Course Title:	Introduction to Differential Equations
Course Code:	MAT 1231
Program:	Bachelor of Science in Applied Mathematics
Department:	Mathematics and Statistics
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University

Table of Contents

A. Course Identification

1. Credit hours:	5 (4 Lectures, 0 Lab, 2 Tutorial)
2. Course type **a.** University ☐ College ☐ Department ▯ Others ☐ **b.** Required ▯ Elective ☐	
3. Level/year at which this course is offered:	Level 6 / Year 2
4.Pre-requisites for this course (if any)**:**	MAT 1102, MAT 1223
5. Co-requisites for this course (if any)**:**	None

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	72	100%
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	48
2	Laboratory/Studio	0
3	Tutorial	24
4	Others (specify)	0
	Total	72

B. Course Objectives and Learning Outcomes

1. Course Description

This course describes the most important ideas, theoretical results, and examples of first order differential equations, second and higher order linear differential equations, Laplace transform and linear systems of linear differential equations. The course includes the essential fundamentals of these topics. The emphasis is on calculations, and some applications are mentioned. The use of Symbolic MATLAB software to solve differential equations is essential.

2. Course Main Objective

- Classify differential equations by order, linearity, and homogeneity.
- Be familiar with techniques for solving first, second and higher order differential equations.
- Solve systems of linear differential equations solving linear system of differential equations using matrix techniques and eigenvalues and notion of the exponential of matrices.
- Use Laplace transforms to solve differential equations and systems of differential equations.

3. Course Learning Outcomes

	CLOs Upon successful completion of this course, students will be able to:	Aligned-PLOs
1	**Knowledge and Understanding:**	
1.1	**Summarize the concept of ordinary differential equations, the meaning of the meaning of their solutions, and the methods to find them.**	**K1, K2**
1.2	**Classify differential equations with respect to their order and linearity to match the corresponding methods to solve them.**	**K1, K2**
2	**Skills:**	
2.1	**Solve real-world problems involving Cauchy-Euler equations Bernoulli, Ricatti differential equations and other initial value problems in fields of such as economics, engineering, and the sciences.**	**S1, S2**
2.2	**Formulate, clearly and precisely, differential equations to solve various applied problems.,**	**S4**
2.3	**Using Symbolic MATLAB software and online CAS to find and visualize solutions of differentia equations.**	**S5**
2.4	**Solve first-order and second-order and high-order ordinary differential equations using the appropriates methods including integration, the method of undetermined coefficients, the method of variations of parameters, Laplace transform.**	**S3**
3	**Values:**	
3.1	**Engage in group discussions and critical interactions**	**V1, V3**
3.2	**differentiate between valid and fallacious Mathematical arguments to model real problem involving differential equations.**	**V1, V2**

C. Course Content

No	List of Topics	Contact Hours
1	**First order differential equations:** Separable equations, First order linear equations, Exact differential equations, Homogeneous differential equations, Bernoulli equations, Riccati equations.	**14**
2	**Second order linear differential equations:** General solution of the homogeneous linear equation with constant coefficients, Particular solution of the non-homogeneous equation, Method of Undetermined Coefficients, Variation of Parameters Method.	**14**
3	**Higher order linear differential equations:** General theory of linear differential equations, Homogeneous linear equations with constant coefficients, Undetermined Coefficients Method, Variation of Parameters Method.	**10**
4	**Laplace Transforms:** Basic definitions and properties, First shifting theorem, Partial fractions, Differentiation and integration of Laplace transforms, Laplace transform of some particular discontinuous functions, the unit step function, Dirac function, shifting on the t- axes and second shifting theorem, Inverse of Laplace transform, Convolution, Solving Initial Value Problems Using Laplace Transforms.	**16**
5	**Linear systems of differential equations:** Superposition principle, Independence, Matrix exponential, Basic theory of systems of first order linear equations, Homogeneous linear systems with constant coefficients, non-homogeneous linear systems of differential equations.	**12**

6	**Using Symbolic MATLAB software to solve differential equations.** Brief introduction to symbolic MATLAB software, solving some generic ODE with examples.	**6**
Total		**72**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding:**		
1.1	**Summarize the concept of ordinary differential equations, the meaning of the meaning of their solutions, and the methods to find them.**	• 4 lecture hours\week • 2 tutorial hours\week • Self-study	• Regular Exams • Assignments • Short Quizzes
1.2	**Classify differential equations with respect to their order and linearity to match the corresponding methods to solve them.**	• 4 lecture hours\week • 2 tutorial hours\week Self-study	• Regular Exams • Assignments Short Quizzes
2.0	**Skills:**		
2.1	**Solve real-world problems involving Cauchy-Euler equations Bernoulli, Ricatti differential equations and other initial value problems in fields of such as economics, engineering, and the sciences.**	Self-study Real-life problems	Participations Short Quizzes
2.2	**Formulate, clearly and precisely, differential equations to solve various applied problems.,**	Self-study Real-life problems	Participations Short Quizzes
2.3	**Using Symbolic MATLAB software and online CAS to find and visualize solutions of differentia equations.**	Self-study Real-life problems	Participations Short Quizzes
2.4	**Solve first-order and second-order and high-order ordinary differential equations using the appropriates methods including integration, the method of undetermined coefficients, the method of variations of parameters, Laplace transform.**	Self-study Real-life problems	Participations Short Quizzes
3.0	**Values:**		
3.1	**Engage in group discussions and critical interactions**	Class discussion and team work	Participation and homework report.
3.2	**differentiate between valid and fallacious Mathematical arguments to model real problem involving differential equations.**	Class discussion	Participation, mini-project and homework.

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Home works, Quizzes, Mini-projects	During the term	20%
2	First Midterm	Week 4-5	20%

#	Assessment task*	Week Due	Percentage of Total Assessment Score
3	**Second Midterm**	**Week 7-8**	**20%**
4	**Final Exam**	**Week** 13	**40%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

- **There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.**
- **All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	▪ ***Elementary Differential Equations and Boundary Value Problems,*** W. Boyce and R. DiPrima, 9th Edition, New York: John Wiley & Sons, 2010. (Main Reference)
Essential References Materials	▪ ***Advanced Engineering Mathematics,*** E. Kreyszig, John Wiley & Sons, INC 10th Edition, 2010. ▪ ***Fundamentals of Differential Equations,*** R. Nagle, E. Saff and A. Snider, Addison-Wisley, 6th Edition, 2011. ▪ ***A first course in differential equations with applications,*** Dennis G. Zill, 5th Edition, PWS Kent Publishing Company, 2000.
Electronic Materials	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms should be equipped with data show and Smart Board.**
Other Resources (Specify, e.g., if specific laboratory equipment is required, list requirements or attach a list)	**None.**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment, Quality of learning resources	Students	During the semester and at the end of the course each student will complete two evaluation forms.
Extent of achievement of course learning outcomes, Quality of learning resources	Instructor	At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL
Reference No.	11/1444
Date	22/04/1444 (16/11/2022)

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	**Math Software**
Course Code:	**MAT 1241**
Program:	**Bachelor of Science in Applied Mathematics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours:	**3 (2 Lectures, 2 Lab, 0 Tutorial)**
2. Course type **a.** University ☐ College ☐ Department ▯ Others ☐ **b.** Required ▯ Elective ☐	
3. Level/year at which this course is offered:	**Level 4 / Year 2**
4.Pre-requisites for this course (if any)**:**	**MAT 1102**
5. Co-requisites for this course (if any)**:**	**None**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	48	100%
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	24
2	Laboratory/Studio	24
3	Tutorial	0
4	Others (specify)	0
	Total	48

B. Course Objectives and Learning Outcomes

1. Course Description

This course describes the most important ideas, theoretical results, and examples for an introduction in MATLAB programming. The emphasis is on calculations, and programming.

