ICT723 VIRTUALISATION AND CLOUD COMPUTING T326 BRIEF

All information in the Subject Outline is correct at the time of approval. KOI reserves the right to make changes to the Subject Outline if they become necessary. Any changes require the approval of the KOI Academic Board and will be formally advised to those students who may be affected by email and via Moodle.
Information contained within this Subject Outline applies to students enrolled in the trimester as indicated

1. General Information

1.1 Administrative Details

Associated HE Award(s)	Duration	Level	Subject Coordinator
Master of Information Technology (MIT) Master of Information Systems (MIS) Graduate Diploma of Information Technology (GDIT) Graduate Certificate of Information Technology(GCIT)	1 trimester	Postgraduate	Dr Mohamad Naji mohamad.naji@koi.edu.au P: +61 (2) 9283 3583 L: 7-11, 11 York Street. Consultation: via Moodle or by appointment

1.2 Core/Elective

This subject is
- an elective subject for the Master of Information Technology (MIT)
- an elective subject for the Master of Information Systems (MIS)
- an elective subject for the Graduate Diploma of Information Technology (GDIT)
- an elective subject for the Graduate Certificate of Information Technology(GCIT)

1.3 Subject Weighting

Indicated below is the weighting of this subject and the total course points

Subject Credit Points	Total Course Credit Points
4	MIT (64 Credit Points); MIS (64 Credit Points); GDIT (32 Credit Points); GCIT (16 Credit Points)

1.4 Student Workload

Indicated below is the expected student workload per week for this subject

No. Timetabled Hours/Week*	No. Personal Study Hours/Week**	Total Workload Hours/Week***
3 hours/week plus supplementary online material	7 hours/week	10 hours/week

* Total time spent per week at lectures and tutorials
** Total time students are expected to spend per week in studying, completing assignments, etc.
*** Combination of timetable hours and personal study

1.5 Mode of Delivery Classes will be face-to-face or hybrid. Certain classes will be online (e.g., special arrangements).

1.6 Pre-requisites Nil

1.7 General Study and Resource Requirements

- Students are expected to attend classes with the weekly worksheets and subject support material provided in Moodle. Students should read this material before coming to class to improve their ability to participate in the weekly activities.
- Students will require access to the internet and their KOI email and should have basic skills in word processing software such as MS Word, spreadsheet software such as MS Excel and visual presentation software such as MS PowerPoint.
- Computers and WIFI facilities are extensively available for student use throughout KOI. Students are encouraged to make use of the campus Library for reference materials.

Software resource requirements specific to this subject: Amazon Web Services or similar cloud provider, VMWare ESXi environment.

1.8 Academic Advising

Academic advising is available to students throughout teaching periods including the exam weeks. As well as requesting help during scheduled class times, students have the following options:

- Consultation times: A list of consultation hours is provided on the homepage of Moodle where appointments can be booked.
- Subject coordinator: Subject coordinators are available for contact via email. The email address of the subject coordinator is provided at the top of this subject outline.
- Academic staff: Lecturers and Tutors provide their contact details in Moodle for the specific subject. In most cases, this will be via email. Some subjects may also provide a discussion forum where questions can be raised.
- Head of Program: The Head of Program is available to all students in the program if they need advice about their studies and KOI procedures.
- Vice President (Academic): The Vice President (Academic) will assist students to resolve complex issues (but may refer students to the relevant lecturers for detailed academic advice).

2. Academic Details

2.1 Overview of the Subject

Cloud computing is a widely accepted IT technology currently implemented by an increasing number of organisations around the world. Cloud services replace investment in infrastructure and can accelerate business innovation by providing the rapid scaling needed to solve ever-increasing computing and storage requirements. This subject is designed to provide fundamental skills and knowledge of cloud computing and of cloud enabling technologies such as virtualisation. The subject enables students to consider various design issues and to address common challenges in implementing modern cloud applications. Students will become familiar with service-oriented architecture, serverless computing and the adoption of cloud services in the design and development of new business applications. Students will gain practical experience working with cloud environments such as Amazon Web Services (AWS) and virtualisation technologies such as the VMWare ESXi environment.

