Content: Information Processes and Technology

HSC Course

Project Management

This topic is intended to give students an understanding of the underlying theory of project management as well as an opportunity to plan, design and implement an information system that has a purpose. The chosen information system implemented in project work should be drawn from:

- a database information system
- a communication system
- a transaction processing system
- a decision support system
- an automated manufacturing system
- a multimedia system.

The construction of the information system will follow the stages detailed in the Preliminary topic Developing Information Systems. Other system development methods have been included beyond the traditional methods. One large project or a number of smaller projects may be undertaken in the course. If smaller projects are undertaken, they need to occur over a significant amount of time and involve sustained work. Project(s) should allow students to see the information system in its full context. Students should identify the purpose for the information system, the participants, data/information and information technology that work with the information processes.

Project work requirements are described in the Course Structure on page 9.

Outcomes

A student:

H1.1	applies and explains an understanding of the nature and function of information technologies to a specific practical situation
H1.2	explains and justifies the way in which information systems relate to information processes in a specific context
H2.1	analyses and describes a system in terms of the information processes involved
H2.2	develops and explains solutions for an identified need which address all of the information processes
H3.1	evaluates and discusses the effect of information systems on the individual, society and the environment
H3.2	demonstrates and explains ethical practice in the use of information systems, technologies and processes
H4.1	proposes and justifies ways in which information systems will meet emerging needs
H5.1	justifies the selection and use of appropriate resources and tools to effectively develop and manage projects
H5.2	assesses the ethical implications of selecting and using specific resources and tools, recommends and justifies the choices
H6.1	analyses situations, identifies needs, proposes and then develops solutions
H6.2	selects, justifies and applies methodical approaches to planning, designing or implementing solutions
H7.1	implements and explains effective management techniques
H7.2	uses methods to thoroughly document the development of individual and team projects.

Students learn about:	Students learn to:
techniques for managing a project • communication skills necessary for dealing with others • the consequences for groups that fail to function as a team, including: – financial loss – employment loss – missed opportunities • project management tools, including: – Gantt charts – scheduling of tasks – journals and diaries – funding management plan – communication management plan • identifying social and ethical issues	• understand the communication skills required to manage a system development project, such as: – active listening – conflict resolution – negotiation skills – interview techniques – team building • understand the need to apply project management tools to develop a system using a team approach • appreciate the advantages of groups that function as a team, including: – increased productivity – enhanced job satisfaction – the development of a quality system • appreciate the need for complete documentation throughout all aspects of the system • assess the social and ethical implications of the solution throughout the project
understanding the problem • approaches to identify problems with existing systems, including: – interviewing/surveying users of the information system – interviewing/surveying participants – analysing the existing system by determining: - how it works - what it does - who uses it • requirements reports • requirements prototype – a working model of an information system, built in order to understand the requirements of the system – used when the problem is not easily understood – repetitive process of prototype modification and participants' feedback until the problem is understood – can be the basis for further system development	• apply appropriate techniques in understanding the problem • interpret a requirements report which includes: – the purpose of the systems – an analysis of an existing system – definition of extra requirements • diagrammatically represent existing systems using context diagrams and data flow diagrams • identify, communicate with and involve participants of the current system • create a requirements prototype from applications packages that provide: – screen generators – report generators • use a prototype to clarify participants' understanding of the problem
planning • a feasibility study of proposed solutions, including: – economic feasibility – technical feasibility – operational feasibility – scheduling • choosing the most appropriate solution • choosing the appropriate development	• conduct a feasibility study and report on the benefits, costs and risks of the project • compare traditional, iterative and agile system development approaches • create Gantt charts to show the implementation time frame • investigate/research new information

Students learn about:	Students learn to:
approaches – traditional – outsourcing – prototyping – customisation – participant development – agile methods • the requirements report that: – details the time frame – details the subprojects and the time frame for them – identifies participants – identifies relevant information technology – identifies data/information – identifies the needs of users	technologies that could form part of the system
designing • clarifying with users the benefits of the new information system • designing the information system for ease of maintenance • clarifying each of the relevant information processes within the system • detailing the role of the participants, the data and the information technology used in the system • refining existing prototypes • participant development, when people within the information system develop the solution – participant designed solutions – tools for participant development such as guided processes in application packages • tools used in designing, including: – context diagrams – data flow diagrams – decision trees – decision tables – data dictionaries – storyboards	• develop a solution to a problem from a prototype • use a guided process in an application to create all or part of a solution • use system design tools to: – better understand the system – assist in explaining the operation of the new system – document the new system

