Chair: Tracy Christofero | **GC#6: Course Addition**

Request for Graduate Course Addition

1. Prepare one paper copy with all signatures and supporting material and forward to the Graduate Council Chair.
2. E-mail one identical PDF copy to the Graduate Council Chair. If attachments included, please merge into a single file.
3. ***The Graduate Council cannot process this application until it has received both the PDF copy and the signed hard copy.***

College: CITE | Dept/Division: Engineering | Alpha Designator/Number: ME- 645 | (•) Graded ( ) CR/NC

Contact Person: Gang Chen | Phone: 696-3204

NEW COURSE DATA:

New Course Title: Nonlinear Dynamics

Alpha Designator/Number: M E 6 4 5

Title Abbreviation: N o n l i n e a r D y n a m i c s

(Limit of 25 characters and spaces)

Course Catalog Description: (Limit of 30 words)

Nonlinear dynamical systems, including concepts of chaos, fractal and classic dynamics equations, one dimension systems, two dimension systems, phase plane, limit cycle, bifurcation, Lorenz equation, and fractals.

Co-requisite(s): None | First Term to be Offered: Fall-2016

Prerequisite(s): Graduate Status | Credit Hours: 3

Course(s) being deleted in place of this addition (*must submit course deletion form*):

Signatures: if disapproved at any level, do not sign. Return to previous signer with recommendation attached.

Dept. Chair/Division Head _____	Date _____
Registrar _____	Date _____
College Curriculum Chair _____	Date _____
Graduate Council Chair _____	Date _____

Request for Graduate Course Addition - Page 2

College: CITE | Department/Division: ENGINEERING | Alpha Designator/Number: ME-645

Provide complete information regarding the new course addition for each topic listed below. Before routing this form, a complete syllabus also must be attached addressing the items listed on the first page of this form.

1. FACULTY: Identify by name the faculty in your department/division who may teach this course.

Gang Chen

2. DUPLICATION: If a question of possible duplication occurs, attach a copy of the correspondence sent to the appropriate department(s) describing the proposal. Enter "***Not Applicable***" if not applicable.

Not Applicable

3. REQUIRED COURSE: If this course will be required by another deparment(s), identify it/them by name. Enter "***Not Applicable***" if not applicable.

None

4. AGREEMENTS: If there are any agreements required to provide clinical experiences, attach the details and the signed agreement. Enter "***Not Applicable***" if not applicable.

Not Applicable

5. ADDITIONAL RESOURCE REQUIREMENTS: If your department requires additional faculty, equipment, or specialized materials to teach this course, attach an estimate of the time and money required to secure these items. (Note: Approval of this form does not imply approval for additional resources.) Enter "***Not Applicable***" if not applicable.

None

6. COURSE OBJECTIVES: (May be submitted as a separate document)

Please refer to the attached syllabus

7. COURSE OUTLINE (May be submitted as a separate document)

Please refer to the attached Syllabus

8. SAMPLE TEXT(S) WITH AUTHOR(S) AND PUBLICATION DATES (May be submitted as a separate document)

Lecture Notes on Nonlinear Vibrations, Richard H. Rand, Cornell Univ., 2010
Nonlinear Dynamics and Chaos, S H Strogatz, Perseus Book Publishing, 1994
Lecture Notes on Nonlinear Dynamics, Daniel Arovas, 2009, UCLA

9. EXAMPLE OF INSTRUCTIONAL METHODS (Lecture, lab, internship)

Lecture

10. EXAMPLE EVALUATION METHODS (CHAPTER, MIDTERM, FINAL, PROJECTS, ETC.)

Mid-term exams 45%
HW & Projects: 25%
Final Exam: 30%

11. ADDITIONAL GRADUATE REQUIREMENTS IF LISTED AS AN UNDERGRADUATE/GRADUATE COURSE

None

12. PROVIDE COMPLETE BIBLIOGRAPHY (May be submitted as a separate document)

Lecture Notes on Nonlinear Vibrations, Richard H. Rand, Cornell Univ., 2010
Nonlinear Dynamics and Chaos, S H Strogatz, Perseus Book Publishing, 1994
Lecture Notes on Nonlinear Dynamics, Daniel Arovas, 2009, UCLA
Any text on nonlinear dynamics
ASME Journal on dynamical systems.

Request for Graduate Course Addition - Page 5

Please insert in the text box below your course summary information for the Graduate Council agenda. Please enter the information exactly in this way (including headings):

Department:
Course Number and Title:
Catalog Description:
Prerequisites:
First Term Offered:
Credit Hours:

Department: Weisberg Division of Engineering
Course Number and Title: ME 645 Nonlinear Dynamics
Catalog Description:
Nonlinear dynamical systems, including concepts of chaos, fractal and classic dynamics equations, one dimension systems, two dimension systems, phase plane, limit cycle, bifurcation, Lorenz equation, and fractals.

