Information Processing and Technology (IPT)

Work Program - 2010 Syllabus

St. Joseph's College,
Gregory Terrace

Course organization

St Joseph's College, Gregory Terrace offers 9 lessons per 2 week cycle, each averaging 45 minutes. This means that one term at Terrace results in 30 hours, on average. Semesters last for 3 x 18 weeks and 1 x 16 weeks, making for approximately 235 hours contact time (including exam block).

Sem 1	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
	AL1 *- Algorithms and Application Structure*									***SP1*** *-Control Structures*								
																Major Project 1		
									Test1					**Writing Task 1**				**Test2**

Sem 2	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
	SP2 *- Data Structures and Abstract Data Types*									***SP3*** *- Web Programming with PHP and JavaScript*								
	Major Project 1 (continued)																	
									Test3									**Test4**

Sem 3	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
	SQL1 *- Structured Query Language*									***RIS1*** *- Object Role Modelling*								
																	Major Project 2	
									Exam1		**Writing Task 2**							**Test5**

Sem 4	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7
	RIS2 *- Online Databases*									***IS1*** *- Knowledge Discovery*						
	Major Project 2 (continued)															
									Exam2						**Minor 1**	

Note: Preliminary work for Major Projects will begin the term before it culminates to allow the full exploration of the DDE cycle
Test 5 exists to cater to College reporting purposes only and is subsumed by Exam2

Of the time allocated, 180 hours are scheduled to cover CORE and 55 hours are scheduled to cover ADDITIONAL MATERIAL as per the following outline of intended student learning**:**

Outline of Intended Student Learning

AL1 – Algorithms and Application Structure (27 hours CORE + 3 hours ADDITIONAL MATERIAL = 30 hours)

Core:

The following will be explored:

- algorithm:
  - results from mapping a specification to a process
  - may operate on a number of sets of data
  - is largely independent of the programming language in which it is eventually implemented
  - involves a finite number of steps
  - consists of processes operating on data structures
- metrics and protocols of testing (e.g. bench testing, exception testing)
- general principles of algorithm development such as top-down design and modularity
- basic elements of algorithm:
  - assignment of a value to a variable
  - procedure call (invocation of another algorithm)
  - skip (specifying that nothing be done)
- standard algorithm control structures:
  - sequence (steps are carried out in sequential order)
  - selection (choice of one element from a number of elements)

  iteration (repetition of an element)

Students will be able to:

- use an algorithm design/description system or method
- define a problem clearly
- specify a problem solution
- design and describe an algorithm that solves a given problem
- design well-structured, modular algorithms

Additional Material:

- search techniques
- Use of CASE tools to capture and desk-check algorithms

Assessment:

- **Test 1** – Prac, Supervised, 1½ hrs - SWA

HCI:

- role of affordances and metaphors in the design of interfaces
- different types of interfaces and fundamental terms used in the description of human–computer interaction
- that interfaces stand as layers (or "abstraction barriers") to assist in the interaction between people and computers
- approach to interfaces from the perspectives of different individuals, e.g. users, designers, programmers, hardware engineers
- value of good interface design in effective human and computer interaction

SEI:

- appropriate terminology for discussing social, ethical, legal and moral issues
- copyright/intellectual property (IP), commercial licensing, open-source, creative commons, freeware/shareware, public domain software, version control

SP1 – Control Structures (27 hours CORE + 3 hours ADDITIONAL MATERIAL = 30 hours)

Core:

The following will be explored:

- use of a 3rd generation programming language (3GL)
- implementation of sequence, selection and iteration (both definite and indefinite) in a 3GL
- metrics and protocols of testing, e.g. alpha- and beta- testing
- common data types to represent real and integer numbers, single and multiple character strings, and variables
- variable scope

Students will be able to:

- convert an algorithm into a 3GL produce programming code from a formal representation of a solution
- make appropriate variable declarations
- de-bug their own or existing programming code
- step through a program monitoring the values stored in specific variables
- utilise integrated development environment like Delphi
- utilise the software development cycle to produce a working program
- employ step-wise refinement in developing program code
- code sequence, selection, definite iteration, and both pre- and post-tested indefinite iteration

