

Architecture 672 : Economic Influences on Architecture

Credit: 3 Hours
Time: Wednesday, 7:30 - 10:00 p.m.
Instructor: Burkhard von Rabenau
289C Brown Hall
e-mail: vrabenau@qn.net, von-rabenau.1@osu.edu
Tel: 292-8279

INTRODUCTION

The purpose of the course is (1) to provide students with an understanding of the economic environment in which architects and project planners operate and (2) to acquaint students with financial tools used in project design, analysis and planning. As a result of this course students should find it easier to communicate with and understand the point of view of developers, financial institutions, builders, and government regulators working with architects and planners on project implementation.

The course makes use of spreadsheets. While some knowledge of spreadsheets is desirable it is not required. Grades are based on a single midterm and four homeworks. The course schedule has been arranged so that it does not conflict with the KSA lecture series.

TEXTS

The following texts are recommended, but not required:

- 1) Leland Blank and Anthony Tarquin, **Engineering Economy**, McGraw Hill Book Company, 1998.
- 2) Robert E. Johnson, **The Economics of Building**, John Wiley & Sons. Inc., 1990
- 3) Burkhard von Rabenau, **Project Financial Analysis for Physical Planners**, Mimeo, 1994 (available on reserve, you may copy it).

All readings are available for limited 2-hour check-out at the Science and Engineering Library.

COURSE OUTLINE

Week 1	Project Design and Analysis: An Overview
Week 2	Project Costing and Cash Flow
Week 3	Interest on Single Payments and Applications
Week 4	Interest on Series of Payments and Applications
Week 5	Midterm
Week 6	Life Cycle Costing
Week 7	Project Development
Week 8	Project and Developer's Financial Analysis
Week 9	Project Comparisons
Week 10	Replacement and Maintenance

CLASS FORMAT

The class meets once per week for up to three hours of lectures. One in-class exam substitutes for a lecture as indicated in the COURSE OUTLINE. In addition, there are four homeworks with due dates to be announced.

COURSE GOALS

The student is to understand the influence of economic factors on the built environment and on the design and building process. The student is to learn to apply that knowledge to improve architectural project decisions, including decisions on project programs, design standards, building systems, and implementation.

COURSE OBJECTIVES

Upon completion of the course the student should be able to define terms, state important principles, methods and facts and apply them to particular cases in the following areas covered by readings and lectures:

- Project programming (programming of space or performance requirements and cost);
- Cash flow diagrams and cash flow analysis;
- Project costing in constant and nominal prices; construction cost indices and the treatment of inflation in cost analysis; physical and financial contingencies;
- Valuation of time, discounting, compounding, comparison of projects based on their rate of return and present or annual worth;
- Cost recovery or breakeven pricing;
- Design to cost; least cost analysis;
- property valuation, depreciation, mortgage instruments, affordability analysis;
- Evaluation of design alternatives regarding quality, maintenance and operating characteristics of buildings and building components; comparison of projects with equal and unequal life;
- Principles of life-cycle costing;
- fixed cost and breakeven analysis; quantity surveying;
- Construction of spreadsheets for project financial analysis, including what-if analysis, sensitivity analysis, scenario construction and solving for goals.

EVALUATION

The evaluation will be based on the student's performance relative to other students enrolled in the course in meeting course objectives. The final grade will be determined by class attendance (10%) midterm exam (30%), and four homeworks counting each 15%. The midterm covers roughly one half of the course materials and takes 60-90 minutes to complete. Exams and lectures require a calculator with power function. The midterm is closed book. Formulas will be given, except as indicated during lectures. You will be able to look at last year's midterm.

The points received in the exams and homeworks will be added together for a potential total of 1000 points. Grades will be assigned as follows:

900	-	1000	=	A
750	-	899	=	B
600	-	749	=	C
450	-	599	=	D
Less than		450	=	E

ACADEMIC MISCONDUCT

All students are held responsible for following and abiding by the University's policies on plagiarism and academic misconduct.

