

SULTAN QABOOS UNIVERSITY COURSE OUTLINE

PROGRAM: Agricultural Engineering

1.	Course Code	SWAE4302	
2.	Course Title	Agriculture in Controlled Environment	
3.	Credits	³ CR, 12 CP, 6 ECTS	
4.	Pre-requisite Course(s)	CAMS Required + SWAE2001	
5.	Co-requisite Course(s)	None	
6.	Equivalent Course(s)	None	
7.	Incompatible Course(s)	None	
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
			Laboratory (Practical)
		Field or Work Placement	Studio
		Seminar	Internship
		Workshop	🖾 Project
11.	Language of Instruction	English	

12. Course Description

This advanced course equips students with theory and applications of various types of protected agricultural structures and systems and their effects on the production of crops planted inside these controlled environments. New technological applications under water-scarce, arid environments such as greenhouse, hydroponics, design, implementation and practices and other related technology will be taught.

The first half of the course will provide all basic information and theory related to crop production under contorolled environments, properties and control of the microclimate and the second half of the course will be on design aspects. Group projectes will be assigned as students can apply the learnt information into development of an ACE system. Field visits and selected activities will also be arranged as students can obtain maximum use of them for understanding both theory and practice.

13. Teaching/Learning Strategies

In this course, topics are organized in a very systematic and knowledge-constructive manner such that general introduction is given in the first topic followed by two sequential topics; breif details on Greenhouse structure and construction and more elaboration on "Environmental control of greenhouses". As the semester progresses, students are taken for field visits to experience the two distinct greenhouse structural designs and management practices. Lastely, after gaining enouch understanding about greenhouse design and microclimate control, students are requested to implement what they learnt in conducting a detailed term paper that covers the construction of a greenhouse from the design, site selection, orientation, markets, personnel, utilities, climate, irrigation and fertigation, pest and disease management and economic prospectives. Lectures normally start with a revision on what has been covered last time before starting a new material. The instructor always encourages student interaction and discussions. At the end of each lecture encourages students to ask questions. Students are taken to field visits to compare between traditional, low-tech and high-tech greenhouse cropping systems. At the end of each visit, students are requested to descibe the greenhouse systems they came across and make the necessary evaluations and comparisons.

14. Assessment Components and Weight [%]						
Quizzes [10%]	Practical [10%]	Other (specify):				
Homework assignments	Project [20%]					
In-term examination(s) [20%]	Final examination [40%]					
15. Grading Method						
A-F Scale Pass/Not pas	sed					
16. Textbook(s) and Supplemental Material						
Class presentation /seminar materials; soft copies of presentations, supplementary notes will be provided in advance.						
OTHER REFERENCE BOOKS:						
The Commercial Greenhouse (1981) by Boodley, J. W.						
Greenhouse Management (1990) by Langhans, R. W.						
Greenhouse Operation and Management (1998) by Nelson, P. A.						
Review of Structural and Functional Charactersitics of Greenhouses in European Union Countries (2000) by von Elsner et						

al.

17.	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. 2. 3. 	apply the knowledge and skills relevant to the specialization communicate effectively and use information and communication technologies critically analyze complex information and present it in simple clear manner	 1. 2. 3. 4. 	interpersonal communication skills and alignment with culture of international labour market to assist them in practical life and in living successfully skills and motivation for independent learning and engagement in lifelong learning and research work ethics and positive values, and intellectual independence and autonomy 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.	A. An ability to apply knowledge of Mathematics, Science & Engineering	1. Demonstrate proficiency in application of mathematics to solve engineering problems	A1
2.	G. An ability to communicate effectively	 Identify the resources required for the presentation and organize the material Present a technical report with demonstrated good command of English Deliver an effective oral presentation 	G1, G3, G4
3.	H. The broad education necessary to understand the impact of engineering solutions in a global context	2. Explain the impact of engineering decisions in global context of agricultural systems and engineering, and provide solutions	H2
4.			
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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:

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

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

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

5. Examinations: As stated in section 13, all assessments are based on class material, homework assignments, and assigned readings.

