MATH 650
Patterns in Mathematical Designs (3 units)

Course Outline

Topics	# of Weeks
Chapter 1: **Proportion :** Introduction, Proportion and Number, The Structure of Ancient Musical Scales, and System of Proportion Based on $\sqrt{2}$, θ , and ϕ	2
Chapter 2: **Similarity:** Introduction, Similarity, Families of Similar Figures, Archimedes Spiral, Logarithmic Spiral, Growth and Similarities in Nature, Growth and Similarity in Geometry, and Infinite Self-Similar Forms	2
Chapter 3: **The Golden Mean:** Introduction, Fibonacci Series, Some Tiling Properties of ϕ . The Golden Rectangle and the Golden Section, The Golden Mean Triangle, and The Pentagon and Decagon	2
Chapter 4: **Graphs:** Introduction, Graphs, Maps, Maps and Graphs on a Sphere, Connectivity of Graphs and Maps, Combinatorial Properties, Regular Maps, New Graphs from Old Ones, Duality, Planar and Nonplanar Graphs, Maps and Graphs on Other Surfaces, The Torus and the Mobius Srtip, Map Coloring, Regular Maps on a Torus, Szilassi and Csaszar Maps, Floor Plans, Bracing Structures, Eulerian Paths, and Hamiltonian Paths	2
Chapter 5: **Tilings with Polygons:** Introduction, Polygons, Regular Tiling of the Plane, Duality, Semiregular Tilings, Symmetry, Duality of Semiregular Tilings, The Module of a Semiregular Tiling, Other Tilings with Regular Polygons, Transformations of Regular Tiling, Nonperiodic Tilings, and Origami Patterns	3
Chapter 7: **Polyhedra: Platonic Solids:** Introduction, The Platonic Solids, The Platonic Solids as Regular Polyhedra, Maps of Regular Polyhedra on a Circumscribed Sphere, Maps of the Regular Polyhedra on the Plane - Schlegel Diagrams, Duality, Combinatorial Properties, Rigidity, The Angular Deficit, From Maps to Polyhedra - The Dihedral Angle, Space-Filling Properties, Juxtapositions, Symmetry, and Star Polyhedra	2
Tests:	1

Textbooks: Connections: The Geometric Bridge between Art and Science by Jay Kappraff,
Bridges: Mathematical Connections in Art, Music, and Science - 2005 by Reza Sarhangi and Robert Moody (Editors) and
Bridges: Mathematical Connections in Art, Music, and Science - 2006 by Reza Sarhangi and John Sharp (Editors)

Adopted: March, 2007