4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: .. **Introduction to Mathematical Biology**....

Course Code: . **4046503-4**..

Course Specifications

Institution: Umm Al-Qura University Date : 31/10/2018
College/Department Faculty of Applied Science/ Department of Mathematical Sciences

A. Course Identification and General Information

1. Course title and code: Introduction to Mathematical Biology (4046503-4)				
2. Credit hours: 4hrs				
3. Program(s) in which the course is offered. (If general elective available in many programs indicate this rather than list programs) Master of Science in Mathematics				
4. Name of faculty member responsible for the course: Dr. Faiza Mohammad Allehiany				
5. Level/year at which this course is offered: Leve 2/ Master				
6. Pre-requisites for this course (if any)				
7. Co-requisites for this course (if any)				
8. Location if not on main campus: Al-Abidiyah campus and Al-Zahir campus				
9. Mode of Instruction (mark all that apply)				
a. traditional classroom	√	What percentage?	85	
b. blended (traditional and online)		What percentage?		
c. e-learning	√	What percentage?	15	
d. correspondence		What percentage?		
f. other		What percentage?		
Comments:				

B Objectives

1. What is the main purpose for this course? ▪ To introduce students to the application of mathematical modelling in the analysis of biological systems including population model for single species, genetics, interacting population model, infectious disease. ▪ To show how mathematics, statistics and computing can be used in an integrated way to analyse biological systems. ▪ To develop students' skills in algebraic manipulation, the calculus of linear and non-linear differential equations, mathematical modelling, matrix algebra and statistical methods.
2. Briefly describe any plans for developing and improving the course that are being implemented. (e.g. increased use of IT or web based reference material, changes in content as a result of new research in the field) Search for more online references materials.

C. Course Description (Note: General description in the form used in Bulletin or handbook)

Course Description: Mathematical Biology is the application of mathematical modeling to solve problems in biology and physiology. It is one of the fastest growing research areas in mathematics and is contributing significantly to our understanding of the biological world and the processes in disease. It also produces new mathematical questions

1. Topics to be Covered		
List of Topics	No. of Weeks	Contact hours
Population Models for Single Species . Continuous logistic models . Insect population models . Continuous delay models . Periodic solutions of delay models . Harvesting . Population model with age distribution . Discrete logistic models . Stability, Periodic solutions and Bifurcation . Discrete delay models	3	12

Interacting populations models: . Predator - Prey Models: Lotka-Volterra Systems . Generalised Lotka-Volterra Predator-Prey System . Realistic Predator - Prey Models . Predator-Prey model analysis with Limit Cycle Periodic Behaviour . Competition . Mutualism . Threshold Phenomena . Discrete Growth Models for Interacting Populations. . Discrete time Predator-Prey system analysis	4	16
Infectious Disease: . The Susceptible – Invective SI model . The Susceptible – Invective – Susceptible SIS model . The Susceptible - Invective SIR epidemic disease model . Vaccination . The SIR endemic disease model . Evolution of virulence	4	16
Population Genetics: . Haploid genetics . Spread of favored allele . Mutation-selection balance . Diploid genetics . Diploid reproduction . Heterosis . Frequency-dependent selection . Recombination and the approach to linkage equilibrium . Random genetic drift.	4	16

2. Course components (total contact hours and credits per semester):

	Lecture	Tutorial	Laboratory or Studio	Practical	Other:	Total
Contact Hours	60	--	--	--		60
Credit	4	--	--	--		4

3. Additional private study/learning hours expected for students per wee k. None

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategy

On the table below are the five NQF Learning Domains, numbered in the left column.

First, insert the suitable and measurable course learning outcomes required in the appropriate learning domains (see suggestions below the table). **Second**, insert supporting teaching strategies that fit and align with the assessment methods and intended learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy ought to reasonably fit and flow together as an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge** Upon completion of the course, the student is expected to		
1.1	have an enhanced knowledge and understanding of mathematical modelling and statistical methods in the analysis of biological systems.	Lectures and homework.	Short quizzes, periodical and final exams.
1.2	Be aware of the basic concepts of mathematical population dynamics	Lectures and homework.	Short quizzes, periodical and final exams.
2.0	**Cognitive Skills** Upon completion of the course, the student is expected to be able to		
2.1	find equilibria of a dynamical system	Lectures and homework.	Short quizzes, periodical and final exams.
2.2	analyse the stability of equilibrium points of a mathematical model	Lectures and homework.	Short quizzes, periodical and final exams.
3.0	**Interpersonal Skills & Responsibility** Upon completion of the course, the student is expected to be able to		
3.1	formulate a mathematical model for the interaction between species.	Lectures and homework.	Short quizzes, periodical and final exams.
3.2	Interpret and comment on the results	Lectures and homework.	Short quizzes, periodical and final exams.
4.0	**Communication, Information Technology, Numerical** Upon completion of the course, the student is expected to be able to		
4.1	Numerically solve a mathematical	Lectures,	Short quizzes,

	model.	discussion and homework.	periodical and final exams.
4.2	Work effectively in groups and independently.	Tasks assigned and homework.	Marking the assignments
4.3	Solve problems concerning the topics of the course.	Homework	Evaluating the homework
5.0	**Psychomotor**		
5.1	Not applicable	Not applicable	Not applicable

5. Schedule of Assessment Tasks for Students During the Semester

	Assessment task (e.g. essay, test, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	Periodic exam (1)	6	20
2	Periodic exam (2)	10	20
3	Home work	During the term	20
4	Final exam	End of semester	40

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice. (include amount of time teaching staff are expected to be available each week)
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E Learning Resources

1. List Required Textbooks

1- Mathematical Biology, J. D. Murray, Volume I: An Introduction. (2002) Springer-Verlag Berlin Heidlberg.

2- Essential Mathematical Biology, N. F. Britton. (2003) Springer-Verlag London Limited.

2. List Essential References Materials (Journals, Reports, etc.)
- Journal of Mathematical Biology.
- Bulletin of Mathematical Biology

3. List Recommended Textbooks and Reference Material (Journals, Reports, etc)
None

4. List Electronic Materials, Web Sites, Facebook, Twitter, etc. https://en.wikipedia.org/wiki/Mathematical_and_theoretical_biology
5. Other learning material such as computer-based programs/CD, professional standards or regulations and software. None

F. Facilities Required

Indicate requirements for the course including size of classrooms and laboratories (i.e. number of seats in classrooms and laboratories, extent of computer access etc.)
1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.) Classroom with the capacity of 10-20 students
2. Computing resources (AV, data show, Smart Board, software, etc.) Matlab software – Smart board
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list) None

G Course Evaluation and Improvement Processes

1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching Student feedback on effectiveness of teaching
2 Other Strategies for Evaluation of Teaching by the Instructor or by the Department Monitoring the achievement of the students in solving homework and periodical exams
3 Processes for Improvement of Teaching Following up the student's homework. Encouraging the students to read and practice more
4. Processes for Verifying Standards of Student Achievement (e.g. check marking by an independent member teaching staff of a sample of student work, periodic exchange and remarking of tests or a sample of assignments with staff at another institution) The instructors watch and give their feedbacks to their students through all work done by them, including exams to verify standards of achievements for different domains of learning outcomes
5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement. Reviewing the course reports submitted at the end of each semester

Name of Instructor: Dr. Faiza Mohammad Allehiany
Signature:_ *Faiza Mohammad Allehiany* _Date Report Completed: 31/10/2018
Name of Field Experience Teaching Staff _____
Program Coordinator:_____
Signature: _____ Date Received:_____