Students learn about:	Students learn to:
implementing • acquiring information technology and making it operational – hardware – software, customised or developed • an implementation plan that details: – participant training – the method for conversion - parallel conversion - direct conversion - phased conversion - pilot conversion – how the system will be tested – conversion of data for the new system • the need for an operation manual detailing procedures participants follow when using the new system	• determine training needs arising from the creation of a new system • compare and contrast conversion methods • justify the selected conversion method for a given situation • convert from the old system to the new • implement the appropriate information technology • develop an implementation plan for the project
testing, evaluating and maintaining • testing and evaluating the solution with test data such as – volume data – simulated data – live data • checking to see that the original system requirements have been achieved • trialling and using the operation manual • reviewing the effect on users of the information system, participants and people within the environment • modifying parts of the system where problems are identified	• compare the new system to the old and evaluate whether the requirements have been met • update system documentation

Information Systems and Databases

Information systems are computer systems that support end users, giving them access to the information. For a large number of information systems, the data is held in databases and access is via database management systems. Information systems perform a variety of tasks and these are considered in the following topics in the HSC course. While all of the information processes are represented in information systems, the emphasis in this topic is on the processes of organising, storing and retrieving with database systems and hypermedia.

Outcomes

A student:

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H1.2 explains and justifies the way in which information systems relate to information processes in a specific context
H2.1 analyses and describes a system in terms of the information processes involved
H2.2 develops and explains solutions for an identified need which address all of the information processes
H3.1 evaluates and discusses the effect of information systems on the individual, society and the environment
H3.2 demonstrates and explains ethical practice in the use of information systems, technologies and processes
H4.1 proposes and justifies ways in which information systems will meet emerging needs
H5.1 justifies the selection and use of appropriate resources and tools to effectively develop and manage projects
H5.2 assesses the ethical implications of selecting and using specific resources and tools, recommends and justifies the choices
H6.1 analyses situations, identifies needs, proposes and then develops solutions
H6.2 selects, justifies and applies methodical approaches to planning, designing or implementing solutions
H7.1 implements and explains effective management techniques
H7.2 uses methods to thoroughly document the development of individual and team projects.

Students learn about:	Students learn to:
information systems • the characteristics of an information system, namely: – the organisation of data into information – the analysing of information to give knowledge • the different types of and purposes for information systems, including systems used to: – process transactions – provide users with information about an organisation – help decision-making – manage information used within an organisation	• identify the type and purpose of a given information system • represent an information system using a systems representation tool – identify the purpose, information processes, information technology and participants within a given system – represent diagrammatically the flow of information within an information system
database information systems • school databases holding information on teachers, subjects, classrooms and students • the Roads and Traffic Authority holding information on automobiles and holders of drivers licences • video stores holding information on borrowers and videos	• identify participants, data/information and information technology for the given examples of database information systems • describe the relationships between participants, data/information and information technology for the given examples of database information systems
organisation • non-computer methods of organising including: – telephone books – card based applications • computer based methods of organising, including: – flat-file systems – database management systems – hypermedia • the advantages and disadvantages of computer based and non-computer based organisation methods • the logical organisation of flat-file databases, including: – files – records – fields, key fields – characters • the logical organisation of relational databases, including: – schemas as consisting of: - entities - attributes - relationships ▪ one to one ▪ one to many ▪ many to many	• choose between a computer based or non-computer based method to organise data, given a particular set of circumstances • identify situations where one type of database is more appropriate than another • represent an existing relational database in a schematic diagram • create a schematic diagram for a scenario where the data is to be organised into a relational database • modify an existing schema to meet a change in user requirements • choose and justify the most appropriate type of database, flat-file or relational, to organise a given set of data

Students learn about:	Students learn to:
– tables as the implementation of entities consisting of: - attributes - records – linking tables using primary and foreign keys – user views for different purposes • data modelling tools for organising databases, including: – data dictionaries to describe the characteristics of data including: - field name - data type - data format - field size - description - example – schematic diagrams that show the relationships between entities – normalising data to reduce data redundancy	• create a simple relational database from a schematic diagram and data dictionary • populate a relational database with data • describe the similarities and differences between flat-file and relational databases • create a data dictionary for a given set of data • create documentation, including data modelling, to indicate how a relational database has been used to organise data • demonstrate an awareness of issues of privacy, security and accuracy in handling data
• the logical organisation of hypermedia, including: – nodes and links – uniform resource locators – metadata such as HTML tags • tools for organising hypermedia, including: – storyboards to represent data organised using hyperlinks – software that allows text, graphics and sounds to be hyperlinked	• compare and contrast hypermedia and databases for organising data • design and develop a storyboard to represent a set of data items and links between them • construct a hypertext document from a storyboard • use software that links data, such as: – HTML editors – web page creation software
storage and retrieval • database management systems (DBMS) including: – the role of a DBMS in handling access to a database – the independence of data from the DBMS • direct and sequential access of data • on-line and off-line storage • centralised and distributed databases • storage media including: – hard discs – CD-ROMs – cartridge and tape • encryption and decryption • backup and security procedures • tools for database storage and retrieval, including: – extracting relevant information through searching and sorting a database – selecting data from a relational database using Query by Example	• search a database using relational and logical operators • output sorted data from a database • generate reports from a database • construct an SQL query to select data from a given database, matching given criteria • calculate the storage requirements for a given number of records (given a data dictionary for a database) • summarise, extrapolate and report on data retrieved from the Internet • use search engines to locate data on the

