

Syllabus

CSE 4GS: Mathematical Beauty in Rome

A UCSD Global Seminar

Basic Information

- Course Title: CSE 4GS, **Mathematical Beauty in Rome**, 4 units
- Date: Summer Session 1, June 30 – August 3, 2018
 - Student *must* enroll in both CSE 4GS and CSE 6GS
- Instructor: Prof. Joseph Pasquale, Dept. of Computer Science and Engineering
 - Email: pasquale@cs.ucsd.edu
 - Web: <http://www-cse.ucsd.edu/~pasquale>
- Website: <http://www-cse.ucsd.edu/mathinrome>

Prerequisites

- Math 20A and Math 20B (Calculus for Science and Engineering I and II), permission of instructor

Overview and Topics

- Exploration of topics in math and engineering of classical Roman architecture
- Analysis of basic structures (arches, vaults, domes, etc.)
- Mathematical and engineering principles of Colosseum, Pantheon, St. Peter's, and other sites to be determined

Texts, Readings, Software - tentative

Text and Software (required)

- *Mathematical Excursions to the World's Great Buildings*, by Alexander J. Hahn, Princeton University Press, 2012.
- *The Geometer's Sketchpad*, Dynamic Geometry Software for Exploring Mathematics, v. 5.0, Key Curriculum Press Technologies, 2010.

Bibliography (books and articles that provide background for class material)

Books

- *Squaring the Circle: Geometry in Art and Architecture*, by Paul Calter. Key College, 2008.
- *Principles of Roman Architecture*, by Mark Wilson Jones. Yale University Press, 2003.
- *Shaping Structures: Statics*, by Waclaw Zalewski and Edward Allen, John Wiley & Sons, 1998.
- *De architectura*, by Vitruvius, 15 BC (*Vitruvius: Ten Books on Architecture*, ed. Ingrid D. Rowland Thomas Noble Howe. Cambridge University Press, 2001.)

- *Tutte l'opere d'architettura et prospetiva*, by Serlio (Sebastiano Serlio on Architecture, Volume 1: Books I-V, Translators: Vaughan Hart and Peter Hicks, Yale University Press, 2005)
- *On the Art of Building in Ten Books*, by Alberti (Leon Battista Alberti On the Art of Building in Ten Books, translated by J. Rykwert, N. Leach, R. Tavernor, MIT Press, 1988).
- *Timaeus*, by Plato (translated by P. Kalkavage, Focus Publishing/R. Pullins Co., June 15, 2001).
- *Classical Architecture*, by James Stevens Curl. W. W. Norton and Co., 2001.
- *Roman Architecture*, by Frank Sear. Cornell University Press, 1983.
- *The Stone Skeleton: Structural Engineering of Masonry Architecture*, by Jacques Heyman. Cambridge University Press, 1995.
- *Arches, Vaults and Buttresses*, by Jacques Heyman, Variorum, 1996.
- *Structural Analysis: A Historical Approach*, by Jacques Heyman, Cambridge University Press, 1998.
- *The Masonry Arch*, by Jacques Heyman. Halsted Press (Wiley), 1982.
- *The Colosseum*, by Keith Hopkins and Mary Beard. Harvard University Press, 2005.
- *Story of the Roman Amphitheatre*, by D. L Bomgardner. Routledge, 2002.
- *Roman Aqueducts and Water Supply*, by A. Trevor Hodge. Duckworth Publishers, Second ed., 2002.
- *Guide to the Aqueducts of Ancient Rome*, by Peter J. Aicher. Bolchazy-Carducci Publishers, 1995.
- *Water Distribution in Ancient Rome: The Evidence of Frontinus*, by Harry B. Evans, University of Michigan Press, 1997.
- *Brunelleschi: Studies of His Technology and Inventions*, by Frank D. Prager and Gustina Scaglia. Dover Publications, 2004.
- *Brunelleschi's Cupola: Past and Present of an Architectural Masterpiece*, by Giovanni Fanelli and Michele Fanelli. Mandragora, 2006.
- *Brunelleschi's Dome*, by Ross King, Penquin Books, 2000.
- *Roman Builders: A Study in Architectural Process*, by Rabun Taylor. Cambridge University Press, 2003.
- *Roman Building: Materials and Techniques*, by Jean-Pierr Adam. Routledge, 2003.
- *Concrete Vaulted Construction in Imperial Rome: Innovations in Context*, by Lynne Lancaster, Cambridge University Press, 2005.
- *Structures or Why things don't fall down*, by J. E. Gordon, Da Capo, 1978.
- *Roman Bridges*, by Colin O'Connor, Cambridge University Press, 1994.
- *Circle and Oval in the Square of Saint Peter's: Bernini's Art of Planning*, by Timoty K. Kitao. New York University Press, 1974.
- *Basilica, The Splendor and the Scandal: Building St. Peter's*, by R. A. Scotti, Plume, 2007.
- *Proportion: Science, Philosophy, Architecture*, by Richard Padovan. Spon Press, 1999.

- Light, Wind, and Structure: The Mystery of the Master Builders, by Robert Mark, MIT Press, 1994.
- Creating the Pantheon: Design, Materials and Construction, by Gene Waddell, Bibliotheca Archaeologica, 42, L'Erma di Bretschneider, 2008.
- The Pantheon in Rome. Contributions to the Conference Bern, November 9-12, 2006, Gerd Graßhoff, Michael Heinzelmann, Markus Wäfler (Eds.). Bern: Bern Studies, 2009. online at digitalpantheon.ch
- How to Read Buildings: A Crash Course in Architectural Styles, by Carol Davidson Cragoe, Rizzoli, 2008.
- Illustrated Dictionary of Historic Architecture, by C. M. Harris (ed.), Dover Publications, 1977.
- Graphical Analysis - A Text Book in Graphic Statics, by William S. Wolfe, McGraw Hill Book Co., 1921.
- Experiencing Architecture, by Steen Eiler Rasmussen, MIT Press, 1959.
- Architectural Principles in the age of Humanism, by Rudolf Wittkower, The Norton Library, 1971.
- Architectonics of Humanism: Essays on Number in Architecture, by Lionel March, Academy Editions, 1998.

Articles from Journals and Conference Proceedings

- M. Rubin, "Architecture and Geometry," *Topologie Structurale / Structural Topology*, No. 1, 1979.
- M. T. Bartoli, "Palazzo della Signoria in Florence: details and rules of Gothic architecture," *Disegnare, idee e immagini*, no. 29, Editore Gangemi, Roma (Dec. 2004), pp. 26-33.
- R. Corazzi and G. Conti, "Brunelleschi's dome between theory and reality," *Disegnare, idee e immagini*, no. 31, Gangemi Editore, Roma (Dec. 2005), pp. 56-67.
- "Il Colosseo Studi e Ricerche," *Disegnare, idee e immagini*, no. 18-19, Editore Gangemi, Roma (June/Dec 1999). (entire issue devoted to research on the Colosseum)
- M. Docci, "The architectural orders of the Colosseum," *Disegnare, idee e immagini*, no. 29, Editore Gangemi, Roma (Dec. 2004), pp. 26-33.
- S. Duvernoy and P. L. Rosin, "The Compass, the Ruler and the Computer," *Proc. Nexus VI: Architecture and Mathematics*, pp. 21-34, 2006.
- N. T. Gridgeman, "Elliptic Parallels," *The Mathematics Teacher*, 63, (1970), pp. 481-485.
- N. T. Gridgeman, "Quadarcs, St. Peter's and the Colosseum," *The Mathematics Teacher*, 63 (1970), pp. 209-215.
- M. Wilson Jones, "Designing Amphitheatres," *MDAI(R), Mitteilungen des deutschen archäologischen Instituts, Römische Abteilung - Mayence* 100 (1993), pp. 391-442.
- P. L. Rosin and E. Trucco, "The Amphitheatre Construction Problem," *Incontro Internazionale di Studi Rileggere L'Antico*, 2005.
- P. L. Rosin, "On Serlio's construction of ovals," *Mathematical Intelligencer*, vol. 23, no. 1, pp. 58-69, 2001.

- T. Thieme, “La geometria di Piazza San Pietro,” Palladio, XXIII (1973), 129-144.
- L. March, “Renaissance mathematics and architectural proportion in Alberti's De re aedificatoria,” Architectural Research Quarterly, 2:54-65, Cambridge University Press, 1996.

Grading - tentative

- 40% weekly homework (4 weekly homework assignments)
- 20% class participation (9 hrs prep per 3 hour lecture = 18 hrs/week)
- 40% final exam

Course Policies

- Attendance to all classes and on-site labs is required
- Late work will not be accepted, extensions will not be given
- Students must abide by the rules of UCSD Policy on Integrity of Scholarship: <http://senate.ucsd.edu/manual/appendices/appendix2.pdf>
- Students must act in a respectful and mature manner when visiting all monuments and sites, and follow all visitation rules; failure to do so can result in immediate expulsion from the program

Schedule (for both CSE 4GS and 6GS) - tentative

- Mon/Thu, 15:00-18:00 Class (CSE 4GS)
- Tue/Wed, 9:30-14:00 On-site labs (CSE 6GS)
- Fri, 9:30-15:30 Excursions (CSE 4GS+6GS)
- Some weeks the activities may be organized differently