City University of Hong Kong

Information on a Course
offered by Department of Computer Science
with effect from Semester A in 2014/2015

Part I

Course Title: Introduction to Database Systems

Course Code: CS3462

Course Duration: One Semester

No. of Credit Units: 3

Level: B3

Medium of Instruction: English

Prerequisites: (Course Code and Title)
CS2360 Java Programming or
CS2363 Computer Programming

Precursors: (Course Code and Title)
Nil

Equivalent Courses: (Course Code and Title)
CS3402 Database Systems

Exclusive Courses: (Course Code and Title)
Nil

Part II

1. Course Aims:

The aim of this course is to provide students with foundations in the principles of database design, implementation and management. This is an introductory course in database systems. The main objective is to introduce the fundamental concepts of database systems and related technologies to students. In addition, the course will also provide students with practical skills to administer and manipulate database systems of multiple databases.
2. **Course Intended Learning Outcomes (CILOs)**

*Upon successful completion of this course, students should be able to:*

<table>
<thead>
<tr>
<th>No.</th>
<th>CILOs</th>
<th>Weighting (if applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>describe relational, object-oriented and XML data models and their essential components of database management systems;</td>
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<td>2.</td>
<td>design a database and critique its correctness using various database models;</td>
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<td>3.</td>
<td>perform database query and modification operations using commonly-used database query languages in query optimization;</td>
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<td>4.</td>
<td>apply knowledge of database concurrency control and database recovery onto transaction management as a database administrator;</td>
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<td>5.</td>
<td>perform relational database normalization and relational algebra measurement;</td>
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<tr>
<td>6.</td>
<td>develop an attitude to propose solution for problems through independent investigation of case studies.</td>
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3. **Teaching and learning Activities (TLAs)**

*(designed to facilitate students’ achievement of the CILOs)*

Teaching pattern:

*Suggested lecture/tutorial/laboratory mix: 2 hrs. lecture; 1 hr. tutorial*

<table>
<thead>
<tr>
<th>ILO No</th>
<th>TLAs</th>
<th>Hours/week (if applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CILO 1 to CILO 6</td>
<td>Students will learn the basic concepts of database systems in lectures and gain practical experience on using and administering database management systems in tutorial sessions.</td>
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</tbody>
</table>

   Based on the Course ILOs, the teaching/learning activities of this course include traditional lectures and tutorial sessions. This course may also include case studies. In the lectures, concepts and techniques will be taught. Problem sets will be given to help students comprehend materials covered in class. These activities help support Course ILO #1, #2, #3, #4 and #5. In tutorial sessions, practical examples will be given to the concepts and techniques covered in lectures. Students will also gain hands-on experience on using and administering popular database management systems in the industry. This series of activities supports Course ILO #6. Cases studies may also be arranged for students to develop |
technical skills for tackling real-life problems in database systems. The purpose is to strengthen the support of all the mentioned Course ILO items.

4. **Assessment Tasks/Activities**  
   *(designed to assess how well the students achieve the CILOs)*

<table>
<thead>
<tr>
<th>ILO No</th>
<th>Type of assessment tasks/activities</th>
<th>Weighting (if applicable)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>CILO 1</td>
<td><strong>Coursework and Exam</strong> – Problem sets and examination questions will be used to evaluate this ILO. Questions and problem sets will be designed to evaluate how well students have understood the various data modelling techniques and data essential components of database management systems.</td>
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<tr>
<td>CILO 2</td>
<td><strong>Coursework and Exam</strong> – Various sample database applications and scenarios will be given and students will be asked to judge the performance of database design, analysis and implementation. The performance of students on answering the questions will be a measure for this ILO.</td>
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<td>CILO 3</td>
<td><strong>Coursework project</strong> – The quality of students’ work on a database inventory project making queries and modifications to a relational database system using structural query language will be measured to assess this ILO.</td>
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<td>CILO 4</td>
<td><strong>Coursework and Exam</strong> – Students will be asked to safeguard database failures problem such as deadlock and solve some typical transaction management problems by applying techniques such as two phase lock and timestamping.</td>
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<tr>
<td>CILO 5</td>
<td><strong>Coursework and Exam</strong> – Questions and exercises on relational algebra formal method and set operations and the various normalization rules and techniques will be designed and used as a measure for this ILO.</td>
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<td>CILO 6</td>
<td><strong>Exam</strong> – Students will be asked to apply various concepts of advanced database systems to solve practical problems which are designed to assess whether the students have grasped the correct notions of those advanced database system concepts.</td>
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</table>
5. Grading of Student Achievement:

Examination duration: 2 hours
Percentage of coursework, examination, etc.: 50% CW; 50% Exam
Grading pattern: Standard (A+AA-…F)
For a student to pass the course, at least 30% of the maximum mark for the examination must be obtained.

Part III

Keyword Syllabus:

A selection of topics from the following: relational model, object-oriented model, XML model, DTD, SQL, query-by-example, relational algebra and relational calculus, extended entity-relationship modelling, normalization, transaction management, query processing, database systems recovery and currency control, and schema mapping, data conversion and integration and transaction translation for multiple databases systems, etc.

Syllabus:

A selection of topics from the following:

1. The relational model and languages

An introduction to the relational model and its languages such as relational algebra, relational calculus, interactive and embedded SQL, query-by-example, and an introduction to some commonly-used data models of relational, object-oriented and XML.

2. Database analysis and design techniques

Topics include database system development lifecycle, modelling such as extended entity-relationship model, DTD Graph, specialization/generalization, data redundancy and update anomalies, and normalization such as 1NF, 2NF, 3NF, BCNF, 4NF and 5NF and denormalization.

3. Transaction management

Recognize the concepts of forward, backward and deferred database recovery, concurrency control, serializability, locking mechanisms such as 2PL, deadlock and timestamping.
4. Query Processing

Perform query decomposition and cost estimation for the relational algebra and set operations such as selection operation, join operation, semi-join operation, project operation and subtract operations.

5. Multiple databases systems management

Basic concepts include schema translation and data conversion from relational to object-oriented and XML, the methodology for Extended Entity Relationship models integration, and the processing of transaction translation from SQL to OSQL and XQuery for multidatabase system on the Internet.

6. Object-oriented and XML database management systems

An introduction to object-oriented database design that includes object-oriented analysis and design with DTD Graph as well as concepts of abstraction, encapsulation and information hiding; an introduction to XML database management systems and the concepts of DTD (data type definition).

Recommended Reading:

Text(s):

Essential Text

Supplementary Reading

Joseph Fong, CS3462 teaching pack.

Online Resources:
Oracle database, MS SQL Server