2. Course Main Objective

- **To provide an introduction to the use of some of the high-level mathematical programming language such MATLAB, Maple and Mathematica, as a practical aid in doing mathematics.**
- **To provide the student with some basic skills in the use of this software without attempting deep coverage.**

3. Course Learning Outcomes

	CLOs	Aligned-PLOs
1	**Knowledge and Understanding:**	
1.1	**Recognize the environment of software "Matlab".**	**K1, K2**
1.2	**Reproduce a range of syntaxes using Matlab.**	**K1, K2**
2	**Skills:**	
2.1	**Create code to provide a solution to a range of Mathematical problems ranging from simple to complex.**	**S1, S2**
2.2	**Design and implement, clearly and precisely, simple programs.**	**S4**
2.3	**Convert Matlab code into a given to online solver.**	**S5**
2.4	**Construct algorithms, M-file script and calculus operation design to solve mathematical problems via Matlab.**	**S3**
3	**Values:**	
3.1	**Work individually and in groups.**	**V1, V3**
3.2	**Show attitude of support the use of mathematical software in solving real life problems.**	**V1, V2**

C. Course Content

No	List of Topics	Contact Hours
1	**Starting with MATLAB:** Introduction to the software and computer, MATLAB windows, ***help*** and ***look for*** commands, arithmetic operations, Display Formats, Built-in functions, Variables assignment, Elementary built-in functions, Command line editing.	**4**
2	**Arrays:** Creating arrays (vectors, matrices), *Lin space* command, some major matrices, operators, Matrix operations in MATLAB, Array addressing, Adding and deleting elements, Strings.	**7**
3	**Other Operators:** Operator Precedence, Relational operations, Logical operations, ***all*** and ***any*** commands, ***find*** command, ***sort*** command, ***max*** and ***min*** command.	**6**
4	**2D and 3D graphs:** ***Plot*** and ***ezplot*** command, ***fplot*** command, multigraphs plots, others plot commands, axis and graphic handling, layout a figure, 3D line plot, Mesh and Surface plots, view command.	**6**
5	**Script files:** Creating and saving a file, ***disp*** and ***fprintf*** commands, loading a file, search path, defining functions, structure of a function file, ***inline*** function, ***feval*** command, local and global variables, ...	**6**
6	**Starting with MATLAB:** Introduction to the software, Command window, help and look for commands, arithmetic operations, Display Formats, Built-in functions, Variables assignment, Command line editing.	**7**
7	**Programming**: If-else structure, for and while loops, Break and continue commands, Switch-case statement.	**6**
8	**Symbolic toolbox:** Symbolic object and expressions, algebraic expression manipulation, factorization, simplification, solving equations.	**6**
Total		**48**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	Knowledge and Understanding:		
1.1	Recognize the environment of software "Matlab".	• 2 lecture hours\week • 2 tutorial hours\week • Self-study	• Regular Exams • Assignments • Short Quizzes
1.2	Reproduce a range of syntaxes using Matlab.		
2.0	Skills:		
2.1	Create code to provide a solution to a range of Mathematical problems ranging from simple to complex.	• Self-study • Real-life problems	Participations, Short Quizzes
2.2	Design and implement, clearly and precisely, simple programs.	Self-study. Real-life problems	Participations, Short Quizzes
2.3	Convert Matlab code into a given to online solver.	Self-study Real-life problems	Participations, Short Quizzes
2.4	Construct algorithms, M-file script and calculus operation design to solve mathematical problems via Matlab.	Self-study Real-life problems	Participations, Short Quizzes
3.0	Values:		
3.1	Work individually and in groups.	Personal questions	Participation
3.2	Show attitude of support the use of mathematical software in solving real life problems.	Team work	Homework and Mini-projects

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Home works, Quizzes, Mini-projects	During the term	20%
2	First Midterm	Week 4-5	20%
3	Second Midterm	Week 7-8	20%
4	Final Exam	Week 13	40%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

- There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.
- All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	▪ ***Introduction to MATLAB***, Delores Etter, Pearson Education Inc, 4th Edition, 2018. **ISBN: 978-0-13-461528-8 (Main Reference)**
Essential References Materials	▪ ***MATLAB: An Introduction with Applications,*** 3rd Edition; Amos Gilat, The Ohio State Univ. 2008. ▪ ***MATLAB Primer,*** K. Sigmon and T. Davis, Champan& Hall, 6th Edition, 2002. ▪ ***Maple V: learning Guide,*** K. Heal & K. Rickard, Springer Verlag, 1996. ▪ ***Mathematica by example,*** M. Abell& J. Braselton, Academic Express, 1997.
Electronic Materials	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms should be equipped with data show and Smart Board.**
Other Resources (Specify, e.g., if specific laboratory equipment is required, list requirements or attach a list)	**None.**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment, Quality of learning resources	Students	During the semester and at the end of the course each student will complete two evaluation forms.
Extent of achievement of course learning outcomes, Quality of learning resources	Instructor	At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL
Reference No.	11/1444
Date	22/04/1444 (16/11/2022)

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

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2020

Course Specifications

Course Title:	**Introduction to Operations Research**
Course Code:	**MAT 1253**
Program:	**Bachelor of Science in Applied Mathematics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours:	**4 (3 Lectures, 0 Lab, 2 Tutorial)**
2. Course type **a.** University ☐ College ☐ Department ▯ Others ☐ **b.** Required ▯ Elective ☐	
3. Level/year at which this course is offered:	**Level 6 / Year 2**
4.Pre-requisites for this course (if any)**:**	**MAT 1151**
5. Co-requisites for this course (if any)**:** **None**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	36
2	Laboratory/Studio	0
3	Tutorial	24
4	Others (specify)	0
	Total	60

B. Course Objectives and Learning Outcomes

1. Course Description

This course describes the most important ideas, theoretical results, and examples of an introduction to operations research. The course includes the essential fundamentals of linear and integer programming. The emphasis is on calculations, and some applications are mentioned.

2. Course Main Objective

After finishing this course, the student should be able to formulate a real problem with a linear program (if possible) and to solve it with the appropriate method (Simplex algorithm, special algorithms for transportation or assignment problems, or algorithms for integer programming) by hand (if possible) or by using TORA software.

3. Course Learning Outcomes

	CLOs Upon successful completion of this course, students will be able to	Aligned-PLOs
1	**Knowledge and Understanding:**	
1.1	**Identify a Linear Programming Problem and its formulation.**	**K1, K2**
1.2	**Summarize techniques of operations research including Linear Programming, Assignment Problem. Integer programming, simplex, duality and sensitive analysis.**	**K1, K2**
2	**Skills:**	
2.1	**Solve proposed real-life problems by applying the methodology and tools of Operations Research including Linear Programming, Assignment Problem. Integer programming, simplex, duality and sensitive analysis.**	**S1, S2**
2.2	**Model in mathematical language understandable operational research problems from the verbal description of the real system.**	**S4**
2.3	**Use of TORA software to solve and online solver to solve some to solve the proposed models..**	**S5**
2.4	**Employ clearly, the best strategy Solve linear programming problems using appropriate techniques and optimization solvers.**	**S3**
3	**Values:**	
3.1	**work individually.**	**V1, V3**
3.2	**Relate well to others and maintain good relationships;**	**V1, V2**

