COURSE OUTLINE

Department & Faculty : Dept. of Mathematical Sciences, Faculty of Science	**Page : 1 of 3**
Subject & Code: DYNAMICAL SYSTEM (SSCM 4733) **Total Lecture Hours**: 42 hours	**Semester:** Semester II **Academic Session:** 2017/18

Lecturers	Section No	Tel No	Room No	E-mail
DR FUAADA MOHD SIAM	1	34244	C22 424	fuaada@utm.my

Synopsis :
This course introduces the concepts of discrete and continous dynamical systems, with the ultimate goal of introducing chaos and fractals. For continous autonamous dynamical systems students learn about fixed points, orbit and invariant sets, and the stability of fixed points. In the discrete dynamical systems, they learn about orbits of one-dimensional maps, bifurcation, period doubling which canlead to chaos and strange attractor. Applications include population growth, and electrical engineering. Computer software will be used to simulate and study the dynamical systems.

Pre-requisites: SSCM 1703 (Differential Equations)

Objectives:
On completing the course, students should be able to:

1. Find the equilibrum points, determine their nature and sketch the phase portrait of one and two-dimensional autonomous ODEs.
2. Find the stable and unstable sets, the bifurcation value and sketch the bifurcation diagram for one and two-dimensional ODEs.
3. Test the stability of an equilibrium point using given Lyapunov function and determine the existense of limit cycle using polar coordinates and certain criteria.
4. Recognize metric spaces, and able to find and determine the nature of fixed-points of one-dimensional maps.
5. Find periods of n cycles, bifurcation value and sketch the bifurcation diagram of one-dimensional maps.
6. Carry out numerical studies of dynamical system for both continous and discrete dynamical systems

Supplementary Texts:

1. R.L Devaney, (1992). A First Course in Chaotic Dynamical Systems, Perseus.
2. S. Lynch (2004). Dynamical Systems with Application using MATLAB, BirkMuser (QA 614 8L97 2004)
3. J.M.T. Thompson and H.B. Stewart (2002). Nonlinear Dynamics and Chaos, John Wiley (QA 871 T47 2002).
4. R.A. Holmgren (1994). A First Course in Discrete Dynamical Systems, Springer-Verlag (QA 614 8H64 1994).

Assessment

1.	Test	25%	26/3/18 (TBA)	Weeks 1-5
2.	Assignments (Individual)	15%		Week 2-14
3.	Project (Group)	10%		Week 5-14
4.	Final	50%		Weeks 1-14

Prepared by: **Name: FUAADA MOHD SIAM** **Signature:** **Date:** 20 February 2018	**Certified by:** **Name:** **Signature:** **Date:**

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Weekly Schedule

Week	Lecture Topics	Notes
1 11/2-15/2/18	**CONTINUOUS DYNAMICAL SYSTEM**: CHAPTER 1: PHASE PORTRAITS WITH EMPHASIS ON FIXED POINTS	**Chinese New Year 18/02/2018**
2 18/2-22/2/18		
3 25/2-01/3/18		
4 04/3-08/3/18	CHAPTER 2: PERIODIC ORBIT AND BIFURCATION Periodic Orbit	
5 11/3-15/3/18		
6 18/3-22/3/18	Bifurcation Value and bifurcation diagram for one and two-dimensional ODEs	**Sultan's Johor Birthday 25/03/2018** **Test 1: 26/3/18 (Mon)**
7 25/3-29/3/18		
30/3-07/4/18	**SEMESTER BREAK**	
8 08/4-12/4/18	**DISCRETE DYNAMICAL SYSTEM:** CHAPTER 3 : DISCRETE DYNAMICAL SYSTEM Metric Space, Iteration function as dynamics	
9 15/4-19/4/18		
10 22/4-26/4/18	CHAPTER 4 : ONE-DIMENSIONAL MAPS Periodic Points, Period Doubling and n-cycles of one-dimensional Maps	**Labour Day 01/05/2018**
11 29/4-3/5/18		
12 06/5-10/5/18	Bifurcation value and bifurcation diagram of one-dimensional map and chaos	**1st Ramadhan 17/05/2018**
13 13/5-17/5/18		
14 20/5-24/5/18	Cantor Set and Tent Maps. Attracting sets, The Lorenz equation	
25/5-02/6/16	**Revision week**	

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Learning Outcomes

By the end of the course, students should be able to:

No.	Course Learning Outcomes	Programme Learning Outcome(s) Addressed	Assessment Methods
CLO1	Find the equilibrum points, determine their nature and sketch the phase portrait of one and two-dimensional autonomous ODEs.	PO1,PO2	Assignment, Test, Final
CLO2	Find the stable and unstable sets, the bifurcation value and sketch the bifurcation diagram for one and two-dimensional ODEs.	PO1,PO2,PO7	Assignment, Project, Test, Final
CLO3	Test the stability of an equilibrium point using given Lyapunov function and determine the existense of limit cycle using polar coordinates and certain criteria.	PO1,PO2	Assignment, Test, Final
CLO4	Recognize metric spaces, and able to find and determine the nature of fixed-points of one-dimensional maps.	PO1,PO2	Assignment,Final
CLO5	Find periods of n cycles, bifurcation value and sketch the bifurcation diagram of one-dimensional maps.	PO1,PO2,PO7	Assignment, Project, Final
CLO6	Carry out numerical studies of dynamical system for both continous and discrete dynamical systems	PO7	Project

Student Learning Time

Teaching and Learning Activities			Student Learning Time
1.	**Face-to-face Learning**		
	a.	Lecture-Centered Learning	
		Lecture (2.5 hrs lecture) x 14 weeks	35
	b.	In-class exercise (0.5 hr) x 14 weeks	7
2.	**Self-Directed Learning**		
	a.	Assignments (4 hrs x 6)	24
	b.	Revision (preparation for lectures, tutorials and assignments)	39
	c.	Preparations for Assessments	**9**
3.	**Formal Assessments**		
	a.	Continuous Assessment (2 tests)	**3**
	b.	Final Examination (3 hrs)	**3**
	Total SLT		**120**

Teaching Methods

(a) Lecture and Discussions

(b) Problem Solving-Individual Assignments

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