Additional Material:

- use of graphics language features for software rendering of images
- recursion (definition of an element in terms of itself)
- other algorithm design methods (e.g. object orientated)
- encryption
- data compression

Assessment:

- **Writing Task 1** – Research Essay (Smart Technologies) – individual, drafts encouraged, scaffolded, 3 weeks - ERA
- **Test 2** – Written (Control Structures), Supervised 2 hours - SWA

HCI:

- fundamental importance of user-centred design for building new interfaces
- importance of sensitivity to other cultural contexts (e.g. Indigenous, American) for good interface design
- differences in human cognitive performance and the logical operation of computers, e.g.:
  - comparison of natural and formal languages
  - speed and accuracy of computation and decision making
  - dealing with uncertainty, ambiguity and errors
- classification of various input–output devices and associated techniques for interaction
- types of interfaces for everyday devices and for computational systems

SEI:

- hacking, software piracy/cracking – the responsibilities of software developers and retailers as well as users and purchasers
- malicious code, e.g. viruses, trojans and worms

SP2 – Data Structures and Abstract Data Types (26 hours CORE + 4 hours ADDITIONAL MATERIAL = 30 hours)

Core:

The following will be explored:

- procedural design and implementation
- implementation of modularity in a 3GL (procedures and functions) and passing of values to and from modules
- metrics and protocols of testing, e.g. alpha- and beta- testing
- common data structures including variables, arrays and text files
- variable scope

Students will be able to:

- produce programming code from a formal representation of a solution make appropriate variable declarations
- de-bug their own or existing programming code
- utilise data structures to represent values
- utilise an integrated development environment like Delphi
- invoke modules from within the main body of a program, passing parameters as required
- utilise the software development cycle to produce a working program
- employ step-wise refinement in developing program code

Additional Material:

- use of static structures such as records, user-defined types, objects
- use of dynamic structures such as sets, binary files, lists, trees and pointers
- creation of network-aware applications that are able to interchange data from host to host
- development of printed manuals and online help systems

Assessment:

- **MP1** – Major Project (Group Work) – Game Development – individual/group, drafts encouraged, scaffolded, 3+8 weeks – PA
- **Test 3** – Written (Data Structures) – Supervised, 2 hours - SWA

HCI:

- principles of user-centred design:
  - design errors such as clutter, embellishment and interference
  - assessment of the fitness of an interface with user-centred criteria
  - usability
  - accessibility, i.e. accommodating for special needs including legal aspects and standards, verification of standards
  - use of style guide.

SEI:

- human resource ethics regarding outsourcing and off-shoring, skill retention and employment security
- monopolies and the nature of competition in the software industry
- failure analysis

SP3 – Web Programming with PHP and JavaScript (26 hours CORE + 4 hours ADDITIONAL MATERIAL = 30 hours)

<table>
<tr><td colspan="2">Core:
The following will be explored:
• procedural design and implementation
• use of a 3rd generation programming language (3GL)
• implementation of sequence, selection and iteration (both definite and indefinite) in PHP/JavaScript
• implementation of modularity in PHP/JavaScript (procedures and functions) and passing of values to and from modules
• common data types and data structures including data types to represent real and integer numbers, single and multiple character strings, and data structures including variables, arrays and text files
• variable scope

Students will be able to:
• make appropriate variable declarations
• de-bug their own or existing programming code
• step through a program monitoring the values stored in specific variables
• utilise data structures to represent values
• invoke modules from within the main body of a program, passing parameters as required
• code sequence, selection, definite iteration, and both pre- and post-tested indefinite iteration</td></tr>
<tr><td>Additional Material:
• creation of web-executable programs using public class libraries
• use of graphics language features for software rendering of images</td><td>Assessment:

• Test 4 – Prac, Supervised, 1½ hrs - SWA</td></tr>
<tr><td>HCI:
• use timing metrics and think-aloud protocols in usability testing
• categorise various physical and computational interfaces
• judge and explain the fitness of physical and computational interfaces from a user's viewpoint</td><td>SEI:
• Phishing
• application of standards in the manufacture, operation and management of computer systems</td></tr>
</table>