C. Course Content

No	List of Topics	Contact Hours
1	**Introduction to Linear programming:** Overview, Linear programming formulations, Graphical Linear Programming Solution, Graphical Sensitivity analysis.	**8**
2	**The Simplex Method:** Standard Linear Programming, Determination of Basic Feasible Solutions; The Simplex Algorithm.	**8**
3	**Special Cases of the Simplex:** Degeneracy, Alternative optimum, Unbounded solution, Infeasibility.	**6**
4	**Duality and Sensitivity Analysis:** Formulation of the Dual Problem, Relationship between Optimal Primal and Optimal Dual Solutions, Economic interpretation of Duality, Dual Simplex and Sensitivity Analysis.	**10**
5	**Special linear programming models:** The transportation model, The assignment model.	**8**
6	**Introduction to Integer Linear Programming:** Illustrative applications, Branch and Bound algorithm, Application to the Traveling Salesman Problem.	**10**
7	**Tora Software:** Use of TORA software to solve exercises and problems from all course chapters.	**10**
Total		**60**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding:**		
1.1	Identify a Linear Programming Problem and its formulation.	• 3 lecture hours\week • 2 tutorial hours\week Self-study	• Regular Exams • Assignments • Short Quizzes
1.2	Summarize techniques of operations research including Linear Programming, Assignment Problem. Integer programming, simplex, duality and sensitive analysis.	• 3 lecture hours\week • 2 tutorial hours\week Self-study	• Regular Exams • Assignments Short Quizzes
2.0	**Skills:**		
2.1	Solve proposed real-life problems by applying the methodology and tools of Operations Research including Linear Programming, Assignment Problem. Integer programming, simplex, duality and sensitive analysis.	• Self-study • Real-life problems	• Participations • Short Quizzes
2.2	Model in mathematical language understandable operational research problems from the verbal description of the real system.	• Self-study Real-life problems	Participations Short Quizzes
2.3	Use of TORA software to solve and online solver to solve some to solve the proposed models..	• Self-study Real-life problems	Participations Short Quizzes
2.4	Employ clearly, the best strategy Solve linear programming problems using appropriate techniques and optimization solvers.	• Self-study Real-life problems	Participations Short Quizzes
3.0	**Values**		
3.1	work individually.	Class discussion	Participation
3.2	Relate well to others and maintain good relationships;	Class discussion Team work	Homework and Mini-projects

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Home works, Quizzes, Mini-projects	During the term	20%
2	First Midterm	Week 4-5	20%
3	Second Midterm	Week 7-8	20%
4	Final Exam	Week 13	40%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice: • **There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.** • **All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	▪ ***Operations Research: An Introduction*****,** H. Taha, Prentice Hall, 8th Edition, 2006. **(Main Reference)**
Essential References Materials	▪ ***Introduction to Operations Research*****,** F. Hillier and G. Lieberman, 7th Edition, McGraw Hill, 2001.
Electronic Materials	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms should be equipped with data show and Smart Board.**
Other Resources (Specify, e.g., if specific laboratory equipment is required, list requirements or attach a list)	**None.**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment, Quality of learning resources	Students	During the semester and at the end of the course each student will complete two evaluation forms.
Extent of achievement of course learning outcomes, Quality of learning resources	Instructor	At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL
Reference No.	11/1444
Date	22/04/1444 (16/11/2022)

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

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2020

Course Specifications

Course Title:	Discrete Simulation
Course Code:	MAT 1465
Program:	Bachelor of Science in Applied Mathematics
Department:	Mathematics and Statistics
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University

Table of Contents

A. Course Identification

1. Credit hours:	**4 (3 Lectures, 0 Lab, 2 Tutorial)**
2. Course type **a.** University ☐ College ☐ Department ▯ Others ☐ **b.** Required ☐ Elective ▯	
3. Level/year at which this course is offered:	**Level 10 or 11 / Year 3**
4.Pre-requisites for this course (if any)**:**	**STA 1202**
5. Co-requisites for this course (if any)**:**	**None**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	36
2	Laboratory/Studio	0
3	Tutorial	24
4	Others (specify)	0
	Total	60

B. Course Objectives and Learning Outcomes

1. Course Description

This elective course makes students familiar with the most important elements of the Monte Carlo method applied to the statistical and Queuing models of discrete event in order to simulate and visualize the solutions. The course puts the theoretical basis of the random number's generators and its application in discrete simulation.

2. Course Main Objective

This course provides an introduction to system modeling using both computer simulation and mathematical techniques. Emphasis will be on discrete-event simulation model development methodologies and implementation techniques.

3. Course Learning Outcomes

CLOs		Aligned-PLOs
1	**Knowledge and Understanding:**	
1.1	**To outline the basic Discrete Event Simulation Concept and language.**	**K1, K2**
1.2	**To memorize the Monte Carlo method and its importance in finance as well as other areas.**	**K1, K2**
2	**Skills:**	
2.1	**To develop basic techniques of discrete simulation.**	**S1, S2**
2.2	**To present Monte Carlo method clearly and precisely both orally and in writing.**	**S4**
2.3	**To use Internet in searching for Markov chains**	**S5**
2.4	**To demonstrate the efficiency of Queuing models.**	**S3**
3	**Values:**	
3.1	**To listen to the teacher's explanation of Mathematics reasoning and illustration.**	**V1, V3**
3.2	**To show attitude of support the use of computers in learning/teaching mathematics.**	**V1, V2**

C. Course Content

No	List of Topics	Contact Hours
1	**Review of some probability and Statistics concepts:** Random variables, probability distribution, Estimation examples.	**6**
2	**Introduction to Simulation:** Random numbers, sequences of connected events, etc.	**9**
3	**Discrete Event Simulation Concept.**	**6**
4	**Monte Carlo simulation.**	**9**
5	**Statistical Models in Simulation**	**9**
6	**Analysis of Queuing Models.**	**6**
7	**Analysis of Simulation Data.**	**9**
8	**Markov chains Monte Carlo method.**	**6**
Total		**60**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding:**		
1.1	**To outline the basic Discrete Event Simulation Concept and language.**	**• 3 lecture hours\week**	**• Regular Exams**
1.2	**To memorize the Monte Carlo method and its importance in finance as well as other areas.**	**• 2 tutorial hours\week • Self-study**	**• Assignments • Short Quizzes**
2.0	**Skills**		
2.1	**To develop basic techniques of discrete simulation.**	**Real-life problems**	**Short Quizzes**
2.2	**To present Monte Carlo method clearly and precisely both orally and in writing.**	**Self-study**	**Participations**
2.3	**To use Internet in searching for Markov chains**	**Real-life problems**	**Short Quizzes**
2.4	**To demonstrate the efficiency of Queuing models.**	**Self-study**	**Participations**
3.0	**Values**		
3.1	**To listen to the teacher's explanation of Mathematics reasoning and illustration.**	**Personal questions**	**Participation**
3.2	**To show attitude of support the use of computers in learning/teaching mathematics.**	**Team work**	**Homework and Mini-projects**

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Home works, Quizzes, Mini-projects**	**During the term**	**20%**
2	**First Midterm**	**Week 4-5**	**20%**
3	**Second Midterm**	**Week 7-8**	**20%**
4	**Final Exam**	**Week 13**	**40%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

- **There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.**
- **All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	*Simulation Modeling and Analysis with Expert fit Software*, **Averill Law, Averill M. Law & Associates, McGraw-Hill Science, 2007. (Main Reference).**
Essential References Materials	***1.*** *Discrete-Event Simulation: A First Course, Lawrence M. Leemis, Stephen K. Park0, Prentice Hall, 2005.* ***2.*** *Simulation Model Design and Execution: Building Digital Worlds, Paul A. Fishwick, Prentice Hall, 1995.* ***3.*** *Monte Carlo Methods, J.M. Hammersley and D.C. Handscomb, Publisher: Chapman and Hall, 1983.*
Electronic Materials	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms should be equipped with data show and Smart Board.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	**None.**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment, Quality of learning resources	Students	During the semester and at the end of the course each student will complete two evaluation forms.
Extent of achievement of course learning outcomes, Quality of learning resources	Instructor	At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL
Reference No.	11/1444
Date	22/04/1444 (16/11/2022)

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA
T4
2020

Course Specifications

Course Title:	**Financial Mathematics (2)**
Course Code:	**MAT 1472**
Program:	**Bachelor of Science in Applied Mathematics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours: **4 (3 Lectures, 0 Lab, 2 Tutorial)**	
2. Course type	
a. University ☐ College ☐ Department ▯ Others ☐	
b. Required ☐ Elective ▯	
3. Level/year at which this course is offered: **Level 10 or 11 / Year 3**	
4.Pre-requisites for this course (if any)**: MAT 1371**	
5. Co-requisites for this course (if any)**:** **None**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	36
2	Laboratory/Studio	0
3	Tutorial	24
4	Others (specify)	0
	Total	60

B. Course Objectives and Learning Outcomes

1. Course Description

This course describes the most important ideas, theoretical results, and examples of simple market model, risk-free assets, risky assets, discrete time market models, portfolio management, forward and future contracts, and option pricing. The course includes the essential fundamentals of these topics. The emphasis is on calculations, and some applications are mentioned.