2.2 Graduate Attributes for Postgraduate Courses

Graduates of postgraduate courses from King's Own Institute will achieve the graduate attributes expected from successful completion of a postgraduate degree under the Australian Qualifications Framework (2nd edition, January 2013). Graduates at this level will be able to apply advanced body of knowledge from their major area of study in a range of contexts for professional practice or scholarship and as a pathway for further learning.

King's Own Institute's generic graduate attributes for a master's level degree are summarised below:

	KOI Postgraduate Degree Graduate Attributes	Detailed Description
	Knowledge	Current, comprehensive and coherent knowledge, including recent developments and applied research methods
	Critical Thinking	Critical thinking skills to identify and analyse current theories and developments and emerging trends in professional practice
	Communication	Communication and technical skills to analyse and theorise, contribute to professional practice or scholarship, and present ideas to a variety of audiences
	Research and Information Literacy	Cognitive and technical skills to access and evaluate information resources, justify research approaches and interpret theoretical propositions
	Creative Problem Solving Skills	Cognitive, technical and creative skills to investigate, analyse and synthesise complex information, concepts and theories, solve complex problems and apply established theories to situations in professional practice
	Ethical and Cultural Sensitivity	Appreciation and accountability for ethical principles, cultural sensitivity and social responsibility, both personally and professionally
	Leadership and Strategy	Initiative, leadership skills and ability to work professionally and collaboratively to achieve team objectives across a range of team roles Expertise in strategic thinking, developing and implementing business plans and decision making under uncertainty
	Professional Skills	High level personal autonomy, judgement, decision-making and accountability required to begin professional practice

Across the courses, these skills are developed progressively at three levels:

- **Level 1 Foundation –** Students learn the skills, theories and techniques of the subject and apply them in stand-alone contexts
- **Level 2 Intermediate –** Students further develop skills, theories and techniques of the subject and apply them in more complex contexts, beginning to integrate the application with other subjects
- **Level 3 Advanced** – Students have a demonstrated ability to plan, research and apply the skills, theories and techniques of the subject in complex situations, integrating the subject content with a range of other subject disciplines within the context of the course

Generally, skills gained from subjects in the Graduate Certificate and Graduate Diploma are at levels 1 and 2 while other subjects in the Master's degree are at level 3.

2.3 Subject Learning Outcomes

Listed below, are key knowledge and skills students are expected to attain by successfully completing this subject:

Subject Learning Outcomes	Contribution to Graduate Attributes
a) Compare and contrast different virtualisation technologies and related architectures	
b) Evaluate the different enabling technologies for building cloud systems	
c) Analyse the architectures for cloud and distributed computing	

d) Develop cloud solutions for scientific and business applications	

2.4 Subject Content and Structure

Below are details of the subject content and how it is structured, including specific topics covered in lectures and tutorials. Reading refers to the text unless otherwise indicated.

Weekly Planner:

Week (beginning)	Topic covered in each week's lecture	Reading(s)	Expected work as listed in Moodle
Week 1 26 October	Introduction	Marinescu (2017) Chs. 1, 4 Lavanya (2021) Ch 1	Introduction for tutorial structure, group project and registration on AWS Formative not graded
Week 2 02 November	What is virtualisation	Lavanya (2021) Ch 5 Additional reading provided on Moodle	Get familiar with four front-runner cloud platforms Tutorial 2 submission
Week 3 09 November	Virtualisation architectures	Marinescu (2017) Ch. 10 Lavanya (2021) Ch 6, 7 & 8	Launch a Windows virtual Machine Tutorial 3 submission
Week 4 16 November	Cloud computing architecture	Marinescu (2017) Ch. 2 Lavanya (2021) Ch 6, 7 & 8	Create a Simple Storage Service (Amazon S3) Tutorial 4 submission
Week 5 23 November	Cloud computing and data centres	Marinescu (2017) Chs. 5, 6 Lavanya (2021) Ch 6, 7 & 8	Use AWS to create a simple table in Amazon Dynamo DB to store information Tutorial 5 submission **Assessment 2 due: Quiz**
Week 6 30 November	Service oriented architecture	Additional reading provided on Moodle	Introduction to Amazon Elastic Load Balancer using the AWS Management Console Tutorial 6 submission
Week 7 07 December	Cloud Applications	Marinescu (2017) Ch.7 Lavanya (2021) Ch 9 & 10	Elastic Beanstalk and AWS Management Console Tutorial 7 submission

