

## **COURSE DESCRIPTIONS 科目簡介**

### **COURSES FOR 4-YEAR UNDERGRADUATE PROGRAMMES**

#### **CDS1001 Introduction to Programming for Data Science (3 credits)**

(from 2019-20 or after)

This course is designed for students to provide an introduction to data science in the digital age. Data science concerns using data to understand and analyse actual phenomena. The course covers basic IT skills, such as computer programming to assist data manipulation, data analysis and data communication. Turing award winner Jim Gray predicts that data science will be a “fourth paradigm” of science, which is data-driven and can be differentiated from empirical, theoretical and computational paradigms. Students will learn the fundamentals and appreciate the importance of data science.

The first half of the course is about learning the programming language. The topics will include: the basic Python language syntax, variable declaration, basic operators, program flow and control, Python data structures, defining and using functions and recursion, file and operating system interface. In the second half of the course, basic Python packages designed for data science will be introduced, such as NumPy, SciPy, Pandas, and Matplotlib.

#### **CDS1002 Calculus (3 credits) (from 2019-20 or after)**

Calculus plays an important role in the understanding of today’s world. This is an introductory course that presents the ideas and techniques of calculus using an informal, intuitive and geometric approach. Students need to learn both differential calculus and integral calculus and their applications to real-life situations in business, economics, the social sciences, natural sciences and visual arts. This course will equip students with the calculus background required for further study in many disciplines.

#### **CDS1003 Probability and Statistics 1 (3 credits) (from 2019-20 or after)**

(Note: Students should take CDS1002 Calculus previously or take both this course and CDS1002 Calculus in the same term)

Probability and Statistics are fundamentals of quantitative analysis. This course introduces the basic theory of probability and statistics to students. It provides a strong mathematical background for students to understand the quantitative techniques used in the analysis of practical problems across different disciplines. Emphasis is placed on the underlying mathematical theories of probability and statistics. The topics covered include descriptive statistics, basic probability, probability distributions, correlation and the use of statistical software for data science.

#### **CDS2001 Probability and Statistics 2 (3 credits) (from 2019-20 or after)**

(Prerequisite: CDS1003 Probability and Statistics 1 or BUS1102 Statistics for Business)

Probability and Statistics are fundamentals of quantitative analysis. This course covers statistical techniques for inferential statistics, such as estimation and hypothesis testing for population parameters. The topics covered include point estimate and interval estimate of population parameters, comparing means, non-parametric techniques and the use of statistical software for data science.

#### **CDS2002 Introduction to Artificial Intelligence (3 credits) (from 2019-20 or after)**

(Prerequisites: CDS1001 Introduction to Programming for Data Science)

Artificial intelligence is the study of intelligent agents. Due to the continued success of applying artificial intelligence to different challenging problems requiring high-level

intelligence, there is an explosive interest in this field for scientists, dreamers, entrepreneurs and educators. This course is designed for students to understand and appreciate the basic principles of artificial intelligence. It covers computational intelligent systems, which can support decision making, interact with humans, navigate vehicles and achieve many other interesting and useful tasks. These intelligent systems are extremely useful in business, science, the humanities and other fields.

### **CDS2003 Data Structures and Object-Oriented Programming (3 credits)**

(from 2019-20 or after)

(Prerequisite: CDS1001 Introduction to Programming for Data Science)

Computer algorithms manipulate data. A good data structure design allows algorithms to perform efficiently. Object-Oriented programming is a programming paradigm based on the concepts of “objects”, which are data structures that can exhibit “behaviour”. Students will learn the basics of data structures for various algorithms and design software using object-oriented programming.

### **CDS2004 Quantitative Decision Making (3 credits)** (from 2019-20 or after)

(Prerequisites: CDS1003 Probability and Statistics 1 or BUS1102 Statistics for Business)

Organisations often need to make decisions in their best interests in various situations. This course provides an introduction to modelling, analysing and solving decision problems under certainty and uncertainty. Students will develop the concepts of spreadsheet modelling, optimisation and uncertainty, and learn how to apply quantitative techniques of optimisation, and decision-making under uncertainty and forecasting to solve a variety of problems that arise in business settings. Microsoft Excel will be used to model and solve most of these problems. Through practising these techniques and Excel functions, students are expected to develop basic analytical skills and managerial insights, and also acquire competency in Excel.