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(QBE) and Structured Query Languages (SQL) commands, including: - select - from - where - order by • tools for hypermedia search and retrieval, including: – free text searching – operation of a search engine - indexing and search robots - metadata • reporting on data found in hypermedia systems	World Wide Web • describe the principles of the operation of a search engine
other information processes for database information systems • displaying – reporting on relevant information held in a database – constructing different views of a database for different purposes	• design and create screens for interacting with selected parts of a database and justify their appropriateness • design and generate reports from a database
issues related to information systems and databases • acknowledgment of data sources • the Freedom of Information Act • privacy principles • quality of data • accuracy of data and the reliability of data sources • access to data, ownership and control of data • data matching to cross link data across multiple databases • current and emerging trends in the organisation, processing, storage and retrieval of data ***(See Course Specifications Document)***	• identify and apply issues of ownership, accuracy, data quality, security and privacy of information, data matching • discuss issues of access to and control of information • validate information retrieved from the Internet

Communication Systems

When participants within the information system have a need to transmit and receive data or information, the type of system required is a communication system. Communication systems support people who are working together, by enabling the exchange of data and information electronically. In this topic, the information processes of transmitting and receiving are featured, with the other processes considered when relevant because all information processes play a role in communication systems.

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H7.1 implements and explains effective management techniques
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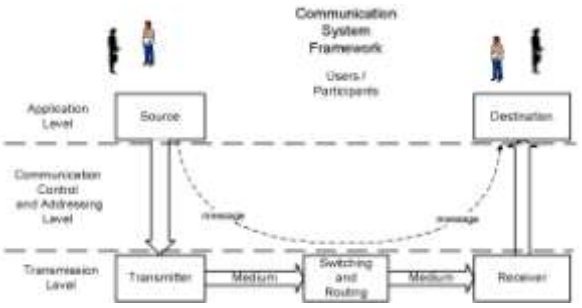
Students learn about:	Students learn to:
characteristics of communication systems • communication systems as being those systems which enable users to send and receive data and information • the framework in which communication systems function, demonstrated by the following model  • the functions performed within the communication systems in passing messages between source and destination, including: – message creation – organisation of packets at the interface between source and transmitter – signal generation by the transmitter – transmission – synchronising the exchange – addressing and routing – error detection and correction – security and management • the roles of protocols in communication – handshaking and its importance in a communications link – functions performed by protocols at different levels • the client–server model – the role of the client and the server – thin clients and fat clients – examples of clients such as web browsers and mail clients – examples of servers such as print servers, mail servers and web servers	• use applications to create and transmit messages • establish a communications link and describe the steps that take place in its establishment • identify and describe specified protocols at different stages of the communication • identify client processing and server processing • describe the advantages and disadvantages of client–server architecture

Students learn about:	Students learn to:
examples of communication systems • teleconferencing systems • messaging systems ***(See Course Specifications Document)*** • other systems dependent on communication technology such as: – e-commerce – EFTPOS – electronic banking	• use a communication system to transmit and receive audio, video and text data • for given examples, identify the participants, information/data, information technology, need and purpose • for given examples explain how data is transmitted and received • for given examples, identify the advantages and disadvantages of the system
transmitting and receiving in communication systems • transmission media, including: – wired transmission ***(See Course Specifications Document)*** – wireless transmission ***(See Course Specifications Document)***	• compare and contrast traditional communication systems with current electronic methods • represent a communication system diagrammatically
• characteristics of media in terms of speed, capacity, cost and security • communication protocols, including: – application level protocols - http - smtp - SSL – communication control and addressing level protocols - TCP - IP – transmission level protocols - Ethernet - Token ring • strategies for error detection and error correction • network topologies, including: – star – bus – ring – hybrid – wireless networks	• predict developments in communication systems based on current trends • simulate activities involved with communication in areas such as – e-commerce – EFTPOS – Internet banking • for a given scenario, choose and justify the most appropriate transmission media • diagrammatically represent the topology
• the functions performed by the following hardware components used in communication systems ***(See Course Specifications Document)*** • characteristics of network operating software • similarities and differences between the Internet, intranets and extranets	• describe the location and role of hardware components on the network • compare the functions of different hardware components • identify the main characteristics of network operating software • compare and contrast the Internet, intranets and extranets