SQL1 – Structured Query Language (28 hours CORE + 2 hours ADDITIONAL MATERIAL = 30 hours)

Core:

The following will be explored:

- terminology such as retrieval, insertion, deletion, update and modification
    - data definition concepts, including table and column names, column data types, defining tables, populating a table with data
- data manipulation using SQL, including:
    - analysing requests for information in order to recognise one or more types of query required
    - retrieval from one or more columns in one table
    - retrieval from one or more columns based on some selection criteria
    - sorting data based on one or more columns
    - use of logical, arithmetic and relational operators to build the relevant selection criteria
    - predefined functions such as maximum, minimum, average and number of elements in a column
    - Inserting, updating and deleting of queries
    - predefined functions on subsets of the table produced by grouping data
    - retrieval from more than one table based upon the logical joins associated with the relational model
    - retrieval of sub queries

Students will be able to:

- investigate and interrogate online databases
- construct and populate tables in a relational database using appropriate data types for columns in tables
- formulate queries using SQL to manipulate or interrogate the data from a given database

Additional Material:

- data retrieval (querying) and presenting information in a system using a relational language, including:
    - data retrieval where relational union, intersection, minus or division, correlated sub queries and any other relational operations easily formulated in SQL
- relational algebra concepts and set theory, QBE

Assessment:

- **Exam 1** – Written (SQL) – Supervised, 2 hours - SWA

HCI:

- existence of interfaces not only between a user and a computer system, but between programming elements (e.g. routine–subroutine communication), applications (e.g. protocols over a network) and hardware (e.g. physical and signal standards)

SEI:

- freedom of information
- power of search facilities on massive databases
- unauthorised access, identity theft
- the “big brother” concept

RIS1 – Object Role Modelling (27 hours CORE + 3 hours ADDITIONAL MATERIAL = 30 hours)

Core:

The following will be explored:

- data, information, knowledge and wisdom, and the differences between the terms as they apply to information systems
- external, logical, conceptual and physical views of information systems
- classification systems for different types of information systems (e.g. flat, network, hierarchical, relational, object-oriented, distributed online)
- formal process of table normalisation
- fact-oriented design method such as object role modelling (ORM including entities, relationships, constraints (e.g. uniqueness, necessity, cardinality, frequency, equality, exclusion, subset and subtype), derivation rules and assumptions
- steps of the information system development cycle for the production of an information system, i.e. identification, conceptualisation, formalisation, implementation, testing, evaluation, documentation and specification documentation
- relational perspectives of information systems, i.e. relational systems in contrast to and in comparison with other systems; relations (tables) including rows, columns, keys (primary, secondary composite and foreign), nulls and views; the creation of relational tables within a database management system
- physical and logical data independence
- system security and integrity, data integrity and its maintenance
- metrics and protocols of testing, e.g. alpha- and beta- testing
- maintaining security and privacy in information systems
- design issues relating to information systems including data dependence, redundancy, performance, optimisation and total cost of ownership
- process-oriented analysis methods such as context diagrams or data flow diagrams (DFD) which include data source, data flow, process and data storage

Students will be able to:

- determine whether an information system would be suitable in a particular situation
- identify redundancy and performance issues in an information system
- explain the relationship between external, logical, conceptual and physical views
- work through all stages of the chosen fact-oriented design method
- derive table definitions
- apply the chosen process-oriented analysis method
- analyse an existing information system

Additional Material:

- reverse-engineering of existing information system to extract the conceptual design
- investigation of the design of non-relational information systems

Assessment:

- **Writing Task 2** – Research Essay (Social Media) – individual, drafts encouraged, scaffolded, 3 weeks – ERA
- **Test 5** – Written (ORM intro), Supervised, Reporting purposes only 1½ hrs - SWA

HCI:

- user interfaces that:
  - provide barriers that hide distracting computational complexity
  - induce mental models (images) that help in visualising internal data operations and states
  - embody the external schema of information systems

SEI:

- issues associated with the physical and logical security of computer systems, e.g. data protection, backup systems, data integrity
- online censorship
- mailing lists, spam
- gaming and social networking addiction
- impact of mobile technologies on society