### **CDS2205 Introduction to Programming (3 credits)**

The course assumes no knowledge in computer programming. It introduces students to the basic concepts and techniques of developing computer programmes for problem solving. Object-oriented programming methodology is used throughout the course to teach the fundamentals of programming. In this course, students learn how to apply an integrated programme development tool to design, implement, test, debug, and document programmes. It establishes a foundation on which students are able to develop application programmes in high-level programming languages such as Java and C++.

### **CDS2209 Digital Video Editing and Movie Making (3 credits)**

This course explores various ways of developing video applications. It formally introduces the theoretical concept as well as the practical usage to students. Video components include text, graphics and images, audio, video, and 3D animation. Students will also learn techniques to develop, manage and process digital video products such as video tapes, CD, DVD, CD-ROM, and others. Distribution of video via the Internet, 3G telephone networks as well as other computer-related methods will be addressed. Upon completion, students should be able to create their own movies.

### **CDS2215 Internet Technology (3 credits)**

This course will examine the various technologies used in Internet. Students will learn the advanced operation of PC and Internet/WWW, and are expected to be able to develop web page using web-authoring tool and programming languages. The application of Internet technologies in different business applications, such as E-commerce, database and Intranet/Extranet, will be examined.

The course does not specify any pre-requisite but students should have acquired basic computing and web page creation skill.

**CDS2250 Electronic Business: Supply Chain Applications (3 credits)**

This course is designed to develop a linkage between traditional businesses and electronic businesses. Particularly, it studies the way electronic business (e-business) changes the flow of goods and services in the supply chain and how it creates threats and opportunities for both the traditional and new firms. Furthermore, based on the basic models of Supply Chain Management (SCM), it uses computer simulation programme, computer based exercises, and case analyses pedagogy to build an integrated view of SCM, planning, and change management. The applications cover logistics, procurement and operations strategy, and are studied through case studies and computer simulations in consumer and industrial settings.

**CDS2251 Digital Imaging and Photography (3 credits)**

This course introduces the basic concepts, techniques, and equipment of Digital Imaging and Digital Photography. It addresses the principles of the hardware and software technologies involved as well as their practical use in real-world applications. Students will also learn to use current digital imaging software and equipment.

**CDS2252 Wireless Technology (3 credits)**

This course provides an overview of wireless technology for students of all levels. It formally introduces the theoretical concept as well as applications to students. Topics covered include technical foundations of mobile devices, telephone technologies, wireless Internet and networks, wireless applications, development tools, security issues and deployments.

**CDS2253 Electronic Publishing and 3D Modelling (3 credits)**

With the advent of computing technology, electronic documents have evolved continuously with ever more precise layout control, exquisite typesetting and multimedia contents. More recently, the availability of affordable computer graphics processors has enabled the widespread use of interactive 3D graphics in many applications that require 3D modelling such as mapping, architecture, product design, etc. Across a myriad of software packages for creating and editing various types of electronic documents with 3D models, standard formats have emerged and one has to be familiar with these formats in order to carry out their modelling and publishing work effectively.

The aim of this course is to introduce the major electronic document and 3D modelling formats that are relevant to business and industry. It addresses the principles of creating and publishing documents and 3D models and illustrates their use in real-world applications. Students will also learn to use relevant software for various publishing and modelling tasks.

**CDS3001 Databases and Data Warehouses (3 credits) (from 2019-20 or after)**

(Prerequisite: CDS2003 Data Structures and Object-Oriented Programming)

This course is designed to introduce the concepts and principles of database and data warehouse. Various types of databases will be thoroughly discussed in this course, such as objected-oriented, relational, document-oriented, graph, NoSQL, and New SQL. Popular database management systems such as Microsoft SQL Server and/or Oracle will be described and implemented. Topics include data models (ER, relational, and others); query language (Structured Query Language); implementation techniques of database management systems (index structures and query processing); management of semi-structured and complex data; distributed and NoSQL databases; the dimensional

modeling technique for designing a data warehouse, and data warehouse architectures, OLAP and the project planning aspects in building a data warehouse.

