

10 *ISP490 IS Capstone Project*

The Capstone Project provides students, working in groups, with a significant project experience in which they can integrate much of the material they have learned in their program, including matters relating to requirements, design, human factors, professionalism, and project management. Students will be guided to develop an information system, employing knowledge gained from courses throughout the program. It includes development of requirements, design, implementation, and quality assurance. Students may follow any suitable process model, must pay attention to quality issues, and must manage the project themselves, following all appropriate project management techniques. Success of the project is determined in large part by whether students have adequately solved their customer's problem.

11 *IOP490 IoT Capstone Project*

The Capstone Project provides students, working in groups, with a significant project experience in which they can integrate much of the material they have learned in their program, including matters relating to requirements, design, human factors, professionalism, and project management. Students will be guided to develop a IoT system, employing knowledge gained from courses throughout the program. They will fully engage in the process of developing an IoT solution. Starting with a systematic analysis of creative idea, students'll apply the skills they learned by designing, building, and testing an IoT system. Success of the project is determined in large part by whether students have adequately solved their customer's problem.

12 *IAT491 IA Capstone Project*

The Capstone Project provides students, working in groups, with a significant project experience in which they can integrate much of the material they have learned in their program, including matters relating to requirements, design, human factors, professionalism, and project management. Students will be guided to develop an IA solution, employing knowledge gained from courses throughout the program. It includes development of risk assessment, analysis and management, implementation, and quality assurance. Students may follow any suitable process model, must pay attention to quality issues, and must manage the project themselves, following all appropriate project management techniques. Success of the project is determined in large part by whether students have adequately solved their customer's problem.

13 *AIP490 AI Capstone Project*

The Capstone Project provides students, working in groups, with a significant project experience in which they can integrate much of the material they have learned in their program, including matters relating to requirements, design, human factors, professionalism, and project management. Students will be guided to develop an AI system, employing knowledge gained from courses throughout the program. They will fully engage in the process of designing an AI solution. Starting with a systematic analysis of creative idea, students'll apply the skills they learned by designing, building, and testing an AI system. Success of the project is determined in large part by whether students have adequately solved their customer's problem.

14 *MAE101 Mathematics for Engineering*

This course provides basic knowledge of analysis and linear algebra and their applications in science and technology. Topics include:

- Analysis: Functions and limits of functions, derivatives, applications of differentials, integrals, series ...
- Linear algebra: System of linear equations, matrix algebra, determinants of matrices, cross-product matrices, vector spaces ...

15 *MAD101 Discrete mathematics*

This course is the first part of the coverage of mathematical foundation for computer science. Topics include: logic, mathematical reasoning and proof techniques, mathematical induction and recursion, set and maps, basic number theory, counting techniques, combinatorics, and discrete probability. The course will expose students to the large range of applications of the mathematical concepts in information technology; for example, application of number theory in cryptography and computer security.

16 *MAS291 Statistics & Probability*

This course starts with an introduction to continuous probability and a review of discrete probability, then explores 5 major topics in statistics: descriptive statistics, parameter estimations, hypothesis testing, regressions & correlations and analysis of variances. For each topics in statistics, students will be exposed to the use of statistical tools (for example Excel with statistics add-on) for solving realistic problems. Emphasis on the application of probability and statistics (for example in software quality control) will be made in appropriate topics. The mathematics knowledge acquired in this course will provide students with tools and methods for data analyzing and decision making in their later career.

17 *CSII01 Introduction to Computer Science*

This course gives students a general picture of the dynamic Information Technology and help them going on with further courses with a consistent level of knowledge. Topics include: history of computing, software tools, computer architecture, numbering systems, operating systems, networks, the Internet, database fundamentals, data & file structures, programming & software engineering, computing security, ethics and technology tendency.

18 *CEA201 Computer Organization and Architecture*

This course introduces computer architecture and organization: including the physical design of computers (organizations) and the logical design of computers (architecture). The main contents include organizing a simple computer storage program: CPU, bus and memory; instruction set, machine code and Assembly language, hardware organization of the simple processor; address translation and virtual memory; input / output devices, interrupt handlers, and multi-tasking systems.

19 *PRF192 Programming Fundamentals*

The course introduces about programming languages, C programming language; software development process; and basic programming using C.

