Prerequisites:
Previous coursework covering regression and knowledge of multivariate statistics. Basic data analysis experience is assumed.

Purpose:
The course will provide a general introduction to structural equation modeling (SEM): path analysis (PA) and exploratory and confirmatory factor analysis (EFA and CFA) techniques, and will examine the uses of these approaches in the social sciences. This course focuses on (a) understanding the basic components of SEM, (b) practical applications, and (c) in-depth examination of methodological issues. Emphasis will be placed on the application of these methods. In this course, students will (a) develop skills to conduct SEM research and (b) critically review the use of SEM in research.

Objectives:
The general objectives of the course are to enable students to:
1. Learn key concepts underlying SEM.
2. Understand research studies using SEM approaches, such as PA, EFA, and CFA.
3. Become familiar with using SEM analysis software.
4. Conduct PA, EFA, and CFA.
5. Present results, as well as interpret and discuss the findings.
6. Be familiar with multigroup (Measurement Invariance) and longitudinal analyses (Growth Modeling) and MIMIC analysis in SEM.
7. Conduct SEM on categorical outcomes.

Texts and Readings:
There are two required texts (1-2), several books on reserve in the library (3-5), and several primary readings. Students are encouraged to consult the additional texts for further discussions of issues. Readings may be added or deleted as necessary.


Most of the journal articles and book chapters from additional texts are available via PDF files on Blackboard.

**Software:**

Computer lab work is a required component of this course. This will give students the opportunity to apply what is discussed in class. Students will be exposed to Mplus. Other software (e.g., AMOS) may be introduced as time allows or need arises. SAS and R, AMOS are available [here](http://library.syr.edu/services/technology/software/public_pc.php) in the university computer labs, including the one in Huntington Hall. A student version of LISREL can be downloaded for free [here](http://www.ssicentral.com). A free demo version of Mplus can be downloaded from [here](http://www.statmodel.com/demo.shtml).

**Grades:**

Grades will be based on (a) participation in class discussions and presentations (30%), (b) homework assignments (30%), and (c) the final project (40%). Attendance is expected. Please notify the instructor in advance, if possible, if you are unable to attend class. As a seminar, students are expected to actively participate in class. You are responsible for the material covered during any class you miss. You are encouraged to work together and assist each other with the course material and assignments. However, all assignments should be your own work. Academic honesty is expected.

**Course Grading Standards:**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>A+</td>
<td>98% and above</td>
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<tr>
<td>A</td>
<td>94% - 97%</td>
</tr>
<tr>
<td>A-</td>
<td>91% - 93%</td>
</tr>
<tr>
<td>B+</td>
<td>88% - 90%</td>
</tr>
<tr>
<td>B</td>
<td>83% - 87%</td>
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<tr>
<td>B-</td>
<td>80% - 82%</td>
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<tr>
<td>C+</td>
<td>77% - 79%</td>
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<tr>
<td>C</td>
<td>73% - 76%</td>
</tr>
<tr>
<td>C-</td>
<td>70% - 72%</td>
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**Assignments (30%):**

There will be three modeling assignments during the semester: Assignment 1, Path Analysis; Assignment 2, EFA and CFA; and Assignment 3, Multi-group analysis (or MIMIC Modeling). The data and further information regarding these assignments will be provided throughout the semester. These computer assignments are designed to help you build up the final project. Data and sample code files will be posted on Blackboard. A computer lab using AMOS and Mplus will be run in Huntington Hall to help with your assignment one week before it is due.

**Presentations (45%):**

Each student will give presentations and lead the class discussion during the semester (i.e., a total of 3 presentations). Presentations 1 and 2 are suggested to be done at different classes. The third
presentation will cover your final project. The first and the second presentations will involve explaining and leading discussions on a methodological aspect of factor analysis (see the reading list). During one presentation (either the first or the second) it will involve an empirical article the student selects to critically review for its use of SEM/factor analysis. Please give the article to the instructor one week prior to your presentation. I will make these available for your peers via Blackboard. An outline for what is expected will be given.

**Final Project (25%)**:  
This is an opportunity to demonstrate and summarize what you have learned throughout the semester. The project involves conducting/proposing an SEM/factor analytic study on data that are of interest to you. The dataset can be obtained from one of your professors, colleagues, or one that you have collected. Your final project can be a summary of work based upon your assignments. If you have questions about a data source, please ask. Projects will be presented to the class at the end of the semester. Your written report is due on 4/30.

The project must be typed and follow APA format (6th edition). The APA style manual is available at bookstores and in the reference section of the library. Font size should be no smaller than 10 or larger than 12 point. Page margins should be 1.0 inch. The 15-page paper should be written in a form suitable for publication or submission for a conference paper in your field. Identification of the computer program used and output from the analysis must be provided with the paper as an appendix. More details will be given in class. Please proof read carefully. Incorrect grammar and misspelled words are unacceptable. Late assignments will not be accepted.

