MATH 102 – Mathematics in Non-European Cultures – SYLLABUS

Department of Mathematics

Millersville University

Description

A survey of mathematical ideas developed by non-European cultures, including, but not limited to, those of Africans, Asians and native North, Central and South Americans. Includes culture and specific examples from the following areas of mathematics: number theory, topology, probability, group theory and logic. No credit under block G2 for math or science majors. (3 credits)

This course may be taken for general education credit (D for all majors, G2 for non-math and non-science majors). No more than one of MATH 100, 102, 107, and 108 may be taken for general education credit.

Prerequisites

MATH 090 with a grade of C- or higher, math placement testing/evaluation before registration.

Course Objectives

By the conclusion of this course the successful student will be able to:

- Develop written and oral communication skills

- Develop analytical reasoning and problem solving skills

- Gain a broader understanding of the mathematical aspects of art

- Become more aware of the cultural diversity of mathematics

- Be able to relate western and non-western mathematical ideas

Assessment

Assessment of student achievement of the course objectives will vary from one instructor to another. Typical criteria for evaluating students performance may include: Attendance, Participation, Discussion, Assignments, and Projects.

Use of Technology

This course may be offered in a blended or fully online format, and may use a mixture of synchronous and asynchronous delivery methods. Learning management system content tools, assignment tools, and/or discussion features may be used for presenting material, giving assignments and discussing course material asynchronously. Video conferencing tools will be used for synchronous discussion sessions with the instructor and peers. Assignments may include synchronous student presentations.

Topics

Students work on multiple projects for presentation to their classmates. A list of topics is available for their selection. Topics are selected from:

- Number Theory

    - Written numbers: They include the grouping system, as used by the Egyptians, in which the values of the symbols are added; the alphabetic system , as used by the ancient Indian katapayadi, whereby numbers are associated with letters of the alphabet; the partially positional system of the Indian Kharosti; and the positional system like the Babylonians'.

    - Spoken numbers: The methods of counting used by most indigenous groups are closely connected with their language structure. Here, the biggest hurdle is the formation of large numbers with a reasonable number of words. The Bantu languages' number words of Africa offer excellent examples.

    - Calendars: Calendrical forms are universal. Special attention is given to the Mesoamerican elaborated system of calendars.

    - Magic squares: They originated in China and later transferred to Japan. The mysterious squares were thought to have special powers, and some cultures used them for astrological and divinatory purposes. Extended magic squares methods were developed in West Africa in the eighteenth century.

- Topology

    - Graphs: The sona sand-drawings of the Tshokwe of Angola, the designs of the Bushoong of Congo, and the rice flour kolam drawings of the Tamil Nadu in India are studied, along with their connections with unicursal Shongo networks.

- Mazes: Sand tracing figures—nitus—and maze-dances of the Malekula of Vanuatu in the South Pacific Islands are investigated together with their geometrical transformations.

- String art: String figure making of the African Batwa Pygmies and Native Americans are analyzed using a series of simple movements called elementary Operations.

- Logical Structures

  - Kinship: The Warlpiri of Australia and the Tongans of the South Pacific Islands have unique kinship relation rules that are studied to gain insight into the political, social, or ritual organization of their members.

  - Recording and counting aids: Artifacts like the Inca quipu, the Chinese rods, the Japanese soroban, and wooden and bone tally sticks are studied. Objects like these were instrumental prior to the invention of paper.

  - Finger counting: More than 20 variations of finger counting are known in Africa among such peoples as the Maasai of Kenya and Tanzania. Students explore how finger counting differs according to region, ethnicity, and historical period.

  - Body counting: The use of the body as a counting tool can be found throughout the world. For example, tribal people in Papua New Guinea use as many as 74 body parts in their counting system.

- Group Theory

  - Symmetry patterns: The seven groups of symmetries of strip patterns are studied using non-Western artifacts like ceramics, fabrics, jewelry, and basketry. In two dimensional symmetry patterns—tessellations—most of the 17 wallpaper symmetry groups are present in non-Western cultures.

  - Groups: We study the connections found among group theory, kinship relations and magic squares.

- Probability

  - Games of chance: We study dice games like the Nyout from Korea, Tablan from India, and Pulic from Central America. Some variations of the African Mancala, believed to be the world's oldest game, are played by students.

  - Games of strategy: African and Native American games of strategy, like those played with stones, bones, or other small objects, are explored.

  - Puzzles: Puzzles from Africa like the Kpelle, river crossing and kinship puzzles are solved by drawing charts to represent the solutions.

  - Games are examined using mathematical reasoning, problem-solving, and cultural approaches.