20 *PRO192 Object-Oriented Programming*

The in-depth course introduces object-oriented programming in Java. The goal is to help students gain a good understanding of the basic concepts of object-oriented programming such as objects, classes, methods, inheritance, polymorphism, and interfaces, and also the basic principles of abstraction, modularity and reuse in object-oriented design.

21 *CSD201 Data Structures and Algorithm*

This course introduces the basic concepts of data structures and algorithms. The topics include the basics of algorithm analysis, basic data structures (including stacks, queues, linked lists, hash tables, trees), recursion and some important applications of these data structures and algorithms.

22 *OSG202 Operating System*

This course covers the knowledge about Operating System, Process, Thread, Deadlock, Memory Management, Input/output, and File Systems

23 *NWC202 Computer Networking*

The course helps students to gain general and basic knowledge about computer network systems, network architecture, reference models, protocols, TCP / IP protocol family, and some basic knowledge about network security. From that, students will have the ability to configure basic services in the network, install and configure a number of network devices;

24 *DBI202 Database Systems*

This course introduces students to the basic knowledge of database systems with relational database models, relational database design theory, and various aspects of relational databases, transactions, data constraints, and stored procedures. Students will have the opportunity to practice on a certain appropriate DMBS with a specific context.

25 *LAB211 OOP with Java Lab*

Practicing object-oriented programming with Java language

- 26** *IOT101 Internet of Things*
 The content includes basic concepts and applications of IoT, practical exercises on the learning KIT. Students are taught how to understand basic concepts of Internet of Things: "things" of the Internet of Things, Networking IoT, Programming IoT, Securing IoT, electrical circuits and electronics and the application of IoT...
- 27** *PMG201 Project management*
 Project management in general and IT projects in particular. Project administration process. Project planning, cost estimation and scheduling. Project management tools. Factors affecting the productivity and success of the project: quality management, human resources, communication, risks and change.
- 28** *ITE302 Ethics in IT*
 This course addresses issues related to ethics of IT professionals and IT users, intellectual property, safety and security, computer and Internet crime, information sharing, employees and employers, privacy, compliance.
- 29** *PRM391 Mobile Programming*
 This course providing enough basic knowledge of Android programming for student to be able to developing useful apps as well as further self-studying more easily. This course also providing basic knowledge of HTML5 programming, and developing Hybrid mobile apps for Android devices. This also covering problem solving and troubleshooting for mobile development.
- 30** *WED201 Web Design*
 This course introduces:
 - Hypertext Markup Language for creating web pages.
 - Cascading Style Sheets - customizing the way data is presented in browsers.
 - Javascript for creating dynamic web pages.
- 31** *PRJ321 Web-based Java Applications*
 After completing this course, students will know how to build complex web applications in a business environment. The course begins with an introduction about the Java Enterprise Edition and basic web application, establishing the server environment, learning about the tools used in developing and exploring technologies and practices in Java. The course covers industry-standard tools and technologies, specific technologies and fundamental programming concepts.
- 32** *SWP391 Application development project*
 This is a subject that learners will learn to complete small SE projects, from choosing ideas, analyzing and planning working methods.
 Under the guidance of teachers, learners will gradually conduct and complete the project.
- 33** *SWE201 Introduction to Software Engineering*
 This course gives general knowledge about the software engineering processes, software development life cycle, project management, change management, software requirements, software architecture design, software testing, software reuse, and modern software development methodologies.
- 34** *SWR301 Software Requirement*
 Software requirements; techniques and collection process and requirement analysis, including formal specifications. Required under the perspective of system construction. Analyzing requirements for different systems: embedded systems, consumer systems, web systems, business systems, scientific and research systems.
- 35** *SWT301 Software Testing*
 This course gives the general concepts of quality and quality assurance; the testing techniques to ensure that appropriate functionalities have been implemented correctly in the software system:a) black box or functional testing, b) clear box or structural testing, c) usage-based statistical testing; test activities, management, and related issues, such as testing sub-phases, team organization, testing process, people's roles and responsibilities.; Other testing, verification and validation techniques; Some practical quality assessment and improvement issues