Prerequisite: Graduate status
First year Offered: Fall 2016
Credit Hours: 3

Marshall University
Syllabus

Course Title/Number	**Nonlinear Dynamics, ME645**
Semester/Year	**Fall / 2016**
Days/Time	**MWF / 11:00 – 11:50 am**
Location	**Weisberg Engineering Lab 101 Classroom**
Instructor	**Gang Chen**
Office	**Weisberg Engineering Lab Room 109c** **Division of Engineering** **College of Information Technology and Engineering** **Marshall University** **Huntington, WV 25755**
Phone	**304-696-3204**
E-Mail	**chenga@marshall.edu**
Office/Hours	**MWF: 12:00-2:00pm** **For those of you who will not be able to meet the instructor during the assigned office hours, you are welcome to come and ask instructor by appointment or at an appropriate time.**
University Policies	**By enrolling in this course, you agree to the University Policies listed below. Please read the full text of each policy be going to www.marshall.edu/academic-affairs and clicking on "Marshall University Policies." Or, you can access the policies directly by going to http://www.marshall.edu/academic-affairs/?page_id=802** **Academic Dishonesty/ Excused Absence Policy for Undergraduates/ Computing Services Acceptable Use/ Inclement Weather/ Dead Week/ Students with Disabilities/ Academic Forgiveness/ Academic Probation and Suspension/ Academic Rights and Responsibilities of Students/ Affirmative Action/ Sexual Harassment**

Catalog Course Description

Nonlinear dynamical systems, including concepts of chaos, fractal and classic dynamics equations, one dimension systems, two dimension systems, phase plane, limit cycle, bifurcation, Lorenz equation, and fractals.

Table: How each student learning outcomes will be practiced and assessed in the course.

Course Student Learning Outcomes	How students will practice each outcome in this Course	How student achievement of each outcome will be assessed in this Course	Program outcomes

Students will be able to understand the concepts of nonlinear dynamics	Lectures, In-class discussions, in-class excises, homeworks	Questions in class, the evaluations of homework and examination problems.	a2,e2
Students will be able to solve for classic nonlinear systems	Lectures, In-class discussions, in-class excises, homeworks	Questions in class, the evaluations of homework and examination problems.	a2,e2
Students will be able to analyze phase plane, limit cycle, bifurcation.	Lectures, In-class discussions, in-class excises, homeworks	Questions in class, the evaluations of homework and examination problems.	a2,e2
Students will be able to analyze one dimension system, two dimension system,	Lectures, In-class discussions, in-class excises, homeworks	Questions in class, the evaluations of homework and examination problems.	a2,e2
Students will be able to analyze Lorenz Equation, fractal.	Lectures, In-class discussions, in-class excises, homeworks	Questions in class, the evaluations of homework and examination problems.	a2,e2

Objective:

After taking this course, students should be able to

- Understand nonlinear dynamics.
- Understand phase space, chaos, fractal, bifurcation.
- Develop dynamics models for complex nonlinear dynamics systems.
- Apply numerical technique for solution

Required Texts, Additional Reading, and Other Materials

Lecture Notes on Nonlinear Vibrations, Richard H. Rand, Cornell Univ., 2010
Nonlinear Dynamics and Chaos, S H Strogatz, Perseus Book Publishing, 1994
Lecture Notes on Nonlinear Dynamics, Daniel Arovas, 2009, UCLA
Any text on nonlinear dynamics

Course Requirements / Due Dates

Course Requirements : Attendance/Homework /Examinations

TEST SCHEDULE:

Hourly Exam #1

Hourly Exam #2
Hourly Exam #3
Final Exam (two hours)

Homework due Dates:

- **Homework will regularly be assigned either during the class time or by e-mail/blackboard.**
- **Checking your e-mail is required on a daily-basis for information regarding homework assignment. Homework must be submitted before the starting time of class on the assignment date.**
- **Late homework is acceptable for an excused absence. For unexcused delay submission, there will be a 20% late penalty for each day it is late--starting with a 20% penalty on the first day if it is not turned in at the beginning of class. After 5 days, it will not be accepted at all.**
- **No late homework will be accepted after the final day of classes for the semester.**
- **You are expected to provide your homework on engineering papers - not a Xerox copy.**
- **Homework must be neat, readable, and must conform to acceptable Standards of Engineering Computation.**

Grading Policy

Exams:

Three exams and a final exam will be given during the course of the semester. Exams will be closed book and closed notes. No makeup exams will be given with the exception of unusual circumstances (institutional excuse, severe injuries, family emergencies, group activities etc.).

Grading Policy:

Homework and Attendance	**25% (attendance 10%)**
Exam 1	**15%**
Exam 2	**15%**
Exam 3	**15%**
Final Exam	**30%**

Total	**100%**

Letter Grade Scale:

90-100--------- A
80- 89 --------- B
70-79 --------- C
60-69 --------- D
0-59 --------- F

The instructor does reserve the right to slightly curve or scale the grades based on class groupings/performance.

Attendance Policy

The attendance policy will follow University's excused absence policy.

You are expected to attend all classes. However, the instructor accepts your absence for one session provided that

an advance notice will be given, unless this is an excused absence such as institutional excuse, severe injuries, family emergencies, group activities etc.

Course Schedule:

LECTURE SUBJECT Schedule & TEXT REFERENCE

1. Introduction of nonlinear dynamical system
2. chaos, fractal and classic dynamics equations,
3. one dimension system,
4. two dimension system,
5. phase plan
6. limit cycle, bifurcation, Lorenz equation, fractal.
7. Applications in mechanical engineering

***** *The instructor reserves the right to slightly change the topics and their order to achieve the maximum benefit of the course learning outcomes.*

Course Prerequisites:

Graduate Status