Students learn about:	Students learn to:
other information processes in communication systems • collecting, such as – the phone as the collection device with voice mail – EFTPOS terminal as a collection device for electronic banking • processing, including: – encoding and decoding analog and digital signals – formation of data packets – routing – encryption and decryption – error checking - parity bit check - check sum - cyclic redundancy check (CRC) • displaying, such as – the phone as the display device with voice mail – EFTPOS terminal as a display device for electronic banking	• distinguish between data in analog and digital form • justify the need to encode and decode data • identify where in a communication system signal conversion takes place • describe the structure of a data packet • describe methods to check the accuracy of data being transmitted
managing communication systems • network administration tasks, such as: – adding/removing users – assigning users to printers – giving users file access rights – installation of software and sharing with users – client installation and protocol assignment – logon and logoff procedures – network-based applications	• detail the network management software in a given network • describe the role of the network administrator and conduct network administration tasks • demonstrate logon and logoff procedures, and justify their use • adopt procedures to manage electronic mail
issues related to communication systems • security • globalisation • changing nature of work • interpersonal relationships • e-crime • legal • virtual communities	• describe and justify the need for ethical behaviour when using the Internet • discuss the social and ethical issues that have arisen from use of the Internet, including: – the availability of material normally restricted – electronic commerce – domination of content and control of access to the Internet – the changing nature of social interactions • identify the issues associated with the use of communication systems, including: – teleconferencing systems – messaging systems – e-commerce – EFTPOS – electronic banking
• current and emerging trends in communications ***(See Course Specifications***	

Students learn about:	Students learn to:
Document)	• design and implement a communication system to meet an individual need • predict developments in communication systems based on current trends

Option Strands

There are FOUR options and students must study TWO of these. The topics are:

- Transaction Processing Systems
- Decision Support Systems
- Automated Manufacturing Systems
- Multimedia Systems.

Option 1: Transaction Processing Systems

Information systems that collect, store, modify and retrieve records of transactions are transaction processing systems. A transaction is an event that generates or modifies data that is eventually stored in an information system. Transaction processing systems meet record keeping and event tracking needs. In addition, analysing data stored in transaction processing systems may meet the information needs of end user(s). This option focuses on the information process of storing/retrieving. Other information processes are important in transaction processing and these are also considered.

Outcomes

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Students learn about:	Students learn to:
characteristics of transaction processing systems • a transaction – a series of events important to an organisation that involve a request, an acknowledgement, an action and an outcome • the components of a transaction processing system, including: – purpose – data – information technology – processes – participants • batch transaction processing – the collection and storage of data for processing at a scheduled time or when there is sufficient data • real time transaction processing – the immediate processing of data • the significance of data validation in transaction processing • the historical significance of transaction processing as the first type of information systems	• recognise and describe a transaction • identify, describe and use a batch transaction processing system • distinguish between the storage of collected data and the storage of processed data in a batch system • identify, describe and use a real time transaction processing system • compare and contrast batch and real time transaction processing • analyse an existing transaction processing system to determine its strengths and weaknesses • design and implement procedures for validating entered data • assess the work routine of a clerk in a manual transaction system to determine its suitability for automation • identify participants, data/information and information technology for the given types of transaction processing systems • describe the relationships between participants, data/information and information technology for the given types of transaction processing systems
types of transaction processing systems • web-based • non web-based • on-line real time • batch • systems that appear real time, responding as the transactions occur, but where the actual updating is batch processed, such as credit card transactions	• for a scenario diagrammatically represent transaction processing using data flow diagrams • distinguish between the different types of transaction processing systems
storing and retrieving in transaction processing systems • storage of digital data in databases and files • retrieval of stored data to conduct further transaction processing such as printing invoices	• store digital data in databases and other files in such a way that it can be retrieved, modified and further processed
• systems to store paper records of transactions	• implement systems to store paper transactions
• data backup and recovery, including: – grandfather, father, son – off-site storage – secure on-site storage – full and partial backups – recovery testing – suitable media – specialised backup software	• select and apply backup and recovery procedures to protect data