[http://owl.english.purdue.edu/owl/resource/560/01/](http://owl.english.purdue.edu/owl/resource/560/01/)

**TENTATIVE Schedule (subject to change as necessary):**

<table>
<thead>
<tr>
<th>Class Meeting, Date</th>
<th>TOPIC</th>
<th>READINGS [Presenter]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1, 1/15</td>
<td>Class overview</td>
<td>No</td>
</tr>
<tr>
<td>Class 3, 1/29</td>
<td>SEM programs: Mplus and Amos; path analysis Note: 2/3 is the last day for late registration and schedule adjustment</td>
<td>Raykov &amp; Marcoulides (2006), Ch. 2 (SEM and Mplus, pp. 55-56, 73-76); Ch. 3 (path analysis)</td>
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<tr>
<td><strong>Final Project: part 1</strong></td>
<td><strong>Introduction, measures, conceptual model</strong></td>
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<tr>
<td>Class Date</td>
<td>Assignment/Project</td>
<td>Topic</td>
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</table>
| 4/2/5      | Assignment 1 due   | Factor analysis in research, assumptions and data, EFA | Brown (2006), Ch. 2  
Floyd & Widaman (1995)  
Tinsley & Tinsley (1987)  
Gorsuch (1983), Ch. 1, pp. 1-13 |
| 2/12       | Final Project: part 2-Path Model development | Factor models, sample size, extraction methods | Gorsuch (1983), Ch. 8  
MacCallum et al. (1999)  
Brown (2006), Ch. 10 (power and sample size) |
| 2/19       | Class 6            | Extraction methods and number of factors | Gorsuch (1983), Ch. 9  
Velicer & Jackson (1990)  
Widaman (1993)  
Zwick & Velicer (1986) |
| 2/26       | Class 7            | Rotation methods and factor scores; *missing data optional | Gorsuch (1983), Ch. 9  
*Schafer & Graham (2002)  
*Brown (2006), Ch. 9 (missing data, pp. 363-378) |
Fabrigar et al. (1999)  
Reise et al. (2000) |
| 3/12       | No Class on March 12th Spring Break! | | |
| 3/19       | Class 9            | CFA, model estimation, *sample size | Brown (2006), Ch. 3  
Raykov & Marcoulides (2006), Ch. 4  
*Muthen & Muthen (2002)  
*Jackson (2001) |
| 3/26       | Class 10           | Model specification and interpretation | Brown (2006), Ch. 4  
Schumacker & Beyerlein (2000)  
Cole (1987) |
| 4/2        | Assignment 2 due   | Model evaluation and modification | Brown (2006), Ch. 5  
Hu & Bentler (1995; 1999)  
Kaplan (1990)  
MacCallum et al. (1992)  
*Browne & Cudeck (1993) |
| 4/9        | Class 12           | Multiple group analyses, latent mean structures | Raykov & Marcoulides (2006), Ch. 5  
Brown (2006), Ch. 7  
Hancock (1997)  
Cole et al. (1993)  
Little (1997) |
Class 13, 4/16
Final Project: part 5-MIMIC and/or multiple group analysis

<table>
<thead>
<tr>
<th>Measurement invariance and MIMIC model</th>
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<tbody>
<tr>
<td>Raykov &amp; Marcoulides (2006), Ch. 5</td>
</tr>
<tr>
<td>Brown (2006), Ch. 7</td>
</tr>
<tr>
<td>Mplus User Guide 6 (examples 5.8, 5.14-15)</td>
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<tr>
<td>Mplus User Guide 6 (Ch. 14: Measurement invariance testing, p. 432)</td>
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Class 14, 4/23
Assignment 3 due

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<tr>
<th>Advanced Topics: 1. Growth modeling, cautions &amp; issues</th>
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<tr>
<td>2. Categorical variables in SEM and factor analysis models</td>
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<tr>
<td>Raykov &amp; Marcoulides (2006), Ch. 6</td>
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<tr>
<td>Bentler &amp; Chou (1987)</td>
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<tr>
<td>Graham et al. (2003)</td>
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<td>Brown (2006), Ch. 9</td>
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<td>Muthen (1984)</td>
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<tr>
<td>Diemer, Wang, &amp; Dunkle (2009)</td>
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Presentation, 4/30

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<tr>
<th>Project Presentations</th>
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<tr>
<td>Final Project Due</td>
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Weekly Readings:


UNIVERSITY POLICIES: http://supolicies.syr.edu

Special Needs:
Students who require reasonable accommodations as a consequence of disability are encouraged to contact me as soon as possible. It is also essential that you contact the Students with Disabilities Services Office (ODS, 804 University Ave., Room 309, 315-443-4498) to communicate your needs and to begin to develop a working relationship with their staff.

Academic Integrity:
The Syracuse University Academic Integrity Policy holds students accountable for the integrity of the work they submit. Students should be familiar with the Policy and know that it is their responsibility to learn about instructor and general academic expectations with regard to proper citation of sources in written work. The policy also governs the integrity of work submitted in exams and assignments as well as the veracity of signatures on attendance sheets and other verifications of participation in class activities. Serious sanctions can result from academic dishonesty of any sort. For more information and the complete policy, see the Academic Integrity Policy (http://supolicies.syr.edu/ethics/acad_integrity.htm).

Religious Observances Policy:
SU’s religious observances policy (http://supolicies.syr.edu/emp_ben/religious_observance.htm) recognizes the diversity of faiths represented among the campus community and protects the rights of students, faculty, and staff to observe religious holy days according to their tradition. Under the policy, students are provided an opportunity to make up any quiz, examination, critique, or work requirements that may be missed due to a religious observance, provided they notify their instructors before the end of the second week of classes. For fall and spring semesters, an online notification process is available through MySlice/Student Services/Enrollment/My Religious Observances from the first day of class until the end of the second week of class.