Cal. State University Channel Islands **Spring** 2007

Syllabus for Math 590: Topology

Instructor: Dr. Mohamed Ait Nouh

Email: mohamed.aitnouh@csuci.edu **Voice:** 805-437-2740

Office: My office is 268, located on the second floor of Sage Hall.

Textbooks:

- **Topology (second Edition),** by *James Munkres*

The following Textbooks are strongly recommended:

- **Algebraic Topology,** by *Allen Hatcher*
  Free download:
  http://www.math.cornell.edu/ hatcher/AT/ATpage.html
- **Basic Topology,** by *M. A. Armstrong*
- **Essential Topology,** by *Martin D. Crossley*
- **The Knot book,** by Collin Adams

Course outcome: This course is a preparation for Masters students who are willing to pursue a Ph.D. degree. We will cover the essentials of topology and algebraic topology including topological spaces and continuous functions, compactness, identification spaces, Fundamental groupand covering spaces, Classification of surfaces, homotopy theory, simplicial and singular homology, Knot theory.

Lecture:

- **Tuesday:** $7:00-9:00PM$

Office hours:

- **Tuesday:** $6:00-7:00PM$

Grades:

(1) Homework: 30%

(2) In-class work: 50%

(3) Attendance and Class Participation: 5%

(4) Presentation 15%

Note that the + and − will be assigned in the final grade.

1. Instructional Outline:

(1) Lesson 1 : Topological spaces (Definition and Examples):

1.0. Examples , weak topology
1.1. Product spaces: Tychonoff theorem
1.2. quotient spaces
1.3. Identification spaces
1.4. Abstract point set topology.
1.5. Topological groups.
1.6. Continuity: Peano theorem, Jordan curve theorem.

(2) Lesson 2 : Homotopy theory

2.1. Homotopy groups
2.2. The strong deformation retracts.
2.3. The Fundamental groups:
2.4. Van-Kampen theorem
2.5. Examples: Homotopy groups of $\mathbb{R}^n$, S^n, $\mathbb{R}P^n$, surfaces and knot exteriors.

(3) Lesson 4 : Classification of surfaces.

(4) Lesson 5 : Covering spaces, universal covering, classification of covering spaces.

(5) Lesson 6 : Homology theory

6.1. simplicial homology modulo 2
6.2. Integral simplicial homology
6.3. Singular homology
6.4. Mayer-Vietoris sequence: Application: The fixed point theorem for the n-disk
6.5. Homology and homotopy group: Hurewitcz Theorem
6.6. Homology of the product space: Kunneth Theorem
6.5. Comparison of simplicial and singular homology: Eilenberg-Steenrod Theorem

(6) Lesson 7 : Introduction to Knot theory

7.1. Definition
7.2. Fundamental group of the exterior of knots
7.3. Jones polynomial
7.4. Coloring of knots by the quandles.