2. Course Main Objective

By the end of this course students must be able to:

- **Understand different financial models in discrete time;**
- **Do pricing and hedging options;**
- **Manage optimal portfolios.**

3. Course Learning Outcomes

	CLOs	Aligned-PLOs
1	**Knowledge and Understanding:**	
1.1	**To understand the fundamentals of the theory of one-period and multi-period financial models.**	**K1, K2**
1.2	**To understand techniques and features of Market Models with both continuous time and discrete time.**	**K1, K2**
2	**Skills:**	
2.1	**To develop techniques of problem solving.**	**S1, S2**
2.2	**To communicate mathematics clearly and precisely both orally and in writing.**	**S4**
2.3	**To use Internet in searching for scientific information**	**S5**
2.4	**To carry out calculations orally and mentally.**	**S3**
3	**Values:**	
3.1	**To work individually.**	**V1, V3**
3.2	**To work in groups.**	**V1, V2**

C. Course Content

No	List of Topics	Contact Hours
1	**Introduction to a Simple Market Model:** Basic Notions and Assumptions, No-Arbitrage Principle, One-Step Binomial Model, Risk and Return, Forward Contracts, Call and Put Options, Managing Risk with Options.	**8**
2	**Risk-Free Assets:** Time Value of Money, Simple Interest, Periodic Compounding, Streams of Payments, Continuous Compounding, How to Compare Compounding Methods, Money Market, Zero-Coupon Bonds, Coupon Bonds, Money Market Account.	**8**
3	**Risky Assets:** Dynamics of Stock Prices, Return, Expected Return, Binomial Tree Model, Risk-Neutral Probability, Martingale Property, Other Models, Trinomial Tree Model, Continuous-Time Limit.	**12**
4	**Discrete Time Market Models:** Stock and Money Market Models, Investment Strategies, The Principle of No Arbitrage, Application to the Binomial Tree Model, Fundamental Theorem of Asset Pricing, Extended Models.	**8**
	Portfolio Management: Risk, Two Securities, Risk and Expected Return on a Portfolio, Several Securities, Risk and Expected Return on a Portfolio, Efficient Frontier, Capital Asset Pricing Model, Capital Market Line, Beta Factor, Security Market Line.	**8**
	Forward and Futures Contracts: Forward Contracts, Forward Price, Value of a Forward Contract, Futures, Pricing, Hedging with Futures.	**8**
	Option Pricing: European Options in the Binomial Tree Model, One Step, Two Steps, General N-Step Model, Cox–Ross–Rubinstein Formula, American Options in the Binomial Tree Model, Black–Scholes Formula.	**8**
Total		60

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	Knowledge and Understanding:		
1.1	To understand the fundamentals of the theory of one-period and multi-period financial models.	• 3 lecture hours\week	• Regular Exams
1.2	To understand techniques and features of Market Models with both continuous time and discrete time.	• 2 tutorial hours\week • Self-study	• Assignments • Short Quizzes
2.0	Skills		
2.1	To develop techniques of problem solving.	Self-study	Participations
2.2	To communicate mathematics clearly and precisely both orally and in writing.	Real-life problems	Short Quizzes
2.3	To use Internet in searching for scientific information	Self-study	Participations
2.4	To carry out calculations orally and mentally.	Real-life problems	Short Quizzes
3.0	Values		
3.1	To work individually.	Personal questions	Participation
3.2	To work in groups.	Team work	Homework and Mini-projects

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Home works, Quizzes, Mini-projects	During the term	20%
2	First Midterm	Week 4-5	20%
3	Second Midterm	Week 7-8	20%
4	Final Exam	Week 13	40%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice: • There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems. • All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	*Mathematics for Finance: An Introduction to Financial engineering*, 2nd Edition. M. Capinski and T. Zastawniak, Springer Verlag, 2011. (Main Reference). ISBN: 1852333308

Essential References Materials	1. *Stochastic Finance: An Introduction in Discrete Time*, **DeGruyter Studies in Mathematics, 2nd Edition, H. Föllmer and A. Schied, Walter de Gruyter, Berlin, 2011.** ISBN: 3110171198. 2. *Introduction to Mathematical Finance: Discrete Time Models, Stanley R. Pliska, Wiley, 1997.ISBN: 978-1-55786-945-6.*
Electronic Materials	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms should be equipped with data show and Smart Board.**
Other Resources (Specify, e.g., if specific laboratory equipment is required, list requirements or attach a list)	**None.**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment, Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
Extent of achievement of course learning outcomes, Quality of learning resources	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL
Reference No.	11/1444
Date	22/04/1444 (16/11/2022)

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA
T4
2020

Course Specifications

Course Title:	Actuarial Mathematics
Course Code:	MAT 1474
Program:	Bachelor of Science in Applied Mathematics
Department:	Mathematics and Statistics
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University

Table of Contents

A. Course Identification

1. Credit hours:	4 (3 Lectures, 0 Lab, 2 Tutorial)
2. Course type a. University ☐ College ☐ Department ☑ Others ☐ b. Required ☐ Elective ☑	
3. Level/year at which this course is offered:	Level 10 or 11 / Year 3
4.Pre-requisites for this course (if any):	MAT 1371
5. Co-requisites for this course (if any):	None

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	36
2	Laboratory/Studio	0
3	Tutorial	24
4	Others (specify)	0
	Total	60

B. Course Objectives and Learning Outcomes

1. Course Description

This course treats the economics of insurance, the future lifetime random variables (discrete and continuous), force of mortality, Life Tables: Select, Ultimate and Select and Ultimate, Annuities and Assurance in both discrete and continuous case, Commutation Functions. The emphasis is on calculations and some applications are mentioned.

2. Course Main Objective

By the end of this course students must be able to:

- Link interest rate with Loan and Mortgage refinancing,
- Understand mortality tables and interpret the force of mortality,
- Compute the net premium for types of Insurance and Life annuities.

3. Course Learning Outcomes

	CLOs	Aligned-PLOs
1	Knowledge and Understanding:	
1.1	To outline the fundamentals of the interest rate related to Loan and Mortgage refinancing.	K1, K2
1.2	To memorize mortality tables and the interpretation of its force.	K1, K2
2	Skills:	
2.1	To develop techniques of life insurance.	S1, S2
2.2	To present methods of premium calculations clearly and precisely both orally and in writing.	S4
2.3	To use Internet in searching for real insurance products	S5
2.4	To demonstrate the efficiency of some insurance techniques.	S3
3	Values:	
3.1	To work individually.	V1, V3
3.2	To work in groups.	V1, V2

C. Course Content

No	List of Topics	Contact Hours
1	**Basics of Probability & Interest:** Probability, Theory of Interest, Variable Interest Rates, Continuous-time Payment Streams.	5
2	**Interest & Force of Mortality:** More on Theory of Interest, Annuities & Actuarial Notation, Loan Amortization & Mortgage Refinancing, Illustration on Mortgage Refinancing, Coupon & Zero-coupon Bonds, Force of Mortality & Analytical Models, Comparison of Forces of Mortality.	12
3	**Probability & Life Tables:** Interpreting Force of Mortality, Interpolation between Integer Ages, Binomial Variables & Law of Large Numbers, Exact Probabilities, Bounds & Approximations, Simulation of Life Table Data, Expectation for Discrete Random Variables, Rules for Manipulating Expectations, Some Special Integrals.	16
4	**Expected Present Values of Payments:** Expected Payment Values, Types of Insurance & Life Annuity Contracts, Formal Relations among Net Single Premiums, Formulas for Net Single Premiums, Expected Present Values for $m = 1$, Continuous Contracts & Residual Life, Numerical Calculations of Life Expectancies.	15
5	**Premium Calculation:** m-Payment Net Single Premiums, Dependence Between Integer & Fractional Ages at Death, Net Single Premium Formulas | Case (i), Net Single Premium Formulas | Case (ii), Approximate Formulas via Case(i), Net Level Premiums, Benefits Involving Fractional Premiums.	12
Total		**60**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding:**		
1.1	To outline the fundamentals of the interest rate related to Loan and Mortgage refinancing.	• 3 lecture hours\week	• Regular Exams
1.2	To memorize mortality tables and the interpretation of its force.	• 2 tutorial hours\week • Self-study	• Assignments • Short Quizzes
2.0	**Skills**		
2.1	To develop techniques of life insurance.	Real-life problems	Short Quizzes
2.2	To present methods of premium calculations clearly and precisely both orally and in writing.	Self-study	Participations
2.3	To use Internet in searching for real insurance products	Real-life problems	Short Quizzes
2.4	To demonstrate the efficiency of some insurance techniques.	Self-study	Participations
3.0	**Values**		
3.1	To work individually.	Personal questions	Participation
3.2	To work in groups.	Team work	Homework and Mini-projects

