Course Description
While the increased capacity and availability of data gathering and storage systems have allowed enterprises to store more information than ever before, most organizations still lack the ability to effectively consolidate, arrange, and analyze this vast amount of data. Analyzing large data sets to forecast and predict future events has become a highly sought-after skill in business, engineering, services, science, health, and other industries.

This course will explore the theory and practice of three major areas:
- Data Warehouses for Enterprises
- Business Intelligence for Enterprise Resource Planning Systems (ERP)
- Business Forecasting
- Cloud Analytics for Enterprises

Learning Objectives
After completing the course, students will be able to
- Describe the components of an enterprise data warehouse
- Model the relational database required for an enterprise data warehouse
- Extract, cleanse, consolidated, and transform heterogeneous data into a single enterprise data warehouse
- Analyze data to generate information and knowledge that lead to informed decisions for businesses
- Show how ERP business intelligence can be derived from data warehouses
- Describe the various forecasting techniques
- Describe components of the cloud analytics and how they compare to enterprise data warehouses
**Prerequisite(s):** ITP 320 or ITP 249

**Course Notes**
Lectures are delivered face to face in classroom. Lectures are not recorded so attendance is strongly recommended. All course materials will be made available through Blackboard. These include:

- Lecture slides
- In-class exercises
- Homework assignments
- Readings
- Software details and instructions for accessing Viterbi Virtual Lab
- Grades and feedback
- Office hours
- Online discussion forums will be used for out-of-class discussions

Announcements made in class and content posted in Blackboard will supersede the contents of this syllabus.

**Technological Proficiency and Hardware/Software Required**
The assignments for this class will include both reading assignments as well as hands-on computer assignments. **Students must bring their laptop computers to lecture** sessions to participate in hands-on activities. Students will be given tutorials to gain familiarity with software tools.

Most of the SAP software required for the class is Windows based. The software will be provisioned through the Viterbi Virtual Lab. Specifically, students will be using: (more tools may be added)

- Eclipse with SAP BW Modeling Tools
- SAP BW/4HANA (Business Warehouse)
- SAP GUI
- SAP Analysis for Microsoft Excel
- SAP Predictive Analytics
- Microsoft Excel and Access
- Amazon Web Services (AWS) Data Lakes and Analytics
- Additional tools as needed

**VITERBI VIRTUAL LAB – VMWARE VDI**
All software can also be accessed into Virtual Desktop by logging in at: [http://mydesktop.vlabs.usc.edu](http://mydesktop.vlabs.usc.edu). See blackboard for additional instructions on installing.

**Required Readings and Supplementary Materials**
[http://store.epistemypress.com/books/analytics.html](http://store.epistemypress.com/books/analytics.html)

In addition to the required reading and supplementary materials listed in the weekly breakdown section of this syllabus, additional materials will be announced in class and published on Blackboard.

**Description and Assessment of Assignments**
*Homework:* Most homework is computer based. Homework should be turned in to Blackboard on time. Grading will be based on completeness, accuracy, and timeliness. Feedback will be provided through Blackboard. These are individual effort assignments.
In-Class Exercises: are guided Q&A and hands-on exercises that are used to spark additional discussion and deeper understanding of the materials and concepts before the student leaves the class. Announcement of in-class exercises may or may not be given prior to the class. In-class exercises can be a team or individual exercises. The score used for grading is the percentage of in-class exercises completed and turned in in-class vs what was assigned in the semester.

Exams: are in-class tests with multiple choice, free response, and/or live tool sections. As an example, students may be required to create an SAP query and analyze the results on a live enterprise data warehouse system as part of the “live tool” portion of the exam.

Final Project: Final project is an individual summative assignment where you will be applying most of the skills that you have learned through the semester. Each semester may have a different final project, but will include modeling the relational database required for an enterprise data warehouse, extract/cleanse/consolidate/transform heterogeneous data into a single enterprise data warehouse, and analyze data.