- 36** *HCI202 UI/IX*
 Psychological principles of robot communication. Evaluating user interface. Task analysis, user-driven design, modeling and related technologies. Software design elements, interfaces (windows, menus and commands). Voice and natural language import. Reaction time and response. Colors, symbols and sounds. Internationalization and localization. User interface architecture and APIs
- 37** *SWD391 SW Architecture and Design*
 This course covers a set of important software design methodologies, architectural styles, guidelines and tools of design. Java is used to explain design principles and present case studies.
- 38** *ITA203 Information System Overview*
 This course provides a foundation for the understanding and analysis of information systems in organizations. It presents fundamental knowledge about the role that information systems play in businesses, how to design and build an appropriate information system and how to effectively manage the business' information resources.
- 39** *ITA301 Information System Design & Analysis*
 The objective of this course is to examine the process of system analysis and design. Topics covered in the course: determining organizational information requirements through interviews and company document analysis, current structured methodologies for systems analysis and design of information systems, current object-oriented techniques for analysis and design. Both the structured and object-oriented techniques of analysis and design are studied.
- 40** *ISC302 E-Commerce*
 This course explains what E-commerce is, how to implement and manage E-commerce, how to evaluate all issues related to E-commerce (opportunities, limitations, risks...) in the manager's perspective, allowing E-commerce becomes relevant and reliable for customers, partners and management agencies.
- 41** *ISM301 ERP*
 Basic concepts and ERP design; functional model, life cycle and process; transformation strategies and projects, ...
- 42** *DBD301 Advanced DataBases*
 The course is to provide students with some most advantage knowledge in DataBase field:
 - Conceptual Database Design (review)
 - Methodology – Logical Database Design for the Relational Model (review)
 - Methodology – Physical Database Design for Relational Databases (review)
 - Distributed DBMSs – Concepts and Design
 - Overview of Networking
 - Functions and Architectures of a Distributed DBMSs
 - Object-Oriented DBMSs – Concepts and Design...
 This course will also first step introduce to students using Oracle (10g version) like DBMS on work.
- 43** *ITB301 Business Intelligence (BI)*
 This course provides an introduction to the concepts of business intelligence (BI) as components and functionality of information systems. It explores how business problems can be solved effectively by using operational data to create data warehouses, and then applying data mining tools and analytics to gain new insights into organizational operations.
- 44** *OSP201 Open Source Platform and Network Administration*
 This course is an introduction to open source client/server networking, basic information security and assurance concepts. Focusing on Linux as a platform and server operating system, the course introduces various concepts related to the security of Linux platforms and applications. It identifies and examines methods to secure Linux platforms and applications. It also explains how these methods can be implemented.
 The course covers threats to Linux operating systems and other open source applications and mitigation of risks. It explains user account management and software management plans. The course also focuses on the various components of the Linux kernel and highlights several ways to address security breaches.

- 45** *PRS301 System Programming*
 System programming course provides knowledge involving designing and writing computer programs that allow the computer hardware to interface with the programmer and the user, leading to the effective execution of application software on the computer system.
- 46** *IAO201 Introduction to Information Assurance*
 A study of security in both the voice and data networks and an examination of the security issues associated with the movement toward a convergence of the two infrastructures. Topics to be covered include voice and data network connectivity, modem security, VOIP security, wireless security, cryptography, intrusion detection systems, voice and data firewalls, malicious software, information operations and warfare, and denial of service attacks.
- 47** *CRY302 Applied Cryptography*
 An introduction to cryptology, the science of making and breaking codes and ciphers. Primes, modular arithmetic, probability, Euler's phi-function, factoring algorithms, cryptographic and cryptanalytic techniques for classical and modern cryptographical systems including public key cryptography; applications of cryptography in information technology.
- 48** *IAA202 Risk Management in Information Systems*
 The course provides a comprehensive view of managing risk in information systems. It covers the fundamentals of risk and risk management and also includes in-depth details on more comprehensive risk management topics.
 Areas of instruction include how to assess and manage risk based on defining an acceptable level of risk for information systems. Elements of a business impact analysis (BIA), business continuity plan (BCP), disaster recovery plan (DRP) and computer incident response team (CIRT) plan are also discussed.
- 49** *IAM302 Malware Analysis and Reverse Engineering*
 This course provides students with an effective immersion into the realm of Malware Analysis and Reverse Engineering. It follows a progressive approach that introduces relevant concepts and techniques while preparing students to become effective malware analysts that can use a standard methodology for detecting, analyzing, reverse engineering and eradicating malware.
- 50** *IAP301 Policy Development in Information Assurance*
 This course serves the essential aspects for developing sound information security policy. Organizational objectives, threats, risk mitigation and cost-benefit analysis is explored. The student will utilize industry accepted methodologies to create practical security policy that will communicate the organization's asset protection objectives.
- 51** *FRS301 Digital Forensics*
 This course is designed to prepare students to become effective cyber crime investigators. The course examines the basic steps required in hardware identification, TCP-IP, rules of electronic evidence, and DOS, network investigation, case management and intrusion detection.
- 52** *HOD401 Ethical Hacking and Offensive Security*
 This course will use hacking techniques used by malicious, black hat hackers as a means to learn best defense from these same hackers. The course is an in-depth study using hands-on lab exercises. While these hacking skills can be used for malicious purposes, this course teaches students how to use the same hacking techniques to perform a white-hat, ethical hack, on systems.
- 53** *PRM391 Mobile Programming*
 This course provides basic knowledge of iOS programming, Android and HTML5 programming, and developing Hybrid mobile apps for iOS and Android devices. This also covers problem solving and troubleshooting for mobile development.
- 54** *IOP391 IoT application development project*
 This is a subject that learners will learn to complete small IoT projects, from choosing ideas, analyzing and planning working methods.
 Under the guidance of teachers, learners will gradually conduct and complete the project.
- 55** *PRC391 Cloud Computing*
 This course covers basic concepts of cloud computing and introduces two strategic cloud computing

services of Microsoft and Amazon: Windows Azure and Office 365, Amazon Web Service. At completion of this course, students shall be able to design, develop, and deploy basic applications in Windows Azure and Office 365, Amazon Web Service.

56 *DGT202 Emerging Digital Technologies*

This course is intended for researchers and business experts seeking state-of-the-art knowledge in advanced science and technology. The course covers details on Big Data (Hadoop, Spark, Storm), Smartphones, Smart Watches, Android, iOS, CPU/GPU/SoC, Mobile Communications (1G to 5G), Sensors, IoT, Wi-Fi, Bluetooth, LP-WAN, Cloud Computing, AR (Augmented Reality), Skype, YouTube, H.264/MPEG-4 AVC, MPEG-DASH, CDN, and Video Streaming Services. The course includes projects on Big Data using IBM SPSS Statistics, AR applications, Cloud Computing using AWS (Amazon Web Service) EC2 (Elastic Compute Cloud), and Smartphone applications to analyze mobile communication, Wi-Fi, and Bluetooth networks.

57- *MCP301 Micro-controller programming*

58 *ESP301 Embedded system programming*

These courses cover embedded systems, the Raspberry Pi Platform, and the Arduino environment for building devices that can control the physical world.

In the final Capstone Project, students'll apply the skills they learned by designing, building, and testing a microcontroller-based embedded system, producing a unique final project suitable for showcasing to future employers.

59 *BDP301 Blockchain Basics*

This course will cover the fundamentals of blockchain technology, including the three core layers of a blockchain and the three types of blockchains. Students will learn about the decentralized peer-to-peer network, an immutable distributed ledger and the trust model that defines a blockchain. This course enables students to explain basic components of a blockchain (transaction, block, block header, and the chain) its operations (verification, validation, and consensus model) underlying algorithms, and essentials of trust (hard fork and soft fork).

60 *DGT301 Digital Signal Processing*

Processing of signal numbers (signals and systems): Laplace transform, Z transformation, system representation and signals in continuous frequency domain, discrete frequency domain, system stability, design FIR, IIR digital filters.

61 *PRP201 Python programming*

This course will introduce fundamental programming concepts including data structures, networked application program interfaces, and databases, using the Python programming language. After completing this course, students will be able to design and create their applications for data retrieval, processing, and visualization.

62 *AIP391 AI programming project*

This is a subject that learners will learn to complete small AI projects, from choosing ideas, analyzing and planning working methods.

Under the guidance of teachers, learners will gradually conduct and complete the project.

63 *CSD301 Advanced Algorithms*

Môn học gồm các chủ đề: Divide-and-Conquer & Recursive strategies in algorithm; Probabilistic Analysis and Randomized Algorithms; Sorting in Linear Time; Medians and Order Statistics; Advanced data structures like Red-Black Trees, B-Trees, Fibonacci Heaps and Strategies to Augmenting Data Structures; Dynamic Programming; Greedy Algorithms; Amortized Analysis; Data Structures for Disjoint Sets; All-Pairs Shortest Paths; Maximum Flow; Multithreaded Algorithms; Linear Programming; Polynomials and the FFT; String Matching; Computational Geometry; Approximation Algorithms.

64 *MAI391 Advanced mathematics*

This course aims to bridge that gap, getting students up to speed in the underlying mathematics, building an intuitive understanding, and relating it to AI, machine learning and data science. At the end of this course, students will have gained the prerequisite mathematical knowledge in linear algebra, calculus, optimization ...to continue their journey and take more advanced courses in

AI.

- 65** *IMP301 Image processing*
This course provides a foundation in the rapidly expanding research field of computer vision, laying the groundwork necessary for designing sophisticated vision applications. Learners explore the integral elements that enable vision applications, ranging from editing images to reading traffic signs in self-driving cars to factory robots navigating around human co-workers. Content includes image processing and state-of-the-art vision techniques, augmented by insights from top leaders in the computer vision field.
Learners gain hands-on experience writing computer vision programs through online labs using MATLAB and supporting toolboxes.
- 66** *AIG201 Artificial Intelligence*
The course introduces history, theory, computational methods of artificial intelligence, knowledge representation and logical calculation methods. Applications in one or two areas will be studied, selected from expert systems, robots, natural language processing, computer vision and image processing.
- 67** *AIL302 Machine Learning*
The course provides adequate knowledge on key machine learning models (supervised and unsupervised), issues (classification, clustering, etc.) and important learning tools (MaxEnt, SVM, ANN - DNN, HMM, CRF, ...).
- 68** *NLP301 Natural Language Processing*
This course will build natural language processing systems using TensorFlow. Students will learn to process text, including tokenizing and representing sentences as vectors, so that they can be input to a neural network.
Students'll also learn to apply RNNs, GRUs, and LSTMs in TensorFlow.
- 69** *CPP101b Basic C++ Programming*
Basic C++ Programming provides core programming skills for programming embedded applications. After completing the course, students will have knowledge and skills on basic concepts of C++ programming language; understand and use the complex data structures of C++; understand functions and program organization in C++; understand the concepts of object-oriented programming in C++; understand how to work and handle files in C++.
- 70** *CPP201b Advanced C++ Programming*
Advanced C++ Programming is the next advanced course of basic C++ Programming. The course provides necessary complicated skills such as Understanding object-oriented properties in C++ (inheritance, polymorphism, destructors, constructors, virtual functions, namespaces), generic programming concepts, generic algorithms, template in C++; exception handling in C++; data structures in C++ (stack, queue, list, tree); basic sorting algorithms with C++ (selection sort, insertion sort, merge sort, quick sort); basic search algorithms with C++ (linear search, binary search); container concept in C++ (sequential container, associative container); concepts of stream input/output and string stream, being able to manipulate input and output data with file; generic concepts and being able to implement generic function, generic class, and manipulate algorithms with generi.
- 71** *CQT201b Create UI in C++ using Qt/QML*
This course will take students to a level where they can write any Qt C++ Gui application you may want. It is aimed at complete beginners but people with varying levels of experience wishing to learn Qt C++ Gui will equally find it useful.
- 72** *IAD101b Intro to Automotive Application Development*
This course equips students with the general idea about key areas in car software development, help them to be familiar with programming languages used in automotive application, software development standards used in automotive industry, role of the C, C++, Android language in automotive application development...
- 73** *AAD305b Final Project - Automotive Application Development*
This course provides students with a complete topic of a practical application in the car. This lesson

allows students to familiarize themselves with automotive application problems and practice the knowledge learned in the same process as the enterprise environment.

74 *BDP301b Blockchain Basics*

The Blockchain basics is the first course of the Blockchain development in Finance program. The course aims to equip students with: development history, fundamental concepts, structure and operational principles of blockchain technology platform; definitions, structure, operational principles of Ethereum blockchain; security mechanisms, transaction authentication, block authentication, blockchain data integrity protection, trust elements and consensus mechanisms and protocols in the blockchain (Consensus). Students are guided to learn and practice with the Ethereum blockchain system.

75 *BDP302b Smart Contract*

After learning the basic concepts in the Blockchain Basics course, this Smart Contract course knowledge and skills about smart contracts, including roles, architecture and basic mechanism of smart contract concept in blockchain; the fundamental of Solidity programming language to build smart contract in Ethereum Virtual Machine; how to build and apply smart contracts in blockchain, best practices in evaluating alternative smart contract solutions in blockchain.

76 *BDP303b Decentralized Application Development (Dapps)*

This course will prepare you to design and develop end-to-end decentralized applications (Dapps) – which provide anyone with access to the blockchain’s features and services. You will use Truffle IDE, smart contracts, a simple web client and a MetaMask client. You will learn about the architecture of a Dapp: the front-end client interface, backed by the blockchain and smart contracts. The course covers the basic design of a Dapp, Truffle development process and commands (init, develop, test and migrate), test-driven development of Dapp, Dapp application models and emerging standards that are essential for predictable Dapp behavior.

77 *BDP304b Blockchain Platforms*

This course help students to explore blockchain platforms including, 2 permissioned blockchain platforms: Linux Foundation’s Hyperledger Fabric và Microsoft Azure’s Blockchain as a Service; 2 Dapp platforms: Augur and Grid+ ; Important Challenges and solutions to develop blockchain platform; other decentralized solutions with Interplanetary File System (IPFS) và Hashgraph; and especially explore 2 blockchain platforms developed by Vietnam: Akachain, Tomochain.

78 *BDP305b Final Project - Blockchain Development*

The project allows users to buy and sell directly without placing orders. Purchasing takes place immediately between the user and a fixed provider. When executing an order, the buyer's / token will be transferred directly to the supplier's wallet and the supplier's token is transferred in the opposite direction, the conversion rate is based on the purchase / sale price at that time. Need to register the information of the supplier directly. Allow buyers to target only the seller or vice versa.

79 *JPD122 Japanese Elementary 2*

The course provides basic knowledge on basic sentence structures and vocabulary for elementary level in Japanese. With the duration of 8 lessons (Elementary Deihu Nihongo Textbook), students can reach equivalently N5 level.

80 *JPD222 Japanese Pre-Intermediate 1*

The course provides adequate knowledge on advanced sentence structures, phrases, and vocabulary for pre-intermediate level in Japanese. With the duration of 07 lessons (Intermediate Deihu Nihongo Textbook), students can reach equivalently N4 level.

81 *JIT301 IT Japanese*

The course focuses on three main contents:

- (+) Reading and understanding IT documents
- (+) Writing emails following Japanese business etiquette
- (+) Writing CV following Japanese standard

After finishing this course, students can read and understand IT documents, translate fluently from Japanese to Vietnamese, have good presentation skills, and write email following Japanese business etiquette.

- 82** *BDA311 Introduction to Big Data*
 This course provide understanding why the Big Data Era has come to be. It is for those who want to become conversant with the terminology and the core concepts behind big data problems, applications, and systems. It is for those who want to start thinking about how Big Data might be useful in their business or career. It provides an introduction to one of the most common frameworks, Hadoop, that has made big data analysis easier and more accessible -- increasing the potential for data to transform our world.
- 83** *BDA321 Big Data Modeling and Management Systems*
 In this course, students will experience various data genres and management tools appropriate for each. Students will be able to describe the reasons behind the evolving plethora of new big data platforms from the perspective of big data management systems and analytical tools. Through guided hands-on tutorials, they will become familiar with techniques using real-time and semi-structured data examples. Systems and tools discussed include: AsterixDB, HP Vertica, Impala, Neo4j, Redis, SparkSQL. This course provides techniques to extract value from existing untapped data sources and discovering new data sources.
- 84** *BDA331 Big Data Integration and Processing*
 This course provides knowledge and skills that is related to:
 - Retrieving data from example database and big data management systems
 - Describing the connections between data management operations and the big data processing patterns needed to utilize them in large-scale analytical applications
 - Identifying when a big data problem needs data integration
 - Executing simple big data integration and processing on Hadoop and Spark platforms
- 85** *BDA341 Machine Learning with Big Data*
 This course provides an overview of machine learning techniques to explore, analyze, and leverage data. Students will be introduced to tools and algorithms you can use to create machine learning models that learn from data, and to scale those models up to big data problems.
- 86** *BDA351 Graph Analytics for Big Data*
 This course gives students a broad overview of the field of graph analytics so they can learn new ways to model, store, retrieve and analyze graph-structured data. After completing this course, they will be able to model a problem into a graph database and perform analytical tasks over the graph in a scalable manner. Better yet, they will be able to apply these techniques to understand the significance of data sets for their own projects.
- 87** *BDA361 Big data - Capstone Project*
 In this culminating project, students will build a big data ecosystem using tools and methods form the earlier courses in this specialization. They will analyze a data set simulating big data generated from a large number of users who are playing imaginary game "Catch the Pink Flamingo". During the five weeks Capstone Project, students will walk through the typical big data science steps for acquiring, exploring, preparing, analyzing, and reporting.
- 88** *BDT311 Big Data Essentials: HDFS, MapReduce and Spark RDD*
 Through this course students will:
 - learn some basic technologies of the modern Big Data landscape, namely: HDFS, MapReduce and Spark;
 - be guided both through systems internals and their applications;
 - learn about distributed file systems, why they exist and what function they serve;
 - grasp the MapReduce framework, a workhorse for many modern Big Data applications;
 - apply the framework to process texts and solve sample business cases;
 - learn about Spark, the next-generation computational framework;
 - build a strong understanding of Spark basic concepts;
 - develop skills to apply these tools to creating solutions in finance, social networks, telecommunications and many other fields.
- 89** *BDT321 Big Data Analysis: Hive, Spark SQL, DataFrames and GraphFrames*
 This course will teach students how to:
 - Warehouse your data efficiently using Hive, Spark SQL and Spark DataFrames.

- Work with large graphs, such as social graphs or networks.
- Optimize your Spark applications for maximum performance.
- Writing and executing Hive & Spark SQL queries;
- Reasoning how the queries are translated into actual execution primitives (be it MapReduce jobs or Spark transformations);
- Organizing your data in Hive to optimize disk space usage and execution times;
- Constructing Spark DataFrames and using them to write ad-hoc analytical jobs easily;
- Processing large graphs with Spark GraphFrames;
- Debugging, profiling and optimizing Spark application performance.

90 *BDT331 Big Data Applications: Machine Learning at Scale*

During this course students will:

- Identify practical problems which can be solved with machine learning
- Build, tune and apply linear models with Spark MLlib
- Understand methods of text processing
- Fit decision trees and boost them with ensemble learning
- Construct recommender system.

91 *BDT341 Big Data Applications: Real-Time Streaming*

This course will teach students how to:

- Warehouse data efficiently using Hive, Spark SQL and Spark DataFrames.
- Work with large graphs, such as social graphs or networks.
- Optimize Spark applications for maximum performance.

92 *BDT351 Big Data Services: Capstone Project*

Students will be given a task to combine data from different sources of different types (static distributed dataset, streaming data, SQL or NoSQL storage). Combined, this data will be used to build a predictive model for a financial market (as an example). First, they design a system from scratch and share it with your peers to get valuable feedback. Second, they can make it public, so get ready to receive the feedback from service users. Real-world experience without any 3G-glasses or mock interviews.

93 *DBS401 Database Security*

This course will introduce the student to the essential best practices in database security strategies. The student will be provided with the tools, techniques and industry accepted methodologies so that upon completion of the course the student will be able to describe key concepts database security and how to apply those concepts to securing database management systems within their organization.

94 *FRS401 Network Forensics*

This course will introduce the student to the essential aspects of information security and network forensics. The student will be provided with the tools, techniques and industry accepted methodologies so that upon completion of the course the student will be able to describe key concepts of network security and forensics and how those concepts apply to themselves and their organization.

95 *IAR401 Incident Response*

This course will introduce the student to the essential aspects of information security and incident response (IR). The student will be provided with the tools, techniques and industry accepted methodologies so that upon completion of the course the student will be able to describe key concepts of network security and incident response and how those concepts apply to themselves and their organization.

96 *IAW301 Web Security*

This course requires students to experience Damn Vulnerable Web App (DVWA). DVWA is a PHP/MySQL web application that is damn vulnerable. Its main goals are to be an aid for security professionals to test their skills and tools in a legal environment, help web developers better understand the processes of securing web applications and aid teachers/students to teach/learn web application security in a class room environment.

97 *NWC301 Advanced Networking*

The course demonstrates concepts, technology, and applications of advanced computer networking. Topics include networking hardware, topologies, media, protocols, and standards; network operating system server and client software, internetworking devices; network planning and administration. Networks falling under the traditional categories of local area networks, metropolitan area networks, and wide area networks will be considered, with possible emphasis on local networks.

Hands-on experience installing and managing network components will be arranged regularly during the course.