TITLE:	Database Systems Engineering
CODE:	CIFM01
CREDITS:	15
LEVEL:	M
SCHOOL:	Computing and Technology
MODULE BOARD:	PG
PRE-REQUISITES:	None
CO-REQUISITES:	None
LEARNING HOURS:	150 the nature of which is specified in the module guide

LEARNING OUTCOMES:
Upon successful completion of this module, students will have demonstrated:

K1	knowledge of current data models and the issues and features of database management systems
K2	critical awareness of current and state of the art developments in the database arena and their application in current application environments

and the ability to:

S1	provide an efficient and secure database environment
S2	design and develop an object based database system using appropriate methodologies

CONTENT SYNOPSIS:
Module content will include:

Topics include, but may change inline with current trends:

Advanced database applications (e.g. data warehousing, data mining). Software engineering approaches to database design and management (e.g. UML). Advanced security. Performance issues (benchmarking, query optimisation, advanced query processing). Database system organization. Transaction, recovery and concurrency control. Data models and architectures (e.g. relational, semantic, object-relational, object-oriented) and their application, e.g. in e-commerce. Distributed and Internet databases. XML. Temporal databases. Database integration issues.

TEACHING AND LEARNING METHODS:
The module will be delivered using the following learning strategy:

Lectures and student presentations:	12 * 1.5 = 18 hours
Tutorials:	12 * 1.5 = 18 hours
Group study and assignment:	40 hours
Self study:	74 hours

ASSESSMENT METHODS:
The module will be assessed using the following strategy:

Individual Coursework	60% of the module marks	Assesses Learning outcomes: S1, S2
Examination	40% of the module marks	Assesses Learning outcomes: K1, K2

INDICATIVE READING LIST:

1. Connolly, T and Begg, C: Database Systems - A Practical Approach. Addison Wesley, 2005.
2. Date, C J: An Introduction to Database Systems. Addison Wesley, 2004.

PROGRAMMES USING THIS MODULE AS CORE/OPTION:
MSc Software Engineering MSc Internet Engineering MSc e-Technology for Business MSc Information Systems Security

FRANCHISED:	No

MODULE LEADER:
Dr David Nelson david.nelson@sunderland.ac.uk ext. 3643

AMPLIFIED CONTENT:	
Lecture 1	Module Introduction History of database development, Data models, database terminology, ANSI-SPARC architecture, DBMS
Lecture 2	Object-oriented databases Semantic data models, object data models, object database standards, e.g. the object-oriented manifesto, OQL, use of object databases in the real world
Lecture 3	Object-oriented database design Limits of traditional modelling for object-oriented applications, use of techniques such as UML for designing object-oriented databases, mapping an OO design to OO, OR and relational databases
Lecture 4	The relational model The relational model, relational algebra, extensions to the relational algebra, relational calculus, SQL, comparing query languages
Lecture 5	Object-relational databases Extending the relational model, use of data models and databases in the real world, object-relational database standards, e.g. object-relational manifesto's, extended SQL standards, Oracle vs Postgres
Lecture 6	Advanced relational design Functional dependencies, Armstrong's axioms, closure, irreducibility, Normalisation (1NF – 5NF), the need for normalisation
Lecture 7	Transaction processing ACID transactions, transaction support, database recovery techniques, concurrency (scheduling and serialisability) and techniques, advanced transaction models, handling OO transactions
Lecture 8	Database security Risk and countermeasures, access control methods, Oracle security, statistical databases, web database issues, e-commerce issues, SQL injection
Lecture 9	Database performance Database benchmarking, improving database and query performance through de-normalisation, indexes, query processing, etc.
Lecture 10	Data warehousing Data warehousing, architectures, design techniques (e.g. star schemas), data analysis techniques: OLAP, data mining, temporal databases
Lecture 11	Distributed Databases Client-server, n-tier, distributed data approaches, homogenous, heterogeneous and federated systems, semi-structured data and XML, data integration and interoperability
Lecture 12	Current trends in database systems A chance to look at some current research areas in databases, e.g. data streaming, Grid databases

EXPANDED READING LIST:

1. Connolly, T and Begg, C: Database Systems - A Practical Approach. Addison Wesley, 2005.
2. Date, C J: An Introduction to Database Systems. Addison Wesley, 2004.
3. Diettrich and Arban. An Advanced Course in Database Systems: Beyond Relational Databases. Pearson, 2005.
4. Rahayu, Taniar and Pardede. Object-Oriented Oracle, IRM Press, 2006.
5. Stonebraker, M and Brown, P: Object-Relational DBMS, 2nd edition, Morgan Kaufmann, 1999.
6. Cattell, R G G et. al.: The Object Data Standard ODMG3.0. Morgan Kaufmann, 2000.
7. Research papers and journals used to highlight research and emerging technologies: e.g. ACM Transactions on Databases, VLDB Journal.