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Home works, Quizzes, Mini-projects	During the term	20%
2	First Midterm	Week 4-5	20%
3	Second Midterm	Week 7-8	20%
4	Final Exam	Week 13	40%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

- There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.
- All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	***Actuarial Mathematics and Life-Table Statistics*, Eric V. Slud, CRC Press (Verlag), 2001.** (Main Reference). ISBN: 9781439861974.
Essential References Materials	**1.** ***Fundamentals of Actuarial Mathematics*, S. David Promislow, Wiley, 2010.**ISBN: 978-0-470-68411-5. **2.** ***Actuarial Mathematics*, by Newton L. Bowers, Hans U. Gerber, James C. Hickman, Donald A. Jones and Cecil J. Nesbitt (1997).** ISBN 10: 0938959468, ISBN 13: 9780938959465. **3.** ***Actuarial Mathematics for Life Contingent Risks, 2nd Edition, David C. M. Dickson, Mary R. Hardy and Howard R. Waters, Cambridge University Press, 2013. ISBN: 9781107044074.***
Electronic Materials	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms should be equipped with data show and Smart Board.**
Other Resources (Specify, e.g., if specific laboratory equipment is required, list requirements or attach a list)	**None.**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment, Quality of learning resources	Students	During the semester and at the end of the course each student will complete two evaluation forms.
Extent of achievement of course learning outcomes, Quality of learning resources	Instructor	At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL
Reference No.	11/1444
Date	22/04/1444 (16/11/2022)

List of Equipment's in COMPUTER LABS for the College of Science

Deanship of Information Technology at Imam Mohammad Ibn Saud Islamic University (IMSIU) provides computer lab facilities to support the academic, research and instructional activities of the university. The resources provided are intended for the sole use of university faculty, staff, students, and authorized users.

No.	*Item*	*DETAILS*
1.	Number of Desktop PCs with configuration of Intel Core i9-10900 Processor @ 2.80GHz; 32GB RAM, 500 GB 7200 RPM SATA HDD (3.5 in), DVD Writer, Keyboard, Mouse, LCD/LED Monitor	100 HP EliteDesk 800 G6 Small Form Factor PC for the male section distributed in 3 rooms. 120 HP EliteDesk 800 G6 Small Form Factor PC for the female section distributed in 4 rooms.
2.	Computer - Student Ratio	1:1
3.	Campus –LAN	Campus Network on 10km OFC backbone spanning 50buildings and more to be connected.
4.	Proprietary Software	Windows 10 Pro 64 (University License), Office 365 (including all app), IBM SPSS 28.0.0.0 (190), Matlab R2022b, Embacabero Dev-C++ 6.3 (updated continuously), Python, R-project, MikTex, Acrobat reader
5.	Internet Connection through University Network	1Gbps (1:1) dedicated
6.	Antivirus	Norton 360
7.	Number of Nodes/Computers with Internet Facility at University Campus	All computers are connected to the internet under the supervision of IT Deanship.
8.	Support services to Wired/Wi-Fi Internet Connection, Technical support	Campus LAN and Wi-Fi, technical support provided by the IT-Deanship from 8:00 AM to 3:00 PM
9.	Printers	6 HP LaserJet Pro 400 m451dn Duplex Color Laser Printer

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Education & Training Evaluation Commission

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2020

Course Specifications

Course Title:	**General Chemistry 1**
Course Code:	**CHM 1101**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

A. Table of Contents

B. Course Identification

1. Credit hours: **5(4 Lectures, 0 Tutorial, 2 Lab)**							
2. Course type							
a.	University	☐	College	☐	Department	✓	Others ☐
b.	Required	✓	Elective	☐			
3. Level/year at which this course is offered: **Level 1/Year 1**							
4. Pre-requisites for this course (if any): **None**							
5. Co-requisites for this course (if any): **None**							

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	72	100%
2	Blended		
3	E-learning		
4	Correspondence		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	48
2	Laboratory/Studio	24
3	Tutorial	0
4	**Others** (specify)	0
	Total	72

C. Course Objectives and Learning Outcomes

1. Course Description:

This introductory and general chemistry course covers fundamental observations, laws, and theories of chemistry at the basic level. Topics include atoms/molecules, stoichiometry, acids/bases, solutions, equilibrium, gases, solids, liquids, thermodynamics, the periodic table, and chemical bonding. The chemistry lab is taken in parallel with the course and covers the following basic experiments: density, mass-mass relationship, limiting reactant, acid-base titrations, solubility product, reactions in aqueous solution, Calorimetry and redox reactions.

2. Course Main Objective: ***This course is entended:***

- Recognize atoms, molecules and ions, atomic theory, structure of the atom, isotopes, chemical formulas, naming compounds, stoichiometry, Avogadro's number, mass spectrometer, empirical formulas, chemical equations, limiting reagents and changes taking place.
- Describe chemical reactions in aqueous solutions and their general proprieties.
- Recall types of chemical reactions (precipitation, acid-base, oxidation-reduction).
- Solve ideal gas equation, stoichiometric data, partial pressures and the kinetic molecular theory of gases,
- Identify quantum theory, electronic structure, Bohr's theory, dual nature of electron, quantum mechanics, and electron configuration, periodic classification periodic variation in physical properties, ionization energy, and electron affinity.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	To recognize the atomic theory and structure of the atom.	K1, K3
1.2	To describe different phenomena related to chemical reactions and its stoichiometry.	K1
1.3	To memorize gases laws and their physical properties.	K1, K3
1.4	To define the principles of safety, list of emergency responses and outline the routes of exposures to hazards, the minimization, and controlling and laboratory management.	K4
2	**Skills :**	
2.1	To differentiate between protons, neutrons and electrons.	S1
2.2	To write correct chemical equations and balance it.	S1
2.3	To interpret the ideal gas laws and illustrate chemical calculations.	S1,S3
2.4	To diagram and explain experimentally obtained data during laboratory classes and field tasks, and to demonstrate oral and network communication and technical writing skills	S1, S2, S4
3	**Values:**	
3.1	To appraise coordination in teamwork and raise Knowledge during various evaluations, initiatives, and Lab-reports to uphold scientific integrity.	V1;V2
3.2	To provide students with practical field experience, and help them to adapt to the work environment culture as well as link theoretical study with practical reality.	V2