READING/MATERIALS

Reading Assignments come from Blank and Johnson below. In addition, you may consult other texts listed below available at Science and Engineering Library:

Blank	L. Blank and A. Tarquin, Engineering Economy , McGraw Hill (1989).
Johnson	R. Johnson, The Economics of Building , John Wiley & Sons, Inc. (1990)
Neil	J. Neil, Construction Cost Estimating for Project Control , Prentice-Hall (1982).
Smith	H. Smith, C. Tschappat and R. Racster, Real Estate and Urban Development , 3rd ed., Richard D. Irwin (1981)
Rabenau	Rabenau, B. v. Project Financial Analysis for Physical Planners , mimeo (1993)

READING ASSIGNMENT AND LECTURE SCHEDULE

- Week 1 Project Design and Analysis: Models in project design and planning; stylized facts of construction projects; architectural models vs financial spreadsheet models; trade-offs and optimization of project flexibility of use, speed of construction, durability and maintenance, energy efficiency; facility programming.
Read:
- Johnson Chs. 1-2
- Week 2 Project Costing and Cash Flow: Project costing; economies and diseconomies of scale in project size; scale elasticity of cost as means to estimate cost; cash flow diagrams; typical cash flow over project life; interest calculations for single payments; compound amount and present worth factors.
Read:
- Johnson Ch. 3, 8, 14
 - Blank Ch. 1
- Week 3 Interest on Single Payments: Real and nominal income; project cost in constant and current prices; real and nominal interest; inflation; physical and financial contingencies; spreadsheet preparation and formatting; need for identification of input parameters; spreadsheet transparency; what if analysis.
Read:
- Johnson Ch. 4
 - Blank Ch. 2.1-2.2
- Week 4 Interest on Series of Payments: Capital recovery and present worth factor, sinking fund and compound amount factor; applications to energy and operating cost, life cycle calculations, mortgages and mortgage payments (conventional mortgage, adjustable rate mortgage), property valuation, project design problems, and cost recovery pricing.
Read:
- Johnson Ch. 5
 - Blank Ch 2.3-2.8
- Week 5 Midterm and following Midterm: effective vs nominal interest rate; ordinary annuity vs. annuity due; project cost analysis in constant vs. current prices; applications to project analysis, including least cost analysis, designing to cost; cost recovery/breakeven pricing.
Read:
- Johnson Ch. 7
 - Blank Ch. 3-4
- Week 6 Life Cycle Analysis: development cost and residual value; annual maintenance and operating cost; periodic rehabilitation; present value vs. annual value of project life cycle cost; spreadsheet implementation; conditions for meaningful comparison of alternatives.
Read:
- Johnson Ch. 16
 - Blank Ch. 16

- Week 7 Project Development: Property valuation (income capitalization approach, replacement net of depreciation method; market comparison approach); alternative depreciation methods; advantages of accelerated depreciation; alternative methods to shelter taxes and use in development; internal rate of return – simple case and iterative methods.
Read:
 - Johnson Ch. 6
 - Blank Ch. 13
- Week 8 Project and Developer's Financial Analysis: Leveraging and impact on project rate of return and project risk; analysis of rental property; income before and after taxes; income after tax and amortization; project cash flow vs. developer cash flow; project vs developer's internal rate of return; capital gains and their taxation; spreadsheet implementation of property analysis; financial formulas in Excel; use of solver; what if analysis using scenarios; goal seeking; optimization using solver.
Read:
 - Johnson Ch. 13
 - Blank Ch.
- Week 9 Project Comparisons: Equivalence of annual worth and present worth calculations; comparison of project alternatives and conditions for comparability (same life, same cost, same reinvestment rate); comparison of projects when life differs; conditions for meaningful annual cost comparisons; financial vs. economic analysis; elements of a feasibility analysis.
Read:
 - Blank Ch. 5-8
- Week 10 Maintenance and Replacement Analysis: Replacement issues such as whether and when to replace; how much to maintain; and how to choose the optimal life of a building or of project components such as roofs, heating and air-conditioning systems (for architects), trees (for landscape architects) or road surfaces (as an example for city planners).
Read:
 - Blank Ch. 10