Syllabus and Course Description
Math 489
Instructor: Eric Rowell
Course Title: **Special Topics in Geometry and Algebraic Topology: Beijing**

Summer I 2016

This course is an introduction to topics in Geometry and Algebraic Topology, with an emphasis on developing intuition through a hands-on approach. We will discuss algebraic structures that help us distinguish and classify geometric and topological objects such as wallpaper, knots, surfaces and polyhedra. We will also explore symmetry and topology in Chinese architecture, art and music, such as Chinese knotting, paper cutting and ceiling design.

**Prerequisites**
M220 or equivalent, and a GPA of 2.5.

**Text**
Online resources.

**Overall Plan**
We will spend 4 weeks in Beijing. This will be preceded by a pre-departure orientation and introduction to subject. (led by Rowell and assistants) and language crash-course (offered by Confusius Institute).

**Course Content and Syllabus Outline**
- **Week 0: Orientation**: pre-departure meeting, project description, introduction to topology and Mandarin language crash course.
- **Week 1: Geometric Symmetry**: types of symmetry (reflection, translation, rotation, glide reflection).
• Week 2: **Polyhedra and Surfaces**: Euler characteristic and curvature.

• Week 3: **Knot Theory**: classical and quantum invariants, Markov’s theorem, Alexander’s theorem.

• Week 4: **Projects**: Students present their research projects to the group.

• Week 5: **Final Draft**: The students turn in written reports on their project (electronically).

The material will be first presented from a hands-on perspective, with a view towards giving a mathematical description. Having developed an intuition, we will make conjectures and eventually arrive at the fundamental theorems in each area.

Each of the 4 weeks in Beijing we will dedicate one day to visiting a cultural site, and will write about our mathematical and cultural experiences. Tentatively we will visit:

• The Great Wall (MuTianYu section)
• Forbidden City
• National Center For the Performing Arts
• Temple of Heaven
• Summer Palace

Total contact hours: 45: 2 hours per day for 20 days in Beijing, and additional 5 hours before the trip.

**Grading**

The course grade will be based on weekly journal assignments (both mathematical and cultural experiences) and one final project. The mathematical journal topics will include several specific problems/questions for individual exploration. The final project will be presented to the class and turned in as a 5-10 page report in lieu of a final exam.

The grading scale is the standard one: 90-100% A, 80-89% B, 70-79% C, 60-69% D, 0-59% F.

The assignments will be weighted as follows, with the final grade computed out of 100 points:

1. Journals (4) 15 points each.

2. Final project: 20 points for the rough draft, 15 points for the final draft and 5 points for the presentation.
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