RIS2 – Online Databases (19 hours CORE + 11 hours ADDITIONAL MATERIAL = 30 hours)

<table>
<tr>
<td>Core:
The following will be explored:
• maintaining security and privacy in information systems
• design issues relating to information systems including data dependence, redundancy, performance, optimisation and total cost of ownership</td>
<td>Students will be able to:
• determine whether an information system would be suitable in a particular situation
• identify redundancy and performance issues in an information system
• analyse an existing information system
• create, document and evaluate a working information system</td>
</tr>
<tr>
<td>Additional Material:
• relational algebra concepts and set theory
• query by example (QBE)
• use of data definition language queries to create databases, tables and associated properties
• use of scripting languages to extract and display data
• creation of online database solutions
• updating of selected records
• create, document and evaluate a working information system</td>
<td>Assessment:
• MP2 – Major Project (Group Work) – Database System – individual and group sections, drafts encouraged, scaffolded, 5+8 weeks – PA
• Test 3 – Written (Database Design) – Supervised, 2 hours - SWA</td>
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<tr>
<td>HCI:
• design prototype interfaces that conform to given guidelines and standards
• develop interfaces for information and computational systems that implement external schema features
• conduct usability tests for interfaces that are given or that they construct e.g.:
o identifying clients and the tasks they perform
o planning interface testing with test clients
o implementing iterative and informed interface development
o assessing the impact of user interfaces on behaviour</td>
<td>SEI:
• personal publishing, digital footprints, including implications of posting personal information online, lifelong personal profiles, manipulating the identity of others
• cyber bullying
• the digital “haves” and “have nots”
• communication using visual images and hypertext and its effect on reading and writing
• access to broadband internet</td>
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IS1 – Knowledge Discovery (0 hours CORE + 25 hours ADDITIONAL MATERIAL = 25 hours)

Additional Material:

- concepts of artificial intelligence
  - brief history of artificial intelligence
  - overview of elements of artificial intelligence, e.g. knowledge representation, machine learning
  - philosophical issues surrounding intelligent systems and attempts to model human behaviour and intelligence, such as the Turing test, the mind-body question
- neural networks
  - components, learning and structure
  - training and testing for a specific purpose
  - applications
- knowledge-based systems (in particular, rule-based) including:
  - general nature of knowledge-based systems and how they differ from information systems
  - some areas of application of knowledge-based systems and the major types of existing systems
  - general properties of rule-based systems
  - characteristics and components of rule-based systems
  - knowledge-based design, e.g. decision trees, decision matrices
  - the importance of the feature of rule-based systems being able to justify their own reasoning and conclusions
  - some of the limitations and problems involved with knowledge based systems
  - interrogation of a rule-based system
  - creation of a decision tree and/or decision matrix using a familiar situation
  - obtaining of rules suitable for use in a knowledge-based system from a given decision tree
  - implementation of a decision tree and/or decision matrix using a knowledge-based system shell
  - explanation of the functions of, and relationships between, the components of a knowledge-based system
  - distinguishing between a fact and a rule
  - tracing the logic of an inference engine of a knowledge-based system during a consultation

Assessment:

- **Minor 1** – Minor Project (Individual) – Expert Systems – individual, drafts encouraged, scaffolded, 3 weeks - PA

HCI:

- explore emergent approaches and technologies
- employ user interface toolkits in programming
- parse commands in a command-driven interface

SEI:

- accountability, responsibility for damage to property and/or people caused by inadequate systems or data
- effect of computers and networks on employment, e.g. creation of new employment opportunities; automated processes and their impact on unemployment
- professional practice, e.g. remote robotic surgery
- responsibilities and obligations in developing programs and systems, e.g. reliability of automated expert systems for diagnosis
- predictions about the future uses of information and communication technologies

Assessment

Semester	Term	Unit	Topic	Item	Technique	M/V	F/S	Dim
S1	T1	AL1	Algorithms	**Test 1** – Prac, Supervised, 1½ hrs	SWA		F	KA,AS,EC
S1	T2	SP1	Control Structures, Software Programming	**Writing Task 1** – Research Essay (Smart Technologies) – individual, drafts encouraged, scaffolded, 3 weeks **Test 2** – Written (Control Structures), Supervised, 2 hours	EXR SWA	M M	F F	KA,AS,EC KA,AS,EC
S2	T3	SP2	Data Structures, Software Programming	**Major 1** – Game Development (System and Manual), individual/group work, drafts encouraged, scaffolded, 3+8 weeks **Test 3** – Written (Data structures) – Supervised, 2 hours	PA SWA	M M	F F	KA,AS,EC KA,AS,EC
S2	T4	SP3	Web Programming (JavaScript, PHP)	**Test 4** – Prac, Supervised, 1½ hrs	SWA		F	
S3	T1	SQL1	DB Languages (SQL)	**Exam 1** – Written (SQL), Supervised, 2hrs	**SWA**	V	S	KA,AS,EC
S3	T2	RIS1	ORM	**Writing Task 2** – Research Essay (Social Media), Individual, drafts encouraged, scaffolded, 3 weeks **Test 5** – written (ORM intro), Supervised, Reporting purposes only 1½ hrs	**EXR** SWA	V	S F	KA,AS,EC KA,AS,EC
S4	T3	RIS2	Online Databases (PHP, MySQL)	**Major 2** – Database (System and Manual), group work, drafts encouraged, scaffolded, 5+8 weeks **IS Exam 2** – Written (DB Design), Supervised, 2 hrs	**PA** **SWA**	V V	S S	KA,AS,EC KA,AS,EC
S4	T4	IS1	Knowledge Discovery, Expert Systems	**Minor 1** – ES, Individual, drafts encouraged, scaffolded, 3 weeks	**PA**		S	KA,AS,EC

PA = Product Assessment
EXR = Extended Response
SWA = Supervised Written Assessment

M = Present in Monitoring Folio
V = Present in Verification Folio

Students will be given opportunities to work collaboratively, will be presented with opportunities to submit drafts of written assignment work for constructive feedback and will be required to document development processes and cite references to aid in authorship authentication.

Sample Student Profile

			Item	Instrument	Topics	Technique	Submission	Knowledge and Application	Analysis and Synthesis	Evaluation and Communication	Grade, LOA
								KA	**AS**	**EC**	
T1	S1	Algorithms, Software Programming	**A**	**Test 1** (prac)	ALG, SP	SWA					
T2	S1	Control Structures, Software Programming	**B**	**Writing Task 1**	SEI	ERA	M				
			C	**Test2** (written)	ALG, SP	SWA	M				
							End Semester 1 progress				
T3	S2	Data Structures, Software Programming	**D**	**MP1** – Game	SP, HCI	PA	M				
			E	**Test3** (written)	SP	SWA	M				
T4	S2	Online Programming (Javascript, PHP)	**F**	**Test4** (prac)	SP, HCI	SWA					
							End Semester 2 progress				
							MONITORING				
T1	S3	DB Languages, SQL	**G**	**Exam1** (written)	SQL	**SWA**	V				
T2	S3	ORM, Database Design	**H**	**Writing Task 2**	SEI	**ERA**	V				
			I	**Test 5**	RIS	SWA					
							End Semester 3 progress				
T3	S4	Online Databases, PHP, MySQL	**J**	**MP2** – DB	RIS, HCI	**SWA**	V				
			K	**Exam 2** (written)	RIS	**PA**	V				
							VERIFICATION				
T4	S4	Knowledge Discovery, Expert Systems	**L**	**Minor Project**	IS, SEI	**PA**					
							EXIT LOA				

PA = Product Assessment
EXR = Extended Response
SWA = Supervised Written Assessment
M = Present in Monitoring Folio
V = Present in Verification Folio

VHA / A	Standard A in any two dimensions and no less than a B in the remaining dimension
HA / B	Standard B in any two dimensions and no less than a C in the remaining dimension
SA / C	Standard C in any two dimensions and no less than a D in the remaining dimension
LA / D	At least Standard D in any two dimensions
VLA / E	Standard E in the three dimensions