SULTAN QABOOS UNIVERSITY

COURSE OUTLINE

PROGRAM: Agricultural Engineering

1. Course Code	SWAE4304	
2. Course Title	Modeling and Analysis of Bio-physical Systems	
3. Credits	3 CR, 12 CP, 6 ECTS	
4. Pre-requisite Course(s)	MATH2107, PHYS (2101 or 2107)+CR*	
5. Co-requisite Course(s)	N/A	
6. Equivalent Course(s)		
7. Incompatible Course(s)		
8. Course Category	☐ University Requirement	☐ University Elective
	☐ College Requirement	☐ College Elective
	☐ Department Requirement	☒ Department Elective
	☒ Specialization Requirement	☐ Specialization Elective
	☐ Other (specify):	
9. Course Owner	College: CAMS	Department: SWAE
10. Course Type	☐ Lecture	☐ Lecture/Lab
	☐ Lecture/Seminar	☐ Lecture/Studio
	☐ Lecture/Tutorial	☒ Lecture/Lab/Tutorial or Seminar
	☐ Tutorial	☐ Laboratory (Practical)
	☐ Field or Work Placement	☐ Studio
	☐ Seminar	☐ Internship
	☐ Workshop	☐ Project
11. Language of Instruction	English	

12. Course Description

This course deals with mathematical modeling of biological and physical systems. The overall course objective is to provide the student with concepts and techniques of mathematical modeling. Initially, students will learn how to analyze data sets using graphical methods, and learn examples of numerical methods such as root solving and numerical integration. This will be followed by classification and purpose of modeling. Subsequently, examples of stochastic models and deterministic analytical models, and an introduction to numerical modeling will be taught. The latter part of the course will cover selected sections of operations research, particularly linear programming and network analysis (PERT, CPM) applications, in biophysical Systems.

13. Teaching/Learning Strategies

In this course weekly based goals are achieved by having two hours of theory, one-hour each on hands-on exercises and closed-book assignment. The classes are conducted in a computer lab where students will be able to try exercises with the help of instructor. Students will interact with the instructor in each and every practical work and learning and skills improvement will be efficient. As there are weekly assessments, students will have to have continuous engagement. There are 10 to 12 weekly assessments in addition to the mid-semester and final exams. Continuous class participation is essential as course objectives are achieved weekly basis.

The objectives of this course are:

1.Mainly to introduce students the systems analysis techniques; both the deterministic ans stochastic modeling techniques using Excel.

2.Introduce students about data types, how to recognize and analyse them.

3.Introduce students the statistical analyses; linera simple and multiple regression analyses.

4.Introduce students the numerical methods and approximations.

5.Introduce students the operations research techniques such as linear programing, transportation and assignment algorithms, PERT and CPM network analysis technques.

6.Enable students to hands-on practice with exmples related to bio-physical systems.

14. Assessment Components and Weight [%]		
☒ Quizzes 20%	☐ Practical	☐ Other (specify):
☒ Homework assignments 20%	☐ Project	
☒ In-term examination(s) 20%	☒ Final examination 40%	

15. Grading Method

☒ A-F Scale ☐ Pass/Not passed

16. Textbook(s) and Supplemental Material

Class presentation materials; soft copies of presentations, lecture notes, Excel data sheets will be provided in advance.

References:

Helsel, D.R. & R.M. Hirsch. Statistical Methods in Water Resources. Elesevier 2000.
Donnell Hunt. Engineering Models for Agricultural Production. AVI Publishing Company, 1986.
Bronson, R. & G. Nandimuthu. Operations Research. Schaum's Outlines. McGraw-Hill 1997, ISBN 0-07-008020-8.

17. Matching Course Objectives with Program Outcomes and SQU Graduate Attributes

SQU Graduate Attributes

A. SQU graduates should be able to:	B. SQU graduates possess	C. SQU graduates should
1. apply the knowledge and skills relevant to the specialization 2. communicate effectively and use information and communication technologies 3. critically analyze complex information and present it in simple clear manner	1. interpersonal communication skills and alignment with culture of international labour market to assist them in practical life and in living successfully 2. skills and motivation for independent learning and engagement in lifelong learning and research 3. work ethics and positive values, and intellectual independence and autonomy 4. teamwork skills and display potential leadership qualities	relish good citizenship qualities, be conscious of their national identity and be socially responsible, engage in community affairs and be mindful of contemporary issues.