Week (beginning)	Topic covered in each week's lecture	Reading(s)	Expected work as listed in Moodle
Week 8 14 December	Cloud Hardware and Software	(Marinescu (2017) Ch 8 Lavanya (2021) Ch 9 & 10	AWS Command Line Interface (CLI) to access Amazon S3 Tutorial 8 submission **Assessment 3 due: Research Report**
Week 9 04 January	Cloud Resource Management and Scheduling	Marinescu (2017) Ch. 9 Lavanya (2021) Ch 9 & 10	Virtual private cloud (VPC) Tutorial 9 submission
Week 10 11 January	Big Data, Data Streaming, and the Mobile Cloud	Marinescu (2017) Ch. 12	Amazon CloudWatch Tutorial 10 submission
Week 11 18 January	Concurrency in Cloud Computing	Marinescu (2017) Ch. 3 Lavanya (2021) Ch 9 & 10	Group project meeting and progress report Demonstrate the AWS Command Line Interface (CLI) Tutorial 11 submission **Assessment 4: Group Project Report due**
Week 12 25 January	Revision, Student presentation	All Chapters	**Assessment 4: Group Project, individual contribution and demonstration**
Week 13 01 February	Study review week and Final Exam Week		
Week 14 08 February	- Final Exam Week - Continuing students - enrolments for T127 open		Please see the exam timetable for the exam date, time and location
Week 15 15 February	- Student Vacation begins - New students - enrolments for T127 open		
Week 16 22 February	• Results Released • Review of Grade Day for T326 – see Sections 2.6 and 3.2 below for relevant information. • Certification of Grades NOTE: More information about the dates will be provided at a later date through Moodle/KOI email.		
T127 01 March 2027			
Week 1 01 March	Week 1 of classes for T127		

2.5 Teaching Methods/Strategies

Briefly described below are the teaching methods/strategies used in this subject:

- *Lectures* (1 hours/week) are conducted in seminar style and address the subject content, provide motivation and context and draw on the students' experience and preparatory reading.
- *Tutorials* (2 hours/week) include class discussion of case studies and research papers, practice sets and problem-solving and syndicate work on group projects. Tutorials often include group exercises and so contribute to the development of teamwork skills and cultural understanding. Tutorial participation is an essential component of the subject and contributes to the development of many of the graduate attributes (see section 2.2 above). Tutorial participation contributes towards the assessment in many subjects (see details in Section 3.1 for this subject). Supplementary tutorial material such as case studies, recommended readings, review questions etc. will be made available each week in Moodle.
- *Online* teaching resources include class materials, readings, model answers to assignments and exercises and discussion boards. All online materials for this subject as provided by KOI will be found in the Moodle page for this subject. Students should access Moodle regularly as material may be updated at any time during the trimester
- *Other contact* - academic staff may also contact students either via Moodle messaging, or via email to the email address provided to KOI on enrolment.

2.6 Student Assessment

Assessment is designed to encourage effective student learning and enable students to develop and demonstrate the skills and knowledge identified in the subject learning outcomes. Assessment tasks during the first half of the study period are usually intended to maximise the developmental function of assessment (formative assessment). These assessment tasks include weekly tutorial exercises (as indicated in the weekly planner) and low stakes graded assessments (as shown in the graded assessment table). The major assessment tasks where students demonstrate their knowledge and skills (summative assessment) generally occur later in the study period. These are the major graded assessment items shown in the graded assessment table.

Final grades are awarded by the Board of Examiners in accordance with KOI's Assessment and Assessment Appeals Policy. The definitions and guidelines for the awarding of final grades are:

- *HD High distinction* (85-100%): an outstanding level of achievement in relation to the assessment process.
- *D Distinction* (75-84%): a high level of achievement in relation to the assessment process.
- *C Credit* (65-74%): a better than satisfactory level of achievement in relation to the assessment process.
- *P Pass* (50-64%): a satisfactory level of achievement in relation to the assessment process.
- *F Fail* (0-49%): an unsatisfactory level of achievement in relation to the assessment process.
- *FW:* This grade will be assigned when a student did not submit any of the compulsory assessment items.