COURSE INFORMATION						
Course Code			SWAE4302	Course Title	Agriculture in Controlled Env	ironment
Semester/Year			Fall 2018	Section(s)	10	
Day, Time, and Place			SUN 08:00-09:20 am &	z TUE 8:00-9:20 am	, classroom B11	
Course	e Coordinato	r	Dr. Abdulrahim Al-Ism	aili		
Office	Location		CAMS 246	Office Hours	MON & WED, 11:00-12:00	
0.66			1006	T 'I	TUE & THU, 12:00-13:00	
Office	Tel. Ext.		1226	Email	abdrahim@squ.edu.om	
				Tentative Schedu	ıle	
Week	Lecture #		Тор	ic/Material to be co	overed	Assessment
1	1.	Wl	nat is Controlled Environ	ment Agriculture (C	EA or ACE)?	
	Introducti	Hi	gh-tech CEA			
	on	Wl	ny do we need to control	Environment ?		
		As	signed Reading 1.1			
2		WI	hat can we grow in CEA	systems ?		
	Introducti	Fa	ctors controlled by CEA	systems		
	on		signed Peeding 1.2			
2	2	As Ro	fore Constructing a Gree	nhouso		Ouiz#1
5	2. Geenhous	Pre	liminary Considerations	linouse		Qui2#1
	es	Fac	ctor 1. Accessibility • Fa	ctor 2. Expandabilit	v • Factor 3 [.] Markets • Factor	
	•5	4:	Orientation• Factor 5:	Personnel • Factor	6: Topography • Factor 7:	
		Uti	ilities/water • Factor 8: C	limate	·······	
		Fie	eld Visit#1			
4	2.	Gr	eenhouse Structure & Co	Instruction		Lab Report#1
	Geenhous	Gr	eenhouse Types & Shape	es		-
	es	Detached Greenhouses: A. Even-span B. Uneven-span C. Quonset D. Gothic				
		Arch E. Curvilinear F. Dome-shape G. Lath house H. Screen-house				
		Attached Greenhouses: A. Lean-to B. Sawtooth C. Ridge-and-Furrow i.				
		Gutter-connected ii. Venlo-type D. Barrel vault				
	Greenhouse Structural Components					
-	2	As	signed Reading 2	<u> </u>		
5	3: Environm	3.1 Cr	Greenhouse Environme	ntal Control: Green	ilouse Environmental Control,	
	ental	Gr	reenhouse Heating Greenhouse Instrumentation			
	Control	UI	Steenhouse Heating, Oreenhouse Instrumentation			
	Of					
	Greenhou					
	ses					
6	3:	3.2	Psychrometric Chart: Pl	hysics of Temperatu	re & Enthalpy, Psychrometric	Quiz#2
	Environm	Ch	art, Use of Psychrometrie	c Charts, Digital Psy	chrometric Chart	
	ental Tutorial					
	Control					
	Of					
	Greenhou	ou la				
	ses	ses				
7	3: Environment	3: 3.3 Irrigation and Fertigation in Greenhouses: Irrigation in Greenhouses,				
	Environm Irrigation Types, Choice of Irrigation, Fertigation in Greenhouses,					
	ental Greenhouse hydroponic systems					
	Of					
	Greenhou					
	ses					

8	3:	Field Visit#2	Midterm Exam
	Environm		
	ental		
	Control		
	Of		
	Greenhou		
	ses		
9	3:	3.4 Greenhouse Ventilation and Cooling: Greenhouse Calculations, GH	Lab Report#2
	Environm	Summer Cooling Systems, GH Winter Cooling Systems, Types of	-
	ental	Greenhouse ventilation systems, Natural Ventilation	
	Control	Assigned Reading 3	
	Of		
	Greenhou		
	ses		
10	4.	4.1 Semester Project: Description, Tasks, Method of Evaluation	
	Semester	Report Format	
	Project	Field Visit#3	
11	3:	3.5 Greenhouse Maintenance: Why GHs should be well maintained?, What	Quiz#3
	Environm	components in the GH to be maintained?	Lab Report#3
	ental	3.6 Greenhouse Sanitation General: What is Sanitation?, Disease Triangle,	Ĩ
	Control	Plant diseases, Pathogens, Scouting for Plant Disease, Root diseases, Disease	
	Of	Management Principles	
	Greenhou		
	ses		
12	3:	3.7 Greenhouse Sanitation Pest Control: Greenhouse Pest Management,	
	Environm	Major Greenhouse Pests, Integrated Pest Management	
	ental	3.8 Greenhouse Sanitation Disease control: Plant Diseases, Economic	
	Control	impacts of plant diseases, Disease Control Measures, Cultural Controls,	
	Of	Biological Controls, Chemical Controls, Organic Control Methods, GH	
	Greenhou	Sanitation	
	ses		
13	4.	4.2 Greenhouse Calculations: Rate of Air Exchange, Selection of Fans,	
	Semester	Number of Fans, Selection of Cooling Pads, Pad Area, Water Delivery to	
	Project	pads. Capacity of the Sump	
	5	Assigned Reading 4	
14	4.	4.3 Greenhouse Economics: Bill of Quantity (BoQ), Initial Capital	Quiz#4
	Semester	Investment, Construction Costs, Fixed Costs, Variable Costs, Break-even	
	Project	Analysis	
	5	Greenhouse Financial Analysis	
15	4.	Evaluation of Semester Project	Semester Project
	Semester		Report and
	Project		Presentation
16	Final		Final Exam
	Exams		
17	Final		
	Exams		
	1		

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

APPENDIX B: ADDITIONAL INFORMATION

Performance Indicators for the ABET A tdesign and conduct experimentso K Outcome for the Agricultural Engineering Program

- A. An ability to apply knowledge of Mathematics, Science & Engineering
- 1. Demonstrate proficiency in application of mathematics to solve engineering problems
- 2. Demonstrate proficiency in application of science in solving engineering problem
- 3. Demonstrate proficiency in application of engineering principles in real world problems

B. An ability to design experiments as well as to analyze & interpret data

1. Ability to design experiments by choosing appropriate testing parameters and standard procedures

2. Perform the experiments using relevant equipment and following safe procedure to collect data

3. Process the collected data using needed formulae , check the data viability, and present the results in the form of tables or figures

4. Analyse and interpret data in terms of identifying trends, comparing with predictive equations and drawing conclusions

C. An ability to design a system, component or process to meet desired needs within realistic constraints

1. Formulate requirements to design a system, and components of a system for desired needs in agricultural engineering sector

2. Identify realistic constraints that needs to be considered while making the design of systems

3. Construct a prototype and evaluate the performance

4. Improve the prototype based on performance evaluation results

D. An ability to function in multi-disciplinary teams

1. Ability to form a team based on the goal in real world agricultural engineering design projects

2. Explain the role in the team in a well-defined context and bring a particular experience in solving the problem

3. Contribute to the team in a meaningful manner to achieve the team's goals

E. Ability to identify, formulate & solve engineering problems

1. Identify an engineering problem and break it down into manageable parts

2. Formulate the agricultural engineering problems related to the specified areas and identify the key variables

3. Analyze alternate solutions for a problem and justify the selected solution

F. An understanding of professional and ethical responsibility

1. Understanding of the professional responsibility; become aware of professional responsibilities and commitments as an engineer

2. Understanding of the ethical responsibility; identify and respond with respect to ethical aspects and cultures

G. An ability to communicate effectively

1. Identify the resources required for the presentation and organize the material

2. Provide sufficient statistical data to support claims and convince audience

3. Present a technical report with demonstrated good command of English

4. Deliver an effective oral presentation

H. The broad education necessary to understand the impact of engineering solutions in a global context

1. Identify the problems in global context of agricultural systems and engineering

2. Explain the impact of engineering decisions in global context of agricultural systems and engineering, and provide solutions

I. Recognition of the need for, and an ability to engage in life-long learning

1. Demonstrate the awareness of the continuing process of education after graduation

2. Demonstrate ability to learn independently from various sources

J. Knowledge of contemporary issues

1 Identify contemporary issues related to social, economic and environmental, and explain potential solutions

K. An ability to use the techniques, skills & modern engineering tools necessary for engineering practice

1. Use design and drawing in solving various engineering problems

2. Use modeling and simulation tools in solving real worldproblems

3. Use standards, codes and regulations in solving problems related to engineering practices

4. Demonstrate proficiency to integrate tools and techniques in solving problems and communicating solutions