Project Timeline: (may differ slightly based on the individual pace of the class)
- Week 13: Project assigned
- Week 14: Solution approach and design
- Week 16: Final project due

Grading Breakdown
- Homework: 30%
- In-Class Exercises: 10%
- Exam I: 25%
- Exam II: 25%
- Final Project: 10%
- TOTAL: 100%

Grading Scale
Final grades represent how you perform in the class relative to other students. Historically, the average grade for this class is about a 3.4.

Assignment Submission Policy
It is the responsibility of the student to make sure problem solution and assignment are turned in on time. Make sure you follow the procedures outlined in each assignment (Blackboard submissions).

Students are encouraged to work with their classmates. However, students must turn in their own, original work. Late homework submissions will be subject to a late penalty. The penalty is 25% per day. No assignments will be accepted later than four days from after the due date.

Grading Timeline
Assignments Grading will typically be completed 7 days after submission. Any variations will be announced in class or on blackboard.

Additional Policies
No make-up exams (except for documented medical or family emergencies) will be offered nor will there be any changes made to the Final Exam schedule, except as permitted by university rules. The use of mobile devices, books, notes or computers is not permitted during the exam unless explicitly specified by the professor – e.g. use of a computer for the live tool portion of an exam.
# Course Schedule:

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<tr>
<th>Week 1</th>
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<th>Topics/Daily Activities</th>
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<td>Course Introduction</td>
<td>Lecture 0</td>
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<td>• Course objectives and outcomes</td>
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<td>Enterprise Data Analytics</td>
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<td>• Why do enterprises need data analytics?</td>
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<td>• What is a data warehouse?</td>
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<td>• Various types of data repositories</td>
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<td>Log into VMware (bring laptops)</td>
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<td>NO CLASS ON MONDAY – MLK DAY</td>
<td>Lecture 2</td>
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<td>Data &amp; Relational Database Concepts</td>
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<td>• Types &amp; Instances</td>
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<td>• Tabular vs Multi-Dimensional Data</td>
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<td>• ER Diagrams</td>
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<td>• Database Normalization, normal forms</td>
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<td>• Denormalization of tables</td>
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<td>IC #1: Data Modeling (ER Diagram &amp; Access)</td>
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<tr>
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<td>SQL Review</td>
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<td>• JOINs</td>
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<td>• Introduction to in-memory databases</td>
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<td>IC#2: SQL (SQL on Access &amp; Teradata)</td>
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<td>Data Warehousing Concepts</td>
<td>Lecture 4</td>
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<td>• Transactional vs Master data</td>
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<td>• Types and sources of data</td>
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<td>• Transactional databases vs. data warehouses</td>
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<td>• Enterprise data warehouses</td>
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<td>• Data store objects</td>
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<td>• Multidimensional Model for data warehouses</td>
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<td>Star Schema</td>
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<td>• Dimension and fact tables</td>
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<td>Snowflake Schema</td>
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<td>• Difference between star schema and snowflake schema</td>
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<td>• Master data tables</td>
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<td>o Attributes – Display, Navigational</td>
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<td>IC #3: Schemas</td>
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<td>Data Warehousing Implementation</td>
<td>Lecture 5</td>
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<td>• SAP HANA &amp; BW/4HANA</td>
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<td>• InfoObjects</td>
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<td>• Source Systems</td>
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<td>IC #4: SAP BW/4HANA Components (Eclipse)</td>
<td>Exam I Review</td>
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**Week 6**  
**Feb 17**  
Exam I – Feb 19 in CLASS

**Week 7**  
**Feb 24**  
InfoObjects: Key Figures & Characteristics  
- Creating InfoObjects  
- Handling aggregations – standard and exception  
- Handling time dependency  
- Handling language dependency  
IC #5: Characteristics

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<tr>
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| HW #4 (Key Figures & Characteristics)  
HW #5 (Master Data Load) |