Provided below is a schedule of formal assessment tasks and major examinations for the subject.

Assessment Type	When Assessed	Weighting	Learning Outcomes Assessed
Assessment 1: Weekly Tutorial	Week 2 - 11	20%	a, b, c, d
Assessment 2: Quiz (In Class)	Week 5	20%	a, b
Assessment 3: Individual Research report (2000-word report)	Week 8	30%	a, b, c
Assessment 4: Group development project report and presentation (2000 words length)	Week 11- Report Week 12 – presentation	Group 20%; Individual contribution / Presentation 10%	b, c, d

Requirements to Pass the Subject:

To gain a pass or better in this subject, students must gain a *minimum of 50%* of the total available subject marks.

2.7 Prescribed and Recommended Readings

Provided below, in formal reference format, is a list of the prescribed and recommended readings.

Prescribed Text:

Lavanya, S., & Venkatachalam, K. (2021). *Building cloud and virtualization infrastructure: A hands-on approach to virtualization and implementation of a private cloud using real-time use-cases*. https://dokumen.pub/building-cloud-and-virtualization-infrastructure-a-hands-on-approach-to-virtualization-and-implementation-9789390684472.html

Marinescu, D. (2017). *Cloud computing: Theory and practice* (2nd ed.). Morgan Kaufmann. https://www.amazon.com.au/Cloud-Computing-Practice-Dan-Marinescu-ebook/dp/B0778MSZPV

Recommended Readings

Baron, S. (2020). *AWS: The complete beginner's guide to mastering Amazon Web Services*. Independently published. https://www.amazon.com.au/AWS-Beginners-Complete-Understand-Services/dp/B09KN7Z1GY

Daswani, R. (2021). *AWS certified cloud practitioner exam guide: Build your cloud computing knowledge and build your skills as an AWS certified cloud practitioner*. Packt Publishing Ltd. https://www.amazon.com.au/Certified-Cloud-Practitioner-Exam-Guide/dp/180107593X

Kaya, G. (2024). *Analyzing the effects of virtualization on cloud platform performance*. https://www.diva-portal.org/smash/record.jsf?pid=diva2%3A1832804&dswid=-5692

Patrão, L. (2024). Understanding virtualization. In *VMware vSphere essentials: A practical approach to vSphere deployment and management* (pp. 1–7). Apress. https://www.amazon.com.au/VMware-vSphere-Essentials-Deployment-Management-ebook/dp/B0CVN9267B

Piper, B., & Clinton, D. (2020). *AWS certified solutions architect study guide: Associate SAA-C02 exam* (3rd ed.). Sybex. https://www.wiley.com/en-nl/AWS+Certified+Solutions+Architect+Study+Guide%3A+Associate+SAA-C02+Exam%2C+3rd+Edition-p-9781119713104

Sharma, V. K., Singh, A., Krishna, R. J., Bairwa, A. K., & Srivastava, D. K. (2022). Introduction to virtualization in cloud computing. In *Machine learning and optimization models for optimization in cloud* (Vol. 1). https://www.taylorfrancis.com/chapters/edit/10.1201/9781003185376-1/introduction-virtualization-cloud-computing-vijay-kumar-sharma-arjun-singh-krishna-jaya-amit-kumar-bairwa-devesh-kumar-srivastava

Journals

Aliev, I., Gazul, S., & Bobova, A. (2023, March). Virtualization technologies and platforms: Comparative overview and updated performance tests. In *AIP Conference Proceedings* (Vol. 2700, No. 1). AIP Publishing. https://doi.org/10.1063/5.0125249

Gharibvand, V., Kolamroudi, M. K., Zeeshan, Q., Çınar, Z. M., Sahmani, S., Asmael, M., & Safaei, B. (2024). Cloud based manufacturing: A review of recent developments in architectures, technologies, infrastructures, platforms and associated challenges. *The International Journal of Advanced Manufacturing Technology*, 1–31. https://link.springer.com/article/10.1007/s00170-024-12989-y

Gorantla, V. A. K., Sriramulugari, S. K., Gorantla, B., Yuvaraj, N., & Singh, K. (2024, March). Optimizