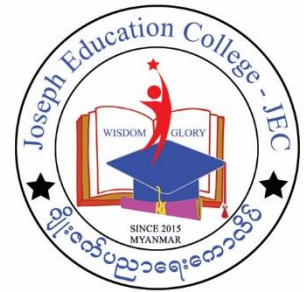


Joseph Education College

ကျိုးရိပ်ညာရေးကောလိပ်



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ကျောင်းလိပ်စာ၊ အိမ်အမှတ် (၇၃၉-၇၄၁)၊ ပုဂံလမ်း (၃)၊ ရပ်ကွက် (၁၂၃)၊ အရှေ့ဒဂုံမြို့နယ် ၁၁၄၅၃၊ ရန်ကုန်။

Remark: Joseph Education College adopted the detailed modules of ANGLIA RUSKIN UNIVERSITY – ARU of England for the below Undergraduate Program.

BEng (Hon) Computer Science Detailed Modules for 3 Years

Year 1

Foundation in Engineering, Computing and Technology

In your first year you'll study with our partner, ARU College. This module will provide you with the necessary skills to begin studying at level 4 in engineering, computer science and related courses. You will be introduced to the core skills necessary to succeed in higher education, including thinking critically, researching and referencing appropriately, demonstrating appropriate numeracy and ICT skills, and communicating effectively verbally and in writing. In addition to these fundamental skills, you'll cover the subjects underpinning the technological disciplines. Fundamental mathematical skills will be covered, alongside pre-calculus, followed by an introduction to calculus and vector and matrix arithmetic. You will also be introduced to classical mechanics, and its application to real-world scenarios. You will be introduced to the fundamentals of computer science, learning about the principles behind programming and applying them through a series of practical coding exercises. You'll undertake a multi-disciplinary group project as you learn about the collaborative nature of engineering, and design from a broader perspective of business. The module is made up of the following eight constituent elements: Interactive Learning Skills and Communication (ILSC); Information Communication Technology (ICT); Critical Thinking; Maths for Scientists; Maths for Engineers; Physics for Engineers; Fundamentals of Computing; Engineering Design.

Year 2

Computer Systems (30 credits)

This module consists of two strands: 'Computer Architecture' and 'Network fundamentals'. Both strands will enable you to learn materials that are of great interest to employers. This module aims to provide you with an understanding of the fundamental behaviour and components of a typical computer system, and how they collaborate to manage resources and provide services in scales from small embedded devices up to the global internet. You will be introduced to IP networks exemplified through the TCP/IP and OSI models. Laboratory sessions will give you hands-on experience on constructing and configuring network devices. You will use the Cisco CCNA introduction to data network technology course which is the first of four Cisco courses that can be used to obtain a Cisco CCNA qualification. This module will lay the foundation of and prepare you for the computer software, computer networking and cyber security sector to name a few.

Software Principles (15 credits)

In your studies we will introduce you to the fundamental concepts required to understand, design, implement and test high-level programming languages. You will be introduced to a design methodology to help develop linear and hierarchical trains of thought from idea conception through design and implementation to testing. Using a simple interactive programming environment, you will discover how to create and use a wide variety of different basic and complex data structures. By the end of the module, you will be able to: Analyse a simple set of requirements; design appropriate data structures; select appropriate language syntax to manipulate program data; understand and use syntax for the implementation of conditional logic and repetition; be able to create simple scripts to perform a number of operations in turn to achieve a desired effect; demonstrate familiarity with the taxonomy of programming languages and the software development life-cycle and gain sufficient experience of a range of algorithm design techniques, such that, given a simple problem description, appropriate variables you can identify decisions and repetitive actions and translate them into appropriate code constructs.

Introduction to Programming (30 credits)

Computers are a part of everyday life and there is no indication that this aspect will ever change. Understanding how they work and having the ability to program them for specific tasks (i.e. Factory Automation, Cash Point, etc.) is a key skill in today's world. You will be introduced to the procedural programming paradigm, requiring no prior programming experience. You will use industry-standard tools and techniques to design, implement, test and document simple programs using a current programming language such as C, Python, or C++. The skills within will help you to understand the principal components of a program, laying the foundation for subsequent modules requiring structured programming ability. The principles of good programming practice will be emphasized and you will be introduced to techniques required to develop software which: is robust and efficient; satisfies the needs of the customer; consists of

elegant, easy to read code; and is resilient within the cyber security context. By the end of the module, you should have sufficient mastery of a procedural programming language to allow you to design, implement and test simple programs. The skills taught within the module are intended to be directly transferable to the workplace and to provide a suitable foundation for pursuing a wide range of computing-related careers.

Core Mathematics for Computing (15 credits)

As a student embarking on a degree in computer science or a closely related discipline, this module will equip you with the core mathematical skills needed to succeed. This module also contributes to the professional body accreditation of your programme of study, reflecting the criticality of mathematics/statistics skills in professional computing roles and in computer science research. During much of the module, you will be studying topics in discrete mathematics, such as set theory and logic, Boolean algebra, functions, matrices, sequences/series and product/summation notations. Further topics include probability and statistics, which are useful in understanding the behaviour of non-deterministic algorithms, data visualisation, and in the design and implementation of computer science research projects. The topics you will study will be directly related to computing principles. For example, the use of set theory for: the representation of computational structures such as lists, trees and graphs; computations on discrete collections of data (such as in databases); the relationship between number classes and data types and in evaluating computability; and parallels between set theoretic operations and programming logic. The relationship between Boolean algebra and logic operators used in computer programming will be discussed, along with topics like the evaluation and simplification of Boolean expressions. Topics such as sequences and series will be related to elementary algorithm complexity (e.g., linear, logarithmic, and exponential functions), and mathematical functions (injective, surjective, bijective) will be related to program functions, with common functions found in nearly all non-trivial computer programs (such as modulus, floor/ceiling, and numerical operations such as gcd and lcm) being introduced and demonstrated in context. Permutations and combinations will be related to computer security, and the notion of intractable computational problems. Matrices will be in discussed in terms of their ability to represent computational structures such as images, graphs, and computer networks. Core descriptive and inferential statistics used for data visualisation and hypothesis testing (including histograms, distribution types, measures of central tendency and dispersion, and basic inferential statistics such as t-tests and linear correlation) will be examined. Mathematics and statistics skills are regarded as a core competency in computing professionals, and graduates with these skills are highly valued by employers in all job roles in computing and more widely.

Operating Systems (30 credits)

During this module you will be introduced to the fundamental features of modern operating systems, their components and their use. We will look at key concepts including the kernel and its modes; memory and resource management; file systems, security and authentication; single and multi-tasking; interrupts, hardware and device

drivers and command line and graphical user interfaces (GUI). Case studies will introduce you to command line interface (CLI) commands and scripting in both the Windows CLI and a Linux shell and allow you to develop simple scripts to automate activities in both operating system environments. You do not need any special technical knowledge before undertaking the module, however a basic user level familiarity with a GUI based operating system (such as Windows) will be useful. The skills acquired in the module will enable you to go on to study material in later modules which involve topics such as system administration, network and server configuration and technical support, all of which are key skills you may need as a graduate when working in the systems and network support industries.

Into JEC

Entering higher education is exciting; but it can also be a daunting experience. At JEC, we want all our students to make the most of the opportunities higher education provides, reach your potential, become lifelong learners and find fulfilling careers. However, we appreciate that the shift from secondary education, or a return to formal education is, in itself, quite a journey. This module is designed to ease that transition. You'll be enrolled on it as soon as you receive an offer from ARU so you can begin to learn about university life before your course starts. Through Into ARU, you'll explore a virtual land modelled around JEC values: Courage, Innovation, Community, Integrity, Responsibility, and Ambition. This innovative module is designed as a game, where you collect knowledge and complete mini tasks. You'll proceed at your own pace, though we you to have completed your Into JEC exploration by week 6. If for any reason you're unable to complete by that date, we'll signpost to existing services so that we can be confident that you are supported.

Year 3

Computing Research Methodologies (15 credits)

The Computing Research Methodologies module aims to elevate your understanding of research conventions in the field of computer science, reinforce your research skills and most importantly enable you to deploy them in your studies or your professional life. This module offers a comprehensive solution, comprising the required techniques to critically appraise published research, and carry out a piece of original research from the ground up. You will gain the experience of topic-specific research, analysis, and application which helps you to conduct a computer science-based research project. The module also covers the essential skills in project management and planning so that you can develop a viable research project plan, identify appropriate methodologies and technologies, and conduct the research experimental process. Through the course of this module, you will be exposed to data collection, statistical analysis and evaluation strategies, the essential skills you need to carry out an academic career. In conclusion, this module will aid those of you who have to conduct research as part of your studies and paves your way toward postgraduate studies or other academic career routes.

Database Design and Implementation (15 credits)

Databases is identified as a specific area of study within the 2007 QAA Computing benchmark. Computer science and information science are mostly all about data. A database management system is a way to store data in a way that makes it easier to retrieve, update, search and delete. Databases is a specialist field in its own domain leading to careers such as Database Designer, Database Developer and Database Administrator. Moreover, it is a part and parcel for many other job roles e.g. Software Engineer, Game Developer, Full-stack Web Developer and Back-end Developer. You will not only learn the specialist skills to design and implement a database, but also practice soft skills such as time management, presentation, teamwork, and collaboration. You will work in teams and analyse an existing e-commerce system, propose a database solution for such a system, design the database, implement the database and evaluate it using SQL queries. You will be guided to think critically for the rationale of your design and write useful queries considering their business purpose and benefit of writing these one way than the other.

Digital Security (15 credits)

Knowledge of Digital Security is a core skill you require for any cybersecurity role and provides a springboard to intermediate level cybersecurity jobs. Your studies will comprise of real-world best practices in cybersecurity to ensure you have practical security problem-solving skills and learn how to address security incidents, not just identify them. You will also gain the knowledge and skills required to install and configure systems to secure applications, networks, and devices; perform threat analysis and respond with appropriate mitigation techniques; participate in risk mitigation activities; and operate with an awareness of applicable policies, laws, and regulations; in summary all the essential skills you need to get employed in the cyber security domain. Your study will also focus on today's best practices for risk management and risk mitigation, including more emphasis on the practical and hands-on ability to both identify and address security threats, attacks, and vulnerabilities. The skills you'll gain will give you a baseline for nearly all cyber security jobs.

Algorithm Analysis and Data Structures (15 credits)

Data Structures and Algorithms is described in the ACM/IEEE Joint Task Force for Computing Curricula as being 'Fundamental to computer science and software engineering' which also notes that 'Algorithms are essential in all advanced areas of computer science: artificial intelligence, databases, distributed computing, graphics, networking, operating systems, programming, security, and so on'. In this module you will examine the core data structures and algorithms used in all nontrivial software, enabling you to make sound decisions in the construction of computing solutions that have specific constraints in terms of time (speed) and space (memory). You will learn how to compare the asymptotic behaviour of fundamental computational structures and algorithms and develop the critical skill of making evidence-based choices when selecting from among multiple possible approaches to a given computational problem.

To accomplish this, you will study the core mathematical concepts that provide a framework for computational and analytical thinking independently of any particular programming language or computing architecture. In a highly cited cover article by the IEEE Computer Society, what knowledge is important to be a software professional? the results of a survey of 186 software professionals are presented in which they were asked which topics in Computer Science degree programmes they believed to be the most important. Data Structures & Algorithms was rated the second most important topic, preceded only knowledge of "specific programming languages". The importance of this module to your future career in software development or technical/scientific computing cannot be overemphasized.

Network Routing (15 credits)

Modern networks continue to evolve to keep pace with the changing way organizations carry out their daily business. Users now expect instant access to company resources from anywhere and at any time. These resources not only include traditional data but also video and voice. There is also an increasing need for collaboration technologies that allow real-time sharing of resources between multiple remote individuals as though they were at the same physical location. The global Internet is a collection of networks, termed Autonomous Systems (AS), that are linked together via high-speed communication links provided by telecommunication organisations. Your studies will focus on the key concepts and protocols of network routing. We will cover basic routing and switching concepts, including static and default routing, Virtual Local Area Networks (VLANs), and inter-VLANs routing. Dynamic protocols such as RIP and OSPF will be discussed and explored. Network security using Access Control Lists will be introduced and the wider issues of network and Internet security considered. You will study in classes which contain a mixture of theory, delivered through a series of lectures, and practical implementations, delivered through a series of guided laboratory exercises. In the lab sessions you will gain a deep understanding of routing and switching concepts and acquire hands-on-skills using advanced network simulation tools that comply with industry standard router platforms. As part of studying this module you will be able to access on-line materials including the Cisco Networking Academy online curriculum and access specialist laboratory resources.

Software Engineering (30 credits)

A software engineering life cycle explores software development processes including requirements analysis, modelling and design, code implementation and design patterns and testing and maintenance. When studying the subject, you will gain a theoretical understanding and practical experience of the life-cycle of software applications by learning how to apply software engineering principles to the development of a software system. You will look into the difference between the Waterfall and Agile methodologies and use the latter for project management including learning about the cost drivers that can influence projects. You will use a version control tool to manage source code history. In addition, you will apply the knowledge gained in earlier modules to model and design a system by using a range of UML diagrams and you will learn about

architectural design including the application of design patterns. Both the automated and manual testing are discussed and you will have to demonstrate the ability to use both of them. You will build on your employability skills by working in a team to develop a complete and robust software system including coordinating the work among team members using a distributed-version control system.

Ruskin Module (15 credits)

Ruskin Modules are designed to prepare our students for a complex, challenging and changing future. These interdisciplinary modules provide the opportunity to further broaden your perspectives, develop your intellectual flexibility and creativity. You will work with others from different disciplines to enable you to reflect critically on the limitations of a single discipline to solve wider societal concerns. You will be supported to create meaningful connections across disciplines to apply new knowledge to tackle complex problems and key challenges. Ruskin Modules are designed to grow your confidence, seek and maximise opportunities to realise your potential to give you a distinctive edge and enhance your success in the workplace.

Year 4

Final Project (30 credits)

You will engage in a substantial piece of individual research and/or product development work, focused on a topic relevant to your specific discipline. The topic may be drawn from a variety of sources including: Anglia Ruskin research groups, previous/current work experience, the company in which you are currently employed, an JEC lecturer suggested topic or a professional subject of their specific interest (if suitable supervision is available).

Image Processing (15 credits)

Use current industry standard tool and techniques and study the theoretical/mathematical foundations of image processing in tandem with practical work and coursework that applies this theory to modern real-world scenarios. Recent case studies have included security applications for the detection of human faces, systems for the automatic analysis of biological specimens, next-generation gesture-based interfaces, and machine vision systems for automated manufacturing. Image Processing is becoming increasingly important as computing power grows, and is used in a very diverse spectrum of computational problems, from self-driving cars, factory automation and robotics, intelligent medical diagnosis, airport security, the military, astrophysics, biometric systems (such as face, fingerprint and iris recognition), environmental monitoring, human-computer interfaces (such as gesture recognition and lip-reading systems), sport (for example, goal line technology and intelligent camera control in football), barcode and QR-code devices, law (from enhancing and interpreting criminal forensic evidence to upholding copyright law through watermarking), and in any

applications that entail image manipulation and augmentation, such as Facebook Messenger, Snapchat, Instagram and many others. This module provides you with the opportunity to gain a solid understanding of the core computational processes that underlie these diverse applications, and the fundamental knowledge to apply what you have learned to new situations.

Professional Issues: Computing and Society (15 credits)

Professional Issues: Computing and Society aims to provide you an understanding of the issues, opportunities and problems which have arisen as a result of the computerization of wide areas of human activity. It is designed to enhance advanced computer reflective thinking in both computer science specialists and others, and is a key part of the programme of professional development for computer scientists and others seeking to embody professional values and approaches in the IT and computing fields. You will be covered by relevant and current topics in Computer Law (e.g. Data Protection; Intellectual Property Law; Computer Misuse) and other social, ethical and legal topics such as considering the causes and effects of systems failures (including but not limited to computer systems failure). Other aspects such as the ethical and professional responsibilities of graduates - particularly those from IT and computing disciplines - will be critically appraised. It is essential to ensure that a professional engineer has an in depth understanding of professional ethics, law and the impact of what they do on society. The knowledge and understanding obtained in this module will prepare you with an in-depth understanding on different legal, ethical, professional and system aspects of your future career particularly in the areas of IT, computer science and engineering.

Cloud Computing (15 credits)

Cloud computing can be considered as a model to enable ubiquitous, anywhere, any time on-demand network access to a shared pool of configurable resources including networks, storage, processors, servers, applications, and services which can be rapidly provisioned in real-time and automatically. The topics you will study include virtualization, data centres, cloud resource management, cloud storage and popular cloud applications including batch and data stream processing. Your learning will cover different backend technologies to create and run efficient clouds and a study of the way clouds are used by applications to realise computing on demand. You will be involved in practical tutorials on different cloud infrastructure technologies. The knowledge and understanding you will obtain in this module will prepare you to meet the requirements for jobs such as a Cloud Engineer/Developer or a Cloud DevOps Engineer. Also, you will be able to acquire the knowledge and skills to enable you to provide consultancy services to companies who are aiming to transfer to cloud-based services and products.

Artificial Intelligence (15 credits)

Artificial Intelligence (AI) covers a broad range of disciplines ranging from cognitive science and philosophy to more pragmatic engineering subjects. You will learn through

specific examples how AI takes its inspiration from human and other biological behaviour that exhibit intelligence, such as problem solving, planning, decision making and optimization. Whilst intended only to provide a broad overview of AI you will learn about all about the main areas of AI such as behaviour, genetic algorithms, neural networks, fuzzy logic and other topics. The course is intended to be quite practical and you will be expected to solve small coding challenges associated with most of the covered topics, and develop a major AI-related programming assignment. You are expected to have some familiarity in one common high-level programming language prior to taking this module (eg C#, C++ or Java). Currently the topic of AI in the public domain is very high, driven by interest in new technological developments (e.g. autonomous vehicles, applications that can personalise your lifestyle, more meaningful responses to your internet searches) and also the growing need for business to create applications that can retrieve consumer information to target new markets (data analytics). This inevitably means a graduate who can demonstrate basic yet practical technical skills in AI as part of their course portfolio will be very employable in the IT sector.

Ethical Hacking and Countermeasures (15 credits)

Studying this module will give you a rounded introduction to the principles of ethical hacking from both a theoretical and technical perspective. As part of your studies you will be given a contextual setting for ethical hacking by an examination of the issues associated with systems security, cybercrime and the criminal justice system i.e. Computer Misuse Act. Within a mixture of lectures, demonstrations and practical sessions you will be introduced to the basic principles of ethical hacking and the role ethical hacking plays in providing more secure and robust information to support computer systems and networks (including wireless networks). This module will involve being exposed to, and using, the basic tools and techniques of ethical hacking, particularly in regard to penetration testing and systems security within a safe and sandboxed environment. You will be provided with opportunities to develop academic skills in report writing and evidence-based demonstrations. By research and application you will develop the skills to manage the particular legal, ethical and professional challenges facing the Information Security practitioner, with particular reference to the criminal justice system in England and Wales and the Computer Misuse Act.

Digital and Network Security Forensics (15 credits)

Digital evidence features in just about every part of our personal and business lives. Law enforcement and forensic companies rely heavily on digital forensic skills and tools to acquire that evidence. Legal and business decisions hinge on having timely data about what people have actually done. This module will help the student understand how to conduct investigations to correctly gather, analyse and present digital evidence to both business and legal audiences. Students will also learn how to use tools to locate and analyse digital evidence on a variety of devices, including mobile phones, and how to keep up to date with changing technologies, laws and regulations in digital forensics. The importance of Network Security in modern connected organisations cannot be

understated as increasingly data processing and storage are interconnected. Network forensics has had a major impact on analysing the activities of threat actors in compromised networks. Consequently, a thorough understanding and knowledge of both Network Security and Network Forensics is a necessity. This module aims to develop the student's skills and knowledge associated with Network Security and Network Forensics. The additional optional module Advanced Network Solutions helps compliment the skills and knowledge learnt in this module towards achieving the external CCNA certification if required. The module is assessed by a lab portfolio of completed lab exercises and by a patch work of assessments including case study components.

Advanced Network Solutions (15 credits)

Modern IT infrastructures are constantly advancing and expanding to meet the needs of dynamically changing business requirements. The driving force that underpins this comes from many aspects, ranging from the requirement for the adaptation of user mobility, to the advancing computer device and network technologies. Network designers must design and build an enterprise network that is both scalable and highly available. The first part of the module introduces strategies that can be used to systematically design a highly functional network. It also covers network design concepts, principles, models, architectures and the benefits that are obtained by using a systematic design approach. Students will gain not only a deep understanding of the concept of network designs that underpin reliable and scalable networks but also the ability to apply the knowledge in practice. Wide-area networks (WANs) are used to connect remote LANs together. The second part of the module introduces WAN standards, technologies, and purposes. It covers selecting the appropriate WAN technologies such as protocols, services, and devices to meet the changing business requirements of an evolving enterprise. In addition to IPv4, the latest IPv6 protocols and the addressing scheme will also be covered. The module is based on the new R&S CCNA 3 & 4 curriculum offered by The Cisco Networking Academy Program (CNAP), a well-established partnership between academia and industry, to provide the most up-to-date knowledge and skills required by industry and commerce. Students studying this module will need to undertake a significant amount of directed self-study for Packet Tracer based lab exercises in their own time. The additional optional module Digital and Network Security Forensics helps compliment the skills and knowledge learnt in this module towards achieving the external CCNA certification if required.

Embedded Computing (15 credits)

More than 20 billion microprocessors and microcontrollers are currently providing intelligent features, smart capabilities, personalised interfaces, optimised communications to an incredibly wide range of devices. From automotive to healthcare, from science and industry to social science and finance, embedded computing is at the very hearth of almost all modern digital systems. In this module, you will develop a gradual, in-depth knowledge and understanding of embedded computing, analysing its relation to the design of modern digital systems and its applications in different areas

and disciplines. Hands-on programming and code optimisation for embedded devices on commercial microcontrollers will be an important part of this module. You will be guided through different microprocessor architectures, real time and non real time hardware and software requirements for embedded microcontroller systems and different communication protocols. You will also explore the relationship between system performance and hardware and software interfaces. Finally, you will be introduced to some possible ethical and sustainability issues (and mitigations) related to the design and operation of embedded systems and smart devices. The module delivery strategy combines complex theoretical aspects, real-world case studies and practical examples (in lab, both supervised and unsupervised). You will be encouraged to take responsibility for your assignments and to work in your own time as well as during the timetabled classes. The successful completion of this module will increase your employability, acquiring industry standard skills, having a hands-on experience with mainstream embedded systems, directly applicable to real-world projects.

Computer Graphics Programming (15 credits)

Computer graphics is a branch of computer science which studies methods for digitally creating and modifying visual content, specifically in two and three dimensions. Note for this module the definition of computer graphics does not extend to include image processing. You will be introduced to some of the programming techniques used to construct primitive lines and shapes through an understanding and implementation of the drawing algorithms that underpin the subject. You will learn about some of the fundamental graphics algorithms such as line and curve drawing, 2D transformations, 3D perspective transformations, hidden line and surface removal, and ray tracing algorithms. You will implement some of these algorithms using a major software development environment and an appropriate programming language that utilises the graphics capability of the underlying computer hardware. Your assessment will be based entirely on coursework including development of a major programming assignment. Your knowledge of computer graphics programming will be an attractive asset to potential employers involved in developing or using graphical applications (such as for computer games, engineering design, and medical applications).