**Week 8**  
**Mar 2**  
InfoProviders: ADSO & Composite Providers  
- ADSO  
- Composite Provider  
- Defining ADSO  
- Defining a Composite Provider  
IC #6: InfoProviders (ADSO & Composite Providers)

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<th>Lecture 6</th>
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<tr>
<td>HW #6 (ADSO &amp; Composite Providers)</td>
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**Week 9**  
**Mar 9**  
Extraction, Transformation, and Loading (ETL)  
- Source systems  
- Data Sources  
- Extractors for data (APIs etc.)  
- Mapping of fields  
- Transformation rules  
- Data cleansing and harmonization  
- Data flow objects  
Fact Table Loading  
IC #7: Data Cleansing  
IC #8: Fact Table Loading

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<tr>
<td>HW #7 (Data Source &amp; Fact Table Load)</td>
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**Week 10**  
**Mar 23**  
Building queries  
IC #9: Data Analyst: Queries

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<tr>
<td>HW #8 (Build Query in Eclipse)</td>
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**Week 11**  
**Mar 30**  
Slicing and Dicing  
- Basics of slicing and dicing  
- Pivot tables  
- Working with aggregation functions, hierarchies  
- Slicing and dicing multidimensional data  
IC #10: Business Analyst: SAP Analysis for Excel

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<th>Lecture 9</th>
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<tr>
<td>HW #8 (Analyze Data using SAP Analysis)</td>
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**Week 12**  
**Apr 6**  
Slicing and dicing contd.  
- Currency conversion

<p>| Lecture 9 (cont)  |</p>
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<th>Week 13</th>
<th>Apr 13</th>
<th>Business Forecasting</th>
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<td>• Time series analysis</td>
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<td>Final Project Overview</td>
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<td><strong>Exam II Review</strong></td>
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<td><strong>Exam II – APRIL 15 in CLASS</strong></td>
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<td>Week 14</td>
<td>Apr 20</td>
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<td>• Comparison to Enterprise Data Warehouse</td>
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<td>• Tool Mappings</td>
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<td>IC #10: AWS Part 1</td>
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<td>IC #11: AWS Part 2</td>
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<td><strong>Week 16</strong></td>
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<td>Final Project Due</td>
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Statement on Academic Conduct and Support Systems

Academic Conduct
Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in Scampus in Part B, Section 11, “Behavior Violating University Standards” https://policy.usc.edu/scampus-part-b/. Other forms of academic dishonesty are equally unacceptable. See additional information in Scampus and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct.

Support Systems
Student Counseling Services (SCS) - (213) 740-7711 – 24/7 on call
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention. https://engemannshc.usc.edu/counseling/

National Suicide Prevention Lifeline - 1-800-273-8255
Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. http://www.suicidepreventionlifeline.org

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-4900 - 24/7 on call
Free and confidential therapy services, workshops, and training for situations related to gender-based harm. https://engemannshc.usc.edu/rsvp/

Sexual Assault Resource Center
For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: http://sarc.usc.edu/

Office of Equity and Diversity (OED)/Title IX Compliance – (213) 740-5086
Works with faculty, staff, visitors, applicants, and students around issues of protected class. https://equity.usc.edu/

Bias Assessment Response and Support
Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. https://studentaffairs.usc.edu/bias-assessment-response-support/

The Office of Disability Services and Programs
Provides certification for students with disabilities and helps arrange relevant accommodations. http://dsp.usc.edu

Student Support and Advocacy – (213) 821-4710
Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic. https://studentaffairs.usc.edu/ssa/

Diversity at USC
Information on events, programs and training, the Diversity Task Force (including representatives for each school), chronology, participation, and various resources for students. https://diversity.usc.edu/

USC Emergency Information
Provides safety and other updates, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible, http://emergency.usc.edu

USC Department of Public Safety – 213-740-4321 (UPC) and 323-442-1000 (HSC) for 24-hour emergency assistance or to report a crime.
Provides overall safety to USC community. http://dps.usc.edu