D. Course Content

No	List of Topics	Contact Hours
	Topics to be covered (Lectures and Tutorial)	
1	**The Study of Change:** Science for the twenty-first century, the study of chemistry, the scientific method and hypothesis, a law and theory, matter and substance, mixture, physical means, elements and compounds, classification of matter, The three state of matter, Types of changes, Physical and chemical properties of matter, Extensive and Intensive properties, Measurement, handling numbers, Accuracy and precision	**6**
2	**Atoms, Molecules and Ions:** The atomic theory, Dalton's atomic theory, Cathode ray tube, Millikan's experiment, Types of radioactivity, Thomson's model, Rutherford's experiment, The structure of the atom, Atomic number, Masse number, Isotopes, The periodic table, Molecules and ions, Formulas and models, Chemical formulas, molecular formula, empirical formula, Formula of Ionic compounds, Chemical nomenclature, Naming compounds, Organic chemistry.	**6**
3	**Masse Relationships in chemical reactions (Stoichiometry):** The mole, Avogadro's number, Molar mass, Molecular mass, Formula mass, the mass spectrometer, Percent composition and empirical formula, Experimental determination of empirical formulas, Chemical reaction, Chemical equations, Balancing chemical equations, Amounts of reaction and reactants and products, Reaction Yield, Limiting reagents.	**10**
4	**Reaction in aqueous solutions:** General proprieties of aqueous solutions, Solution, solute, solvent, An electrolyte and nonelectrolyte, Precipitation reactions, Solubility, Properties of acids, Properties of bases, Arrhenius acid and base, Brønsted acid and base, Neutralization reaction. Oxidation-	**7**

	reduction reactions, Oxidation number, Types of oxidation-reduction reactions, Solution Stoichiometry, Concentration, dilution, indicators, Equivalence point, Gravimetric analysis, Acid base titrations, Redox titrations.	
5	**Gases:** Physical characteristics of gases, Units of pressure, Boyle's law, Charles' & Gay-Lussac's Law, Avogadro's law, and The gas laws. The ideal gas equation, Gas stoichiometry, Dalton's law of partial pressures, The kinetic molecular theory of gases, Molecular Speed Distribution, Gas diffusion, Gas effusion, Deviations from ideal behavior.	**8**
6	**Quantum Theory and the Electronic Structure of Atoms:** Properties of waves, Line emission spectrum, Bohr's model of the atom, The dual nature of the electron, Schrodinger Wave Equation, Quantum numbers, Atomic Orbitals, Aufbau principle, Hund's rule, Electron Configuration.	**7**
7	**The Periodic Table:** Development of the periodic table, ground state electron configurations of the elements, classification of the elements, electron configurations of cations and anions, isoelectronic, effective nuclear charge, atomic radii, ionization energy, electron affinity, diagonal relationships on the periodic table, properties of oxides across a period.	**4**
	Total	**48**
	Topics to be covered (Laboratories)	
1	Density of liquids & Density of regular and irregular solids	**2**
2	Stoichiometry: Mass-mass relationship	**2**
3	The chemical composition by mass percentage	**2**
4	Preparation of primary standard and dilution rule & titration	**2**
5	Determination of the empirical formula	**2**
6	Strong acid-strong base titration	**2**
7	Vinegar Analysis, Mass %	**2**
8	Reactions in Aqueous Solutions & Precipitation reaction & Limiting reactant	**2**
9	Redox titration of Fe^{2+}	**2**
10	Determination of the specific heat of metal	**2**
11	Revision	**4**
	Total	**24**

E. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	To recognize the atomic theory and structure of the atom.	Lecturing	Short quizzes
1.2	To describe different phenomena related to chemical reactions and its stoichiometry.	Solving problems, Homework and assignment	Homework and assignment marks and written exams
1.3	To recall gases laws and their physical properties.	Discussions, Laboratory classes	Quizzes and MCQs, laboratory report
2.0	**Skills**		
2.1	To distinguish between protons, neutrons and electrons.	Lecturing and oral discussion	Short quizzes and Multiples Choice Questions

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.2	To demonstrate the ability to write correct chemical equations and balance it.	Lectures supported by laboratory experiments	Homework assignment, Examination and laboratory sheet
2.3	To interpret the ideal gas laws and illustrate chemical calculations.	Lecturing and oral discussion supported by laboratory experiments	Examination and laboratory report
2.4	To demonstrate ability to do oral communication and technical writing skills through writing and oral presentation of mini reports, operate electronic mail and Network in communicating with others.	• Oral participation • Group discussions and lab experiment and reports • Encourage students to use electronic mail to submit homework and assignments.	• Oral tests and lab performance, reports and sheets Marks • Assignments and homework marks
3.0	**Values**		
3.1	To appraise coordination in teamwork and raise Knowledge during various evaluations, initiatives, and Lab-reports to uphold scientific integrity.	• Group discussion, assignments and homework • Lab-reports • Virtual labs and demonstrations	• Oral tests, lab performance, Lab-reports and sheets Marks • Assignments and homework marks

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Quizzes, Attendance, Participation, Homework**	**All the semester**	**10 %**
2	**Laboratory**	**All the semester**	**30 %**
3	**Midterm Exam 1**	**Around 5th week**	**10 %**
4	**Midterm Exam 2**	**Around 8th week**	**10%**
5	**Final Exam**	**Around 13thweek**	**40 %**
6	**Total**		**100%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

F. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- **There are two office hours per week reserved by each staff member, planned on his timetable, to help the students to solve their problems.**
- **Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counselling.**

G. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	• ***Chemistry***, Raymond CHANG, Mc Graw Hill, 10thEducation, 2010, ISBN 9780073511092.
Essential References Materials	• ***Chemistry***, Steven S. Zumdahl and Susan A. Zumdahl, Houghton Mifflin, 7thEdition, 2006, ISBN: 061852844X • ***Laboratory Manual for Principles of General Chemistry***, J. A. Beran,, 7th Edition, John Wiley & Sons Inc., 2004.
Electronic Materials	• **Blackboard** • **http://highered.mcgrawhill.com/classware/ala.do?isbn=0073048518&alaid=ala_1136810&protected=true&showSelfStudyTree=true** • **http://www.chem1.com/acad/webtext/virtualtextbook.html** • **http://www.shodor.org/UNChem/index.html**
Other Learning Materials	**Internal server: www. Elesevier.com**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	**Each of the class room should be equipped with a whiteboard and a projector, with a maximum of 20 students.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms are equipped with data show, Smart Board, WI-FI access.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	**None**

H. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.

Evaluation Areas/Issues	Evaluators	Evaluation Methods
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey- Observations- Syllabus review- Accreditation review.
Lab Performance	Students Course Responsible	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

I. Specification Approval Data

Council / Committee	**COUNCIL OF DEPARTEMENT OF CHEMISTRY**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

توصيف المقرر الدراسي

اسم المقرر:	مبادىء الاقتصاد
رمز المقرر:	قصد 100
البرنامج:	البكالوريوس – المستوى الرابع-
القسم العلمي:	قسم الاقتصاد
الكلية:	كلية الاقتصاد والعلوم الإدارية
المؤسسة:	جامعة الإمام محمد بن سعود الإسلامية

المحتويات

أ. التعريف بالمقرر الدراسي:

1. **الساعات المعتمدة:** ثلاثة ساعات
2. **نوع المقرر** أ. متطلب جامعة ☐ متطلب كلية ☑ متطلب قسم ☐ أخرى ☐ ب. إجباري ☑ اختياري ☐
3. **السنة / المستوى الذي يقدم فيه المقرر:** السنة الثانية/المستوى الرابع
4. **المتطلبات السابقة لهذا المقرر** (إن وجدت) لا يوجد
5. **المتطلبات المتزامنة مع هذا المقرر** (إن وجدت) لا يوجد

6. **نمط الدراسة** (اختر كل ما ينطبق)

م	نمط الدراسة	عدد الساعات التدريسية	النسبة
1	المحاضرات التقليدية	30 ساعة	%100
2	التعليم المدمج		
3	التعليم الإلكتروني		
4	التعليم عن بعد		
5	أخرى		

7. **ساعات الاتصال** (على مستوى الفصل الدراسي)

م	النشاط	ساعات التعلم
1	محاضرات	30 ساعة
2	معمل أو إستوديو	
3	دروس إضافية	
4	أخرى (تذكر)	
	الإجمالي	30 ساعة

ب- هدف المقرر ومخرجاته التعليمية:

1. **الوصف العام للمقرر:** يتضمّن هذا المقرر المفاهيم الأساسية لعلم الاقتصاد سواء من منظور جزئي (سلوك المستهلك وسلوك المنتج) أو منظور كلي (الدخل القومي, البطالة, التضخم...) بالاضافة الى دراسة مواضيع تهم القطاع المصرفي وآلية عمل المؤسسات المالية وأيضا التجارة الخارجية.
2. **الهدف الرئيس للمقرر** يهدف هذا المقرر للتعريف بمفاهيم واسس علم الاقتصاد وسلوك المنتج والمستهلك وآليات الاقتصاد الإسلامي في معالجة القضايا الاقتصادية المرتبطة بالسوق والتوزيع وحسن تخصيص الموارد النادرة بالإضافة إلى دراسة القطاع المصرفي وآلية عمل المؤسسات المالية وأيضا التجارة الخارجية.