**CDS3002 Operations Simulation with Decision Analysis** (from Term 2, 2022-23)/  
**Simulation** (in Term 1, 2022-23 or before) **(3 credits)**  
(from 2019-20 or after)

(Prerequisites: CDS1003 Probability and Statistics 1 or BUS1102 Statistics for Business or CLD9003 Statistics in Modern Society)

This course is designed for Data Science students. They are required to have previous knowledge of probability and statistics. Simulation is a commonly used and practical technique for modelling and analysing real operating systems to make more effective decisions. Examples of such systems include transportation, supply chain networks, job flow, airports, banks, ocean terminals, information systems, emergency response systems and human behaviour in a social network. Due to the considerable complexity of real systems, many people and organisations find it difficult to investigate human activities, manufacturing and service designs and processes without a computer simulation model. More than 89% of Fortune 500 firms have used simulation for system improvement and have experienced the benefits for a long time. This course is designed to introduce basic concepts of system modelling and computer simulation. The process and methodology of using simulation for problem solving and decision making are emphasised. Moreover, the course assignments involve the use of the simulation language “Arena”. Some of the assignments may require the ability to write computer programs in a language of the student’s choice or the use of a spreadsheet.

**CDS3003 Machine Learning (3 credits)** (from 2019-20 or after)

(Prerequisites: CDS2001 Probability and Statistics 2, CDS2002 Introduction to Artificial Intelligence and SSC2113 Linear Algebra)

This course is designed to introduce methods in machine learning (i.e., the study of how to create a machine that is capable of improving its performance in some tasks, such as perception, cognition and action, by learning from experience and data). This makes computers more intelligent. Machine learning is a powerful tool for recognising hidden and potentially useful relationships in data. It is essential in many organisations, as they can generate huge amounts of data in their daily operations and machine learning enables them to discover important knowledge from this data. The students will learn some powerful software packages for performing machine learning and apply these packages to handle different kinds of problems.

**CDS3004 Data Mining (3 credits)** (from 2019-20 or after)

(Prerequisite: CDS2002 Introduction to Artificial Intelligence)

Data mining is an important component of data science that discovers knowledge from huge databases. Data mining is an interdisciplinary field, integrating statistics, pattern recognition, neuro-computing, machine learning and databases. It is also one of the fundamentals to extracting interesting knowledge (domain-specific rules, patterns, constraints and regularity). Students will learn the basic principles and core ideas of data mining. This course also covers many data mining approaches to discovering knowledge from a vast amount of valuable databases in business, finance, urban and medicine. Quantitative analytical skills are taught to interpret data mining models. Current IT skills are also covered in the course.

**CDS3005 Data Science Project Management (3 credits)** (from 2019-20 or after)

The principles of project management, largely developed and tested on engineering projects, are being successfully applied to projects of all sizes and types in all fields. Furthermore, the role of project management in a cross section of applications, such as IT,

product development and construction, is now emphasised. This course addresses the fundamental principles of project management and the tools and techniques at our disposal to help achieve our goals. The topics covered include project definition and start up; project attribute estimation; planning and scheduling; resource selection and allocation; implementation; post-project evaluation; project management as a career; skills and knowledge required by professionals, such as decision making and resource allocation appropriate to project phases; integration with other disciplines, such as accounting and finance. The Microsoft Project software tool will be introduced for project scheduling and management.

**CDS3007 Introduction to e-Business (3 credits)** (from 2019-20 or after)

Electronic business is aimed at enhancing the competitiveness of an organisation by developing innovative information and communications technology throughout an organisation and beyond, through links to partners and customers. Managers and decision makers need to know not only how to use the new techniques to automate existing business processes, but also how to redesign and transform processes taking advantage of electronic business. The course introduces fundamentals and infrastructure of electronic business to familiarise students with related new technology development. It also discusses how electronic business differs from traditional business in terms of business processes and business activities, and how we can set business strategy with electronic business. How to implement electronic business in current business environment will also be discussed. The tentative topics include but are not limited to the introductory-level knowledge of Internet business models, electronic commerce infrastructure, E-procurement, and E-marketing.

**CDS3008 Business Analytics for e-Business (3 credits)** (from 2019-20 or after)

(Prerequisite: BUS1102 Statistics for Business)

E-Business is the conduct of business processes on the Internet. E-Business organisations need a huge amount of information and knowledge from all data sources to give one holistic view of business partners, customers, products, services, and processes. This allows managers to make informed decisions to achieve effective cooperation among partners, customer acquisition and retention, cross selling, up selling, customer lifetime value maximisation, appropriate marketing strategies, products and services optimisation, innovations, and business process reengineering. The rapid accumulation of various kinds of data has prompted managers to use business analytics to extract useful hidden knowledge to assist decision making and gain competitive advantage.

