

MODULE TITLE: 4D2B Knowledge Engineering

CODE: CS4D2B

LEVEL: Senior Sophister (Mandatory module)

CREDITS: 5

LECTURER(S): Dr Owen Conlan (owen.conlan@scss.tcd.ie)

MODULE ORGANISATION

Semester	Start Week	End Week	Associated Practical Hours	Lectures		Tutorials	
				Per week	Total	Per week	Total
2	1	12	0	2	22	1	11
Total Contact Hours: 33							

MODULE DESCRIPTION

Knowledge Engineering is a second semester course taken by Senior Sophister Electronic/Computer and Computer Engineering students. It builds on the outcomes of 4D2A Data Engineering by introducing knowledge engineering techniques such as information organisation and storage, ontological reasoning and artificial intelligence. It also addresses techniques and technologies for organizing, structuring and storing data. Specifically, this module focuses on the organization and sorting of files including topics such as hardware optimization, indexing and dynamic data structures. These topics are expanded to include advanced knowledge management approaches, such as information retrieval (IR) and data mining, and technologies, such as advanced XML and ontologies. The artificial intelligence aspect of this module investigates search and rule-based systems, case-based reasoning and the semantic web.

The objectives of this module are to give students an understanding of the organization and manipulation of knowledge and data using a variety of techniques.

LEARNING OUTCOMES

On completion of this module, the student will be able to:

- design and engineer a database management system (DBMS) with consideration given to hardware, information organization, hashing and indexing;
- understand the structure of, and apply advanced manipulation techniques to, XML documents;
- develop skills in managing knowledge using ontological and semantic web technologies;
- understand and be able to apply different artificial intelligence techniques;
- understand and compare different information retrieval techniques, specifically those used on the web.

MODULE SYLLABUS

- Record storage and primary file organization;
- Index structures for file;
- Fundamental technologies and techniques for database management systems:
 - storage hardware
 - file basics, file organisation, file sorting
 - hashing
 - single-level indexes, multi-level indexes, B trees, B+ trees
- Knowledge management
 - advanced XML
- XSLT; XPath; XQuery; XUpdate
 - ontologies
- OWL; reasoning
- Application in semantic web
- Artificial intelligence

- rule-based systems; case-based reasoning; Bayesian networks
- Retrieving textual information:
 - IR vs database retrieval
 - classic IR models (Boolean, vector space, probabilistic)
 - retrieval effectiveness - precision and recall
- Information retrieval on the web:
 - first generation search engines
 - the HITS algorithm
 - Google; scamming Google
 - the next generation of search engines

RECOMMENDED TEXT(S)

- *Fundamentals of Database Systems*, 5th edition, Elmasri and Navathe, Addison Wesley
- *Charles F. Goldfarb's XML Handbook*, 5th edition, Charles F Goldfarb, Paul Prescod, Prentice Hall

TEACHING STRATEGIES

The module is taught using a combination of lectures and tutorials. During the tutorials, students will develop their problem solving skills by tackling problems based on the lecture material.

ASSESSMENT

The formal written end-of-year two-hour examination will contribute 100% towards the overall module mark.