3. **مخرجات التعلم للمقرر:**

	مخرجات التعلم للمقرر	رمز مخرج التعلم المرتبط للبرنامج
1	**المعرفة والفهم**	
1.1	▪ يعرف الطالب المصطلحات والمفاهيم الأساسية الخاصة بعلم الاقتصاد. ▪ يعرف الطالب المشكلة الإقتصادية من منظور إسلامي.	ع1

رمز مخرج التعلم المرتبط للبرنامج	مخرجات التعلم للمقرر	
	▪ يعدد الخصائص والضوابط الإسلامية للمستهلك والمنتج والسوق ▪ يعرف النظم والمؤسسات التي تحكم أداء الاقتصاد الاسلامي	
ع2	▪ يعرف الطالب موضوعات الاقتصاد الجزئي والكلي بمنظور اسلامي	1.2
ع3	▪ يستعرض فاعلية آليات الاقتصاد الاسلامي في حسن تخصيص الموارد الاقتصادية النادرة مقارنة بالنظم الأخرى ▪ يستعرض الطالب القضايا والنوازل الاقتصادية المعاصرة في الاسلام ▪ يعدد آليات عمل المؤسسات المالية و التجارة الخارجية	1.3
	المهارات	**2**
م1	▪ يطبق المعارف والضوابط في حل المشكلات الاقتصادية المطروحة ▪ يستنبط الطالب المبادئ الاقتصادية من النصوص الشرعية ▪ يعرض الطالب عقيدته الاسلامية باسلوب عقلاني عصري وبتفهم جيد للتحديات الاقتصادية المعاصرة ▪ يقارن بين اليات الاقتصاد الإسلامي والنظم الاقتصاد الأخرى في مختلف المجالات.	2.1
م2	▪ يتعرف الطالب على الأساليب الرياضية والإحصائية المناسبة لحل مسألة معينة، وتطبيقها، وتفسير النتائج. ▪ يتعرف الطالب على كيفية تعظيم المنفعة لمستهلك. ▪ يتعرف الطالب على كيفية تعظيم الأرباح للمنتج.	2.2
م3	▪ يتواصل بفاعلية شفهيًا وكتابيًا مع الاخرين ▪ يحلل الطالب القضايا الاقتصادية العصرية	2.3
	القيم	**3**
ق1	▪ يتحمل مسؤولياته ويطور من قدراته الذاتية ▪ يطور الطالب قدراته الشخصية من خلال التعلم الذاتي ▪ يتجاوب الطلاب أثناء المحاضرات مع أستاذ المقرر، وتقبل الملاحظات والنصائح المقدمة لهم من أجل تحسين عملية التعلم ▪ تحمل الطلاب مسئولية إنجاز التمارين والبحوث العلمية المطلوبة منهم	3.1
ق2	▪ يتعامل مع الاخرين بروح الفريق ويعبر عن رايه باستقلالية وفي ظل الاحترام المتبادل ▪ يحضر الطالب المحاضرات بروح ايجابية من أدب الاصغاء وروح المشاركة الفاعلة. ▪ يتعاون الطلاب مع زملائه في المجموعات بروح الفريق لإنجاز المهام التي توكل عليهم وممارسة الدور القيادي عند الحاجةِ ▪ يتَصَرَّفُ الطالب بروح عالية من المسؤولية الشخصية تجاه الغير ▪ يجيب الطالب على اسئلة المناقشة المتولدة عن كل فصل من فصول المقرر تحت اشراف الاستاذ.	3.2
ق3	▪ يلتزم الطالب في اعداد واجباته بالدقة والشفافية والامانة ▪ قبول الطالب النتائج التي تحصل عليها في الاختبارات بروح ايجابية وتعلمه من أخطائه ▪ يتصرف الطالب بشكل أخلاقي والالتزام بالقيم الأخلاقية العالية على النطاق الشخصي والاجتماعي.	3.3

ج. موضوعات المقرر

ساعات الاتصال	قائمة الموضوعات	م
4	**مفاهيم أساسية في علم الإقتصاد:** • تعريف علم الإقتصاد • النظم الإقتصادية : النظام الإقتصادي الرّأسمالي, النظام الإقتصادي الإشتراكي, النظام الإقتصادي المختلط و النظام الإقتصادي الإسلامي.	1
4	**النظام الاقتصاد الاسلامي والمشكلة الاقتصادية** • التفرقة بين مفهومي الاقتصاد الإسلامي: علماً ونظاماً.	2

	• الخصائص المميزة للنظام الاقتصاد الإسلامي: عقدية وأخلاقية وفقهية • أهداف النظام الاقتصاد الإسلامي. • المشكلة الاقتصادية وموقف الاقتصاد الاسلامي منها. • مدخل لعلاج المشكلة الاقتصادية من منظور النظام الاقتصاد الإسلامي.	
3	**سلوك المنتج** • مفهوم الإنتاج. • ضوابط الإنتاج. • تعظيم الأرباح. • خصائص المنتج في الإقتصاد الإسلامي • عناصر الإنتاج في الاقتصاد الإسلامي: (راس المال النقدي، رأس المال العيني، الأرض، العمل، المنظم).	2
4	**سلوك المستهلك** - عناصر نظرية سلوك المستهلك - الحرية الاقتصادية المنضبطة - دالة المنفعة الاستهلاكية - تعظيم المنفعة - الرشد الاقتصادي وضوابطه.	2
5	**السوق : تعريفه و أنواعه** مفهوم السوق و هيكله التنافسي. السوق التنافسية: السعر العادل، الضوابط الفقهية حيال الغش، النجش، بيوع الغرر، الغبن، بيع لا يملك الخ. السوق الاحتكارية: مقارنة بين فهومها الفقهي والاقتصادي، بيان حكمها الشرعي، توضيح مفاسدها الاقتصادية	2
	البطالة و التضخم تعريف البطالة و أنواعها البطالة و مستويات الأجور. تعريف التضخم و أنواعه. الآثار الإقتصادية للتضخم.	4
6	**السياسات المالية و النقدية** - السياسة المالية الإنكماشية و السياسة المالية التوسعية. - السياسة النقدية: السوق المفتوحة و الإحتياطي النقدي - دور السياسة المالية و السياسة النقدية في تحقيق الإستقرار الإقتصادي. - توزيع الدخل على عناصر الإنتاج.	4
7	**النقود و البنوك** - . تعريف النقود و وظائفها - تعريف البنوك , أنواعها و وظائفها. - البنك المركزي: دوره و أهميته	4
8	**التجارة الخارجية (الدولية)** - أهمية التجارة الخارجية و خصائصها. - محددات التبادل التجاري - المكاسب الثنائية من التبادل التجاري	4
	المجموع	30

د. التدريس والتقييم:

1. ربط مخرجات التعلم للمقرر مع كل من استراتيجيات التدريس وطرق التقييم

الرمز	مخرجات التعلم	استراتيجيات التدريس	طرق التقييم
1.0	**المعرفة والفهم**		
1.1	▪ يعرف الطالب المصطلحات والمفاهيم الخاصة بالاقتصاد الإسلامي ▪ يعرف الطالب أسس استخدام قواعد الاقتصاد الإسلامي في التحليل الاقتصادي ▪ يعدد الخصائص والضوابط الإسلامية للمستهلك والمنتج والسوق ▪ يعرف النظم والمؤسسات التي تحكم أداء الاقتصاد الاسلامي	▪ محاضرات ▪ مناقشة ▪ العصف الذهني ▪ التعلم التعاوني	▪ اختبارات. ▪ الواجبات. ▪ أسئلة شفهية
1.2	▪ يعرف الطالب موضوعات الاقتصاد الجزئي والكلي بمنظور اسلامي		
1.3	▪ يستعرض فاعلية آليات الاقتصاد الاسلامي في حسن تخصيص الموارد الاقتصادية النادرة مقارنة بالنظم الأخرى ▪ يستعرض الطالب القضايا والنوازل الاقتصادية المعاصرة في الاسلام ▪ يعدد التطبيقات في مجال القطاع المصرفي والتمويلي الإسلامي		
2.0	**المهارات**		
2.1	▪ يطبق المعارف والضوابط في حل المشكلات الاقتصادية المطروحة ▪ يستنبط الطالب المبادئ الاقتصادية من النصوص الشرعية ▪ يعرض الطالب عقيدته الاسلامية بأسلوب عقلاني عصري وبتفهم جيد للتحديات الاقتصادية المعاصرة ▪ يقارن بين اليات الاقتصاد الإسلامي والنظم الاقتصاد الأخرى خاصة في مجال المصرفي	▪ محاضرات ▪ مناقشة ▪ العمل الجماعي ▪ العصف الذهني ▪ التعلم التعاوني ▪	▪ اختبارات. ▪ الواجبات. ▪ البحوث والواجبات. ▪ أسئلة شفهية
2.2	▪ يتعرف الطالب على الأساليب الرياضية والإحصائية المناسبة لحل مسألة معينة، وتطبيقها، وتفسير النتائج. ▪ يستخدم الطالب تقنيات المعلومات والاتصالات، خاصة الإنترنت، لجمع المعلومات، وفهمها، وتبادل المعلومات والأفكار مع الآخرين.		
2.3	▪ يتواصل بفاعلية شفهيًا وكتابيًا مع الاخرين ▪ يحلل الطالب القضايا الاقتصادية العصرية		
3.0	**القيم**		
3.1	▪ يتحمل مسؤولياته ويطور من قدراته الذاتية ▪ يطور الطالب قدراته الشخصية من خلال التعلم الذاتي ▪ يتجاوب الطلاب أثناء المحاضرات مع أستاذ المقرر، وتقبل الملاحظات والنصائح المقدمة لهم من أجل تحسين عملية التعلم ▪ تحمل الطلاب مسئولية إنجاز التمارين والأعمال المطلوبة منهم	▪ مناقشة ▪ العمل الجماعي ▪ التعلم التعاوني ▪	▪ البحوث والواجبات. ▪ أسئلة شفهية
3.2	▪ يتعامل مع الاخرين بروح الفريق ويعبر عن		

الرمز	مخرجات التعلم	استراتيجيات التدريس	طرق التقييم
	رايه باستقلالية وفي ظل الاحترام المتبادل ▪ يحضر الطالب المحاضرات بروح ايجابية من أدب الاصغاء وروح المشاركة الفاعلة. ▪ يتعاون الطلاب مع زملائه في المجموعات بروح الفريق لإنجاز المهام التي توكل عليهم وممارسة الدور القيادي عند الحاجةِ ▪ يتَصَرُّفُ الطالب بروح عالية من المسؤولية الشخصية تجاه الغير ▪ يجيب الطالب على اسئلة المناقشة المتولدة عن كل فصل من فصول المقرر تحت اشراف الاستاذ.		
3.3	▪ يلتزم الطالب في اعداد واجباته بالدقة والشفافية والامانة ▪ قبول الطالب النتائج التي تحصل عليها في الاختبارات بروح ايجابية وتعلمه من أخطائه ▪ يتصرف الطالب بشكل أخلاقي والالتزام بالقيم الأخلاقية العالية على النطاق الشخصي والاجتماعي.		

2. أنشطة تقييم الطلبة

م	أنشطة التقييم	توقيت التقييم (بالأسبوع)	النسبة من إجمالي درجة التقييم
1	اختبار فصلي 1	4	%20
2	اختبار فصلي 2	12	%20
3	كوزات وحضور بحوث علمية ومشاركة	خلال الفصل	%20
4	اختبار نهائي	16	%40
5			
6			

أنشطة التقييم (اختبار تحريري، شفهي، عرض تقديمي، مشروع جماعي، ورقة عمل الخ)

هـ ـ أنشطة الإرشاد الأكاديمي والدعم الطلابي:

- الساعات المكتبية المخصصة لأستاذ المادة من قبل القسم
- تواصل أستاذ المادة مع الطلاب عبر مجلد المقرر على شبكة الانترنت أو البريد الإلكتروني.

و – مصادر التعلم والمرافق:

1. قائمة مصادر التعلم:

المرجع الرئيس للمقرر	ـ الأسس النظرية للاقتصاد الاسلامي: د. خالد بن سعد المقرن، مكتبة المتنبي، الرياض 1434هـ الأساس في علم الإقتصاد: د. محمود الوادي و آخرون, الإسكندرية 1418 هـ
المراجع المساندة	ـ النظرية الاقتصادية الاسلامية: د.يوسف بن عبد الله الزامل ود. بوعلام بن جيلاني، 1417هـ ـ تطور الفكر الاقتصادي الاسلامي: د. عبد الرحمن يسري أحمد، الاسكندرية، 1419هـ مدخل للفكر الإقتصادي الإسلامي: د. سعيد مرطان
المصادر الإلكترونية	☐ الموقع العالمي للاقتصاد الإسلامي ☐ موقع البنك المركزي السعودي.

	□ موقع وزارة الاقتصاد والتخطيط السعودية
أخرى	قائمة بمواد مرجعية أساسية (المجلات العلمية والتقارير وغيرها): □ مجلة الاقتصاد الإسلامي / بنك دبي الإسلامي . □ أبحاث الاقتصاد الإسلامي □ مجلة مجمع الفقه الإسلامي .

2. المرافق والتجهيزات المطلوبة:

العناصر	متطلبات المقرر
المرافق (القاعات الدراسية، المختبرات، قاعات العرض، قاعات المحاكاة ... إلخ)	قاعات دراسية تتسع لأربعين طالب
التجهيزات التقنية (جهاز عرض البيانات، السبورة الذكية، البرمجيات)	قاعات دراسية بها أجهزة عرض (DATA SHOW)
تجهيزات أخرى (تبعاً لطبيعة التخصص)	منصات تعليمية الكترونية (BALCK BOARD)

ز. تقويم جودة المقرر:

مجالات التقويم	المقيمون	طرق التقييم
فاعلية التدريس	▪ الطلاب	▪ غير مباشر (نتائج مسح تقويم الطلاب للمقرر. مرئيات الطلاب التي يتم الحصول عليها من الطلاب مشافهة وكتابيا أو عبر البريد الالكتروني. تعليق الطلاب على المقرر في منتدى طلاب الكلية)
	▪ منسقي المقررات ▪ قيادة البرنامج	▪ مباشر (في نهاية كل فصل دراسي يقوم منسق المقرر بإعداد تقرير مقرر يلخص فيه الايجابيات والسلبيات ويحدد التغييرات التي ينصح باتخاذها لتطوير المقرر. التواصل مع الخريجين والجهات الموظفة)
فاعلة طرق تقييم الطلاب	▪ قيادة البرنامج ▪ الطلاب ▪	▪ مباشر (المقارنة المرجعية) ▪ غير مباشر (استطلاع آراء)
مدى تحصيل مخرجات التعلم للمقرر	▪ أعضاء هيئة التدريس	▪ مباشر (التقييم المباشر للطلاب, تبادل النتائج مع اقسام وكليات أخرى)
مصادر التعلم	▪ أعضاء هيئة التدريس ▪ منسقي المقررات ▪ قيادة البرنامج ▪ الطلاب	▪ مباشر (المراجعة الدورية لمفردات المقرر, تقارير المقررات) ▪ غير مباشر (استطلاع آراء الطلاب)

مجالات التقويم (مثل. فاعلية التدريس، فاعلة طرق تقييم الطلاب، مدى تحصيل مخرجات التعلم للمقرر، مصادر التعلم ... إلخ)
المقيمون (الطلبة، أعضاء هيئة التدريس، قيادات البرنامج، المراجع النظير، أخرى (يتم تحديدها)
طرق التقييم (مباشر وغير مباشر)

ح. اعتماد التوصيف

جهة الاعتماد	مجلس القسم
رقم الجلسة	30
تاريخ الجلسة	1442/9/21