Students learn about:	Students learn to:
– transaction logs – documenting backup and recovery procedures – mirroring – rollback	
• updating in batch systems: – historical significance – limitations of batch processing – technology required – steps in a batch update – suitable applications	• document, including diagrammatical representations, the steps in batch processing • document, including diagrammatical representations, steps in real time transaction processing
• updating in on-line real time systems: – relevance and impact – technology required – hardware requirements – large secondary storage – software requirements (on-line database) with user friendly interface – steps in on-line real time processing – suitable applications	• identify systems for which batch is appropriate and is not appropriate • distinguish between on-line real time and batch systems • create and use a transaction processing system
other information processes in transaction processing systems	
• collecting in transaction processing: – hardware ***(See Course Specifications Document)*** – collection from forms – screen design for on-line data collection – web forms for transaction processing (real time and batch)	• describe the operation of relevant hardware and how each is used to collect data for transaction processing • design and justify paper forms to collect data for batch processing • design user friendly screens for on-line data collection • identify existing procedures that may provide data for transaction processing
• analysing data, in which output from transaction processing is input to different types of information systems, such as: – decision support – management information systems – data warehousing systems (for data mining) – enterprise systems	• create user interfaces for on-line real time and batch updating, and distinguish between them • identify situations where data warehousing and data mining would be an advantage
issues related to transaction processing systems	
• changing nature of work and the effect on participants, including: – the automation of jobs once performed by clerks – shifting of workload from clerks to members of the public	• assess the impact on participants involved in transaction processing • identify jobs that have changed and/or jobs that have been created as a result of transaction processing, and report on the implications of these changes for participants in the system
• the need for alternative procedures to deal with transactions when the TPS is not available	• discuss alternatives for when the transaction processing system is not available and explain why they need to be periodically tested
• bias in data collection: – when establishing the system and deciding what data to collect – when collecting data	

Students learn about:	Students learn to:
• the importance of data in transaction processing, including: – data security – data integrity – data quality • control in transaction processing and the implications it has for participants in the system • current and emerging trends in transaction processing ***(See Course Specifications Document)***	• identify security, bias and accuracy problems that could arise from the actions of participants • recognise the significance of data quality

Option 2: Decision Support Systems

When the task that end user(s) need to perform involves decision-making, the information system required is a decision support system. They can be used in situations that are unstructured, where there is no clear-cut path to the decision, or semistructured, where there is some indication of the path to take. Decision support systems use combinations of models, analytical tools, databases and automated processes to assist decision-making.

Automated processing is achieved via intelligent systems that either focus on rules, such as expert systems, or pattern detection in data, such as neural networks. The interactive nature of decision support systems requires that user(s) have an understanding of analytical tasks. Decision support and intelligent systems make use of all information processes. This topic focuses on organising, analysing and processing.

Outcomes

A student:

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H3.1 evaluates and discusses the effect of information systems on the individual, society and the environment
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H4.1 proposes and justifies ways in which information systems will meet emerging needs
H5.1 justifies the selection and use of appropriate resources and tools to effectively develop and manage projects
H5.2 assesses the ethical implications of selecting and using specific resources and tools, recommends and justifies the choices
H6.1 analyses situations, identifies needs, proposes and then develops solutions
H6.2 selects, justifies and applies methodical approaches to planning, designing or implementing solutions
H7.1 implements and explains effective management techniques
H7.2 uses methods to thoroughly document the development of individual and team projects.

Students learn about:	Students learn to:
characteristics of decision support systems • decision support systems – those that assist user(s) in making a decision • the interactive nature of decision support systems • the nature of decision support systems which model, graph or chart situations to support human decision making	• select and recommend situations where decision support systems could be used
categories of decision making • structured: – decisions are automated – decision support systems are not required • semistructured: – there is a method to follow – requirements are clear cut • unstructured: – there is no method to reach the decision – judgements are required – requires insights into the problem	• classify situations which are structured, semistructured or unstructured
examples of decision support • semistructured situations, such as: – a bank officer deciding how much to lend to a customer – fingerprint matching • unstructured situations, such as: – predicting stock prices – disaster relief management • the use of systems to support decision making, including: – spreadsheets – databases – expert systems – neural networks – data warehouses – group decision support systems – Geographic Information Systems (GIS) – Management Information Systems (MIS)	• identify participants, data/information and information technology for an example of a decision support system • describe the relationships between participants, data/information and information technology for an example of a decision support system • analyse trends and make predictions using an existing spreadsheet model • extract data, based on known criteria, from an existing database to help make a decision • recognise appropriate decision support systems for a given situation
organising and decision support • designing spreadsheets: – creating a pen and paper model – identifying data sources – planning the user interface – developing formulas to be used	• design spreadsheets by: – linking multiple sheets to extract data and create summaries – use absolute and relative references in formulae • implement spreadsheets by: – entering data – naming ranges – creating templates – organising data for easy graphing – using formulae to link and organise

Students learn about:	Students learn to:
• the knowledge base of if-then rules in an expert system	data in cells • design a set of if-then rules for a particular situation • diagrammatically represent the if-then rules
processing and decision support • structure of expert systems – knowledge base – database of facts – inference engine – explanation mechanism – user interface • types of inference engines, including: – forward chaining – backward chaining • certainty factors as a means of dealing with unclear situations • pattern matching in neural networks • the use of macros to automate spreadsheet processing	• enter rules and facts into an expert system shell and use it to draw conclusions or make a diagnosis • describe situations better suited to forward chaining and those better suited to backward chaining • create a simple macro in a spreadsheet • compare and contrast processing methods used by databases, neural networks and expert systems
analysing and decision support • data mining • extracting summary data from a spreadsheet • comparing sequences of data for similarities and differences • spreadsheet analysis, including: – what-if models – statistical analysis – charts • On-line Analytical Processing (OLAP) – data visualisation – drill downs	• describe the process of data mining to search large databases for hidden patterns and relationships and use these to predict future behaviour • analyse alternatives using 'what-if' scenarios • make predictions based on the analysis of spreadsheets • use a simple neural network to match patterns • extract information from a database for analysis using a spreadsheet, including charting relevant data • distinguish between neural networks and expert systems • describe tools used for analytical processing
other information processes • collecting – identification of data for decision support systems – the role of the expert in the creation of expert systems – the role of the knowledge engineer in the creation of expert systems • storing and retrieving using intelligent agents to search data	• determine the sources of data for a decision support system for a given scenario • describe the operation of intelligent agents in situations such as search engines for the Internet
issues related to decision support • the reasons for decision support systems, including: – preserving an expert's knowledge – improving performance and	• describe the impact on participants in decision support systems when some of their decision-making is automated and recommend measures to reduce negative impacts

Students learn about:	Students learn to:
consistency in decision-making – rapid decisions – ability to analyse unstructured situations • responsibilities of those performing data mining, including: – erroneous inferences – privacy • responsibility for decisions made using decision support systems • current and emerging trends of decision support systems ***(See Course Specifications Document)***	• identify situations where user(s) of decision support systems also require knowledge in the area • determine whether the decisions suggested by intelligent decision support systems are reasonable • demonstrate responsible use of a decision support system by using its findings for the intended purpose only • identify situations where decision support systems are of limited value • recognise the importance of business intelligence based on enterprise systems

Option 3: Automated Manufacturing Systems

Manufacturing is the process of producing a product that meets a specific purpose. Manufacturing information systems support the production process in a number of ways, including the tracking of inventory, record keeping, the scheduling of production and carrying out production. Automated manufacturing systems have computerised controls built into the manufacturing equipment. Data is gathered through sensors and following some processing, a signal is sent to an actuator, a device that performs some mechanical action. While such information systems carry out all of the information processes, the information process focused on in this topic is collecting.

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A student:

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H2.2 develops and explains solutions for an identified need which address all of the information processes
H3.1 evaluates and discusses the effect of information systems on the individual, society and the environment
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H5.1 justifies the selection and use of appropriate resources and tools to effectively develop and manage projects
H5.2 assesses the ethical implications of selecting and using specific resources and tools, recommends and justifies the choices
H6.1 analyses situations, identifies needs, proposes and then develops solutions
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H7.2 uses methods to thoroughly document the development of individual and team projects.

Students learn about:	Students learn to:
characteristics of automated manufacturing systems • automated manufacturing systems as information systems involved in production, by inventory tracking, record keeping, production scheduling and actual production • the direct users of these systems as – supervisors overseeing operation – people whose task is dependent on the system for information • the ability of these systems to collect data from the environment through a wide range of sensors, process this data into information and use this information to complete a physical task • the use of microprocessors in these systems as the controller • block diagrams as a tool for describing the interactions between information technology items within these systems	• identify and describe the features of automated manufacturing systems • describe how participants within these systems interact with the information technology within the system • represent the information technology within an automated manufacturing system with a block diagram • within an automated manufacturing system evaluate and refine block diagrams to show more detail for a given situation and identify the sequence of steps that occur
examples of automated manufacturing systems • specific examples, including: – assembly line production such as the car industry – materials and production scheduling – automated warehouses – CAD/CAM such as: computing numerical control (CNC) systems – rapid prototyping – mail sorting • reasons for automation, including: – repetitive tasks – faster decision-making – safety – cost reduction – customisation – quality control – precision and acceptable tolerance range – productivity gains – gains through simulating and modelling, such as: - automated structural calculations - automated ordering of components	• identify participants, data/information and information technology for each example of automated manufacturing systems • discuss the relationships between participants, data/information and information technology for each example of automated manufacturing systems • outline the reasons for automation in each of the examples • diagrammatically represent the processing steps in automated manufacturing systems

Students learn about:	Students learn to:
collecting in automated manufacturing systems • systems that collect data and information from participants via computer aided design (CAD) software and directly link this to the rest of the system through computer aided manufacture (CAM) • identification of the data to be collected and the most appropriate input device • the physical operation and scientific principle(s) underlying sensors used to collect data, including: – temperature – pressure – motion – flow – light • the integration of sensors into manufacturing machinery to automate processing, such as: – robotic arms – conveyor belts • barcode readers, radio frequency identifiers tags (RFID) and inventory tracking and production • the analog nature of the data collected by the sensors and its conversion to digital for use in the system • damping as the process that modifies the signal to the output device based on the input signal • types of damping, including: – underdamping – a quick response to change leading to rapid fluctuations – overdamping – a slow response to change without fluctuations – critical damping – a quick response to change and quick return to stability	• discuss the relationship between CAD and CAM in manufacturing systems • use a CAD software package to reproduce a given design • identify data required by a manufacturing system • recommend the most appropriate device to collect data for a given scenario • describe the physical operation and the scientific principle(s) underlying this for each sensor • use a range of available sensors to collect data that could be used in an automated manufacturing system • describe the operation of barcode readers and RFID tags and how they can assist in inventory tracking and production • describe the process of converting from analog to digital data and demonstrate this with available information technology • describe a situation where changes in collected data lead to a requirement for damping • justify the type of damping for a given situation
other information processes in manufacturing systems • processing: – the trend to mass-production while meeting the needs of individuals – the different types of systems, including: - continuous - batch - discrete – the features of each type of system, the types of tasks they perform and the scheduling of these tasks	• identify manufacturing systems that quickly adapt to a particular need yet still mass produce, such as a car manufacturing plant that mass produces cars but in the colours required by customers • describe the features of each type of system • categorise and justify the categorisation of systems as either continuous, discrete or batch
• displaying: – actuators – specialised display	

Students learn about:	Students learn to:
devices that perform a mechanical action under the control of the system – types of actuators, including: - solenoid - motor - stepping motor - relay - hydraulic pumps – the conversion from digital to analog to control actuators • transmitting and receiving: – noise as the interference in a signal – the causes of noise – ways of correcting noise	• recommend a suitable actuator for a given situation • distinguish between situations suitable for the use of each type of actuator • describe the process involved in converting a digital signal to an analog signal • identify noise in relation to signals within the system and recommend techniques for reducing it • construct a simple automated manufacturing system
issues related to automated manufacturing systems • the changing nature at work resulting from automation in manufacturing technology • the advantages of semi-automation by utilising skills of people which leads to job satisfaction, including: – flexibility – common sense – ingenuity • the need to develop systems that are human-centred and assist participants to complete tasks, as opposed to machine-centred systems where humans assist machines • the reliability and quality of performing repetitive tasks such as: automatic painting, spot welding, newspaper production and computer embroidery • the improved safety as a result of automated manufacturing • current and emerging trends in automated manufacturing systems ***(See Course Specifications Document)***	• discuss the arguments for and against automation from society's perspective • investigate the effect of de-skilling on participants in the information system • describe the positive and negative impacts of working in an automated industry • classify systems as either machine-centred or human-centred and justify the classification • propose and develop human-centred information systems • describe situations where participants and automation functions work well together

Option 4: Multimedia Systems

Multimedia systems are information systems that combine the different types of media. Professional multimedia systems, especially when being created, involve many participants with a wide breadth of experience. Multimedia systems encompass the entire information process. This topic emphasises the information process of displaying.

Outcomes

A student:

H1.1 applies and explains an understanding of the nature and function of information technologies to a specific practical situation
H1.2 explains and justifies the way in which information systems relate to information processes in a specific context
H2.1 analyses and describes a system in terms of the information processes involved
H2.2 develops and explains solutions for an identified need which address all of the information processes
H3.1 evaluates and discusses the effect of information systems on the individual, society and the environment
H3.2 demonstrates and explains ethical practice in the use of information systems, technologies and processes
H4.1 proposes and justifies ways in which information systems will meet emerging needs
H5.1 justifies the selection and use of appropriate resources and tools to effectively develop and manage projects
H5.2 assesses the ethical implications of selecting and using specific resources and tools, recommends and justifies the choices
H6.1 analyses situations, identifies needs, proposes and then develops solutions
H6.2 selects, justifies and applies methodical approaches to planning, designing or implementing solutions
H7.1 implements and explains effective management techniques
H7.2 uses methods to thoroughly document the development of individual and team projects.

Students learn about:	**Students learn to:**
characteristics of multimedia systems • multimedia systems – information systems that include combinations of the following media, including: – text and numbers – audio – images and/or animations – video – hyperlinks • the differences between print and multimedia, including: – different modes of display – interactivity and involvement of participants in multimedia systems – ease of distribution – authority of document	• use multimedia systems in an interactive way and to identify how they control the presentation of information • identify multimedia software appropriate to manipulating particular types of data • compare and contrast printed and multimedia versions with similar content
Students learn about:	**Students learn to:**
• the demands placed on hardware by multimedia systems, including: – primary and secondary storage	• summarise current information technology requirements for multimedia systems

Students learn about:	Students learn to:
requirements as a result of: - bit depth and the representation of colour data - sampling rates for audio data – processing as a result of: - video data and frame rates - image processing, including morphing and distorting - animation processing, including tweening – display devices as a result of: - pixels and resolution	• distinguish between different approaches to animation including path-based and cell-based through practical investigations
• the variety of fields of expertise required in the development of multimedia applications, including: – content providers – system designers and project managers – those skilled in the collection and editing of each of the media types – those skilled in design and layout – those with technical skills to support the use of the information technology being used	• describe the roles and skills of the people who design multimedia systems
examples of multimedia systems • the major areas of multimedia use, including: – education and training – leisure and entertainment – information provision, such as information kiosk – virtual reality and simulations such as flight simulator – combined areas such as educational games • advances in technology which are influencing multimedia development ***(See Course Specifications Document)***	• identify participants, data/information and information technology for one example of a multimedia system from each of the major areas • describe the relationships between participants, data/information and information technology for one example of a multimedia system from each of the major areas • discuss environmental factors that will influence the design of a multimedia system for a given context, and recommend ways of addressing them • critically evaluate the effectiveness of a multimedia package within the context for which it has been designed • interpret developments that have led to multimedia on the World Wide Web • discuss multimedia systems that address new technological developments • compare and contrast multimedia presentations
displaying in multimedia systems • hardware for creating and displaying multimedia ***(See Course Specifications Document)***	• describe how relevant hardware devices display multimedia and use a variety of devices • implement features in software that

Students learn about:	Students learn to:
• software for creating and displaying multimedia ***(See Course Specifications Document)***	support the displaying of multimedia and explain their use • use available hardware and software to display multimedia and interact with it • summarise the techniques for collecting, storing and displaying different forms of media and implement these in practical work • create samples of the different media types suitable for use in a multimedia display
other information processes in multimedia systems • processing: – the integration of text and/or number, audio, image and/or video – compression and decompression of audio, video and images – hypermedia – the linking of different media to one another • organising presentations using different storyboard layouts, including: – linear – hierarchical – non-linear – a combination of these • storing and retrieving: – the different file formats used to store different types of data ***(See Course Specifications Document)*** – compression and decompression • collecting: – text and numbers in digital format – audio, video and images in analog format – methods for digitising analog data	• describe the process of analog to digital conversion • plan a multimedia presentation using a storyboard • diagrammatically represent an existing multimedia presentation with a storyboard • design and create a multimedia presentation • combine different media types in authoring software • design and create a multimedia World Wide Web site that includes text and numbers, hypertext, images, audio and video • identify standard file formats for various data types • recommend an appropriate file type for a specific purpose • describe the compression of audio, image and video data and information • decide when data compression is required and choose an appropriate technique to compress data and later retrieve it • capture and digitise analog data such as audio or video

Students learn about:	Students learn to:
issues related to multimedia systems • copyright: the acknowledgment of source data and the ease with which digital data can be modified • appropriate use of the Internet and the widespread application of new developments • the merging of radio, television, communications and the Internet with the increase and improvements in digitisation • the integrity of the original source data in educational and other multimedia systems • current and emerging trends in multimedia systems ***(See Course Specifications Document)***	• evaluate and acknowledge all source material in practical work • use Internet based multimedia presentations in a responsible way • predict and debate new technological developments based on advancements in multimedia systems • cross-reference material supplied in multimedia presentations to support its integrity