**CDS3009 Social Media and Customer Relationship Management for e-Business (3 credits)** (from 2019-20 or after)

This course introduces the fundamentals of social media and customer relationship management (CRM) and the relevant technologies for e-business. It also covers the strategic use of various social media and CRM applications in e-business.

**CDS3350 e-Procurement and e-Customer Relationship Management (3 credits)**

Procurement deals with the business-to-business purchase of supplies, goods and services in the upstream of supply chain while customer relationship management (CRM) deals with customers' needs and behaviour in the downstream of supply chain.

Today's global logistic and supply chain management systems would inevitably be enabled by Internet technology. The rapid development of Internet and information technology has posed new challenges and opportunities in conducting procurement and CRM over the Internet, that is, E-procurement and e-CRM.

This course examines the strategic nature, business models, operating procedures, technological trends, and implementation issues of e-procurement and e-CRM in today's business environment.

### **CDS3352 Inventory Management (3 credits)**

(Prerequisite: BUS1102 Statistics for Business or instructor's approval)

This course explains the dynamics of inventory management's principles, concepts, and techniques as they relate to the entire supply chain, including customer demand, distribution, and product transformation processes. The inter-relationships of all functions are examined. Emphasis is placed on the ramifications of inventory management. The methods and techniques for reducing the cost of holding goods while providing an efficient and effective service to their customers are covered.

### **CDS3353 Logistics and Transportation (3 credits)**

(Prerequisite: BUS1102 Statistics for Business)

This course is limited to the essential activities within the functional areas of logistics and transportation. It emphasizes the quantitative treatment of the design and planning issues in logistics. This course presents some of the commonly used decision models and algorithms to address various logistics challenges, the latest trends in logistics and a few real-life examples. It also includes topics such as vendor selection, inventory models with logistics costs, advanced transportation models, logistics metrics and recent trends in logistics.

### **CDS4001 Best Practices of Data Science (3 credits)** (from 2019-20 or after)

(Prerequisites: CDS3001 Databases and Data Warehouses and CDS3004 Data Mining)

Data science is the study of where information comes from, what it represents and how it can be turned into a valuable resource in the creation of business and IT strategies. Mining large amounts of structured and unstructured data to identify patterns can help an organization rein in costs, increase efficiency, recognize new market opportunities and increase the organization's competitive advantage. This course elaborates on data science problems in science, social science, arts and business. The appropriate methods of delivering data science results to different domain users and the right processes for deploying results in information and/or intelligent systems are described. Practitioners in different fields, such as marketing and finance, will be invited to share their experience in applying the data science approach to solve their problems.

### **CDS4002 Data Management (3 credits)** (from 2019-20 or after)

(Prerequisite: CDS3001 Databases and Data Warehouses)

Companies need to have more efficient systems to support their decision-making. This is critical to their competitiveness, and has become a critical component of their business strategy. Generally, large organizations have a vast and complex landscape of systems. More often than expected, such companies have multiple and silo-based business systems to support their operations, finance, accounting, and analytical business processes. As the scale of systems in an organization's landscape increases, the complexity for managing the underlying data becomes even more complicated. This course covers the essential concepts, options and best practices for data administration, data protection, privacy control, user security and management, system configurations and data activity and status monitoring. The focus is on issues and principles of managing organizational data. Students will get extensive experience in developing data models, creating relational databases, and formulating and executing complex queries.

**CDS4003 Project (3 credits)** (from 2019-20 or after)

(Prerequisites: CDS3001 Databases and Data Warehouses and CDS3004 Data Mining)

This course provides an opportunity for students to integrate their knowledge obtained in other courses in a data science process that involves the preparation, analysis, reflection and dissemination of data in a chosen application setting. The emphasis is on the management and execution of a well-defined project of a suitable scale. Such projects may involve either real-world or experimental data and students may engage in such projects individually or in groups.

**CDS4004 Web Technologies and Social Networks (3 credits)** (from 2019-20 or after)

(Prerequisite: CDS3004 Data Mining)

Social networking is a major Web 2.0 application. Web technologies, such as JavaScript, not only enrich the user experience of social networking applications, but also handle the collection of data for Web analytics and social network analysis. This course introduces the major Web technologies for rich user experiences with an emphasis on how they also support data collection in social networking applications. Students will learn about the ethical use of these technologies in relevant applications, such as social media marketing.

**CDS4005 Big Data Analytics (3 credits)** (from 2019-20 or after)

(Prerequisite: CDS3004 Data Mining)

This course provides an understanding of the concept and challenge of big data. The focus is on the data analytic techniques to tackle the V's (volume, velocity, variety, veracity, valence, and value) in big data and how these impacts data collection, monitoring, storage, analysis and reporting. Apache Hadoop is an example a big data management system to manage and process large-scale data. The following topics across the big data domain will be introduced: distributed file systems; similarity search techniques; high-performance processing algorithms for data streams; big data search and query technology. Big data analytics applications in data science will be elaborated. Students will actively participate in the delivery of this course through assignments, portfolio development, and projects.

**CDS4006 Deep Learning (3 credits)** (from 2019-20 or after)

(Prerequisite: CDS3003 Machine Learning)

Deep learning is one of the bleeding edge technologies of machine learning. It has been used in the community and industry to solve a number of big data problems in computer vision and natural language processing. Deep learning drives improvement in the precision of medical diagnosis, enhancing digital painting and the development of self-driving vehicles. This course teaches students to understand the theoretical and technical details of deep learning and to design intelligent systems that learn from complex and large-scale datasets.

**CDS4007 Stochastic Process (3 credits)** (from 2019-20 or after)

(Prerequisite: CDS2001 Probability and Statistics 2)

The stochastic process is an important tool in modelling and analysing random patterns in data science. This course aims to equip students with key concepts and theories in stochastic processes, such as sample space, probability (and conditional probability), expectation (and conditional expectation), discrete time Markov chain, continuous time Markov chain and renewal process. The course provides a rigorous development of relevant concepts and models. In addition to technical rigorousness, we want to develop our students' ability to apply the theories and models in real applications in various disciplines. This course should help build a solid background in stochastic processes and models for students and enable them to solve real problems of a stochastic nature.

**CDS4008 Optimization (3 credits)** (from 2019-20 or after)

(Prerequisites: CDS1002 Calculus and SSC2113 Linear Algebra)

In a mathematical optimization problem, one seeks to minimize or maximize a real function of real or integer variables, subject to constraints on the variables. Mathematical optimization refers to the study of these problems, their mathematical properties, the development and implementation of algorithms to solve these problems and the application of these algorithms to real-world problems.

The purpose of this course is to cover the parts of calculus that are most relevant to economics and business, with an emphasis on mathematical optimization questions – finding a choice of variables that maximizes a function (e.g., utility or expected return) or minimizes a function (e.g., cost and risk) in the presence of constraints (e.g., feasibility and limited resources). This course covers foundational topics from multivariable calculus and linear algebra, topics from introductory analysis (e.g., open/closed sets, compactness, maximum theorem and implicit function theorem) and problems in unconstrained and constrained optimization (e.g., Lagrange multipliers, Kuhn-Tucker conditions and applications of convexity). Topics in linear programming and calculus of variations may also be discussed.

**CDS4009 e-Business Models and Start-ups (3 credits)** (from 2019-20 or after)

(Prerequisite: CDS3007 Introduction to e-Business)

With the rise of Big Data, as enabled by the pervasive trend of digitisation almost everywhere around the globe, e-business is becoming one of the core drivers of wealth and economic growth in the 21<sup>st</sup> century. Increasingly, university students after graduation may venture to start up their own businesses, or get involved in extending the product lines of their employers. These present challenges to students to be well versed in related entrepreneurship and innovation concepts. This course intends to prepare students with such challenges. The course will survey and analyse cases of e-business models and start-ups. Their underlying innovations and the related strategies will be discussed. Students will learn about the process of generating business ideas, formulating a business plan, and presenting to potential investors.

**CDS4010 Web Programming for e-Business (3 credits)** (from 2019-20 or after)

E-Business is the conduct of business processes on the Internet. This course is designed to introduce students about the technologies, tools, and software for designing, developing, and administering fully functioning e-Business websites. The practical steps needed to design and develop professional websites will be discussed. The supporting databases as well as the program codes used to enforce business rules and control transactional processing will be described. Students will learn HTML5, CSS3, JavaScript, PHP, and database management systems and use them to create effective web pages and interactive websites.

**CDS4011 e-Business Logistics (3 credits)** (from 2019-20 or after)

(Prerequisite: BUS2211 Operation Management)

This course explores the principles and practices of logistics in the e-Business context. It examines the potentials of logistics management to increase profitability. This course provides general and specific logistics management information that will serve to strengthen the student's ability to participate in today's e-business environment.