#	Intended Student Learning Outcome /Course Learning Objective	Relevant Program Outcome(s)	Applicable Attribute(s)
1.	An ability to apply knowledge of mathematics, science, and engineering.	a. An ability to apply knowledge of mathematics, science, and engineering.	ABET (a) SQU A1
2.	An ability to identify, formulate, and solve engineering problems.	b. An ability to design and conduct experiments, as well as an ability to analyze and interpret data.	ABET (e) SQU A1, A3
3.	Recognition of the need for, and an ability to engage in life-long learning.	c. An ability to design a system, component, or process to meet desired needs.	ABET (i) SQU A1, A3
4.	Acquiring the the knowledge and handling of contemporary issues.	d. An ability to function on multi-disciplinary teams.	ABET (j) SQU A2
5.	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practices.	e. An ability to identify, formulate and solve engineering problems.	ABET (k) SQU A1, A3
6.		f. An understanding of professional and ethical responsibility.	
7.		g. An ability to communicate effectively.	
8.		h. The broad education necessary to understand the impact of engineering solutions in a global and societal context.	
9.		i. A recognition of the need for, and an ability to engage in life-long learning.	
10.		j. The knowledge of contemporary issues.	

11.		k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	
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16. Student Responsibilities

It is the student's responsibility to know and comply with all University Academic Regulations relevant to participation in this course. These regulations specifically include attendance requirement and students` academic code of conduct.

For attendance, it is the student's responsibility to be punctual and to attend all classes.

Students are expected to perform their work with honesty and avoid any academic misconduct, which is defined as the use of any dishonest or deceitful means to gain some academic advantage or benefit. This can take many forms, including but not limited to, the following: copying, plagiarism, collusion and forging documents. For full details, please refer to the Undergraduate Academic Regulations and to the Student Academic Misconduct Policy.

Additionally, this course requires that you:

Students should be aware of and abide by all University Regulations

1.Attendance: Class attendance is mandatory according to the University regulations.

2.No make-up exams will be given without a written medical excuse or prior permission from the instructor.

3.Students are responsible for all materials covered in the class whether presented orally during lectures or assigned from the text.

4.No class assignment of any student will be graded once the same assignment is corrected and returned to the class.

5.Examinations: Class examinations will cover class material, homework assignments, and assigned readings.

COURSE INFORMATION			
Course Code	SWAE4304	**Course Title**	Modeling and Analysis of Bio-physical Systems
Semester/ Year	Spring	**Section(s)**	10/11
Day, Time, and Place	As scheduled in the timetable		

Course Coordinator	Dr. Hemanatha Jayasuriya/ Prof Anvar Kacimov		
Office Location	Room 232/ 237	**Office Hours**	As posted on the office door
Office Tel. Ext.	1223	**Email**	hemjay@squ.edu.om; anvar@squ.edu.om

Tentative Schedule

Week	Lecture #	Topic/Material to be covered	Assessment
1	1.1	Exploratory Data Analysis -Introduction to software use: MS Excel	Practice
2	1.2	Exploratory Data Analysis - Root solvers	Exercise 1 Quiz 1
3	2	Introduction to Numerical Methods - Numerical Integration, using Excel Goal-seek function	Exercise 2 Quiz 2
4	3	Purposes & Classification of Models - Trend lines and curve fitting in Excel	Exercise 3 Quiz 3
5	4	Deterministic –Analytical Models - Introduction to Numerical Modeling Law of Growth & decay; Logistic Curves, Finite Difference Methods, using Excel	Exercise 4 Quiz 4
6	5	Stochastic Models – Simple and Multiple Linear Regression	Exercise 5 Quiz 5
7	6	Selected examples from different application areas: Drying, Irrigation, etc. Using Excel Data Analysis	Exercise 6 Quiz 6
8	8	Review	Mid-semester exam
9	9.1	Introduction to Operations Research - Management Models Optimization techniques: Introduction Using Solver in Excel / OM Excel	Practice
10	9.2	Linear Programming models: Simplex, Big-M method Selected examples: Profit maximization, Cost minimization, Resources distribution Using Solver in Excel / OM Excel	Exercise 7 Quiz 7
11	9.3	Linear Programming models:Transportation algorithms -Resources distribution, Feed formulation optimization Using Solver in Excel / OM Excel	Exercise 8 Quiz 8
12	9.4	Linear Programming models:Assignment algorithms -Resources distribution, Feed formulation optimization Using Solver in Excel / OM Excel	Exercise 9 Quiz 9
13	10.1	Network Analysis Models: Program Evaluation and Review Technique (PERT)	Exercise 10 Quiz 10
14	10.2	Network Analysis Models: Critical Path Method (CPM) with cost analyses	Exercise 11 Quiz 11
15	11	Review	Exercise 12 Practice
16			Final Exam
17			

APPENDIX A: INSTRUCTORS OF MULTIPLE SECTIONS					
Section	**Instructor**	**Day, Time, and Place**	**Office Location and Extension**	**Email**	**Office Hours**

APPENDIX B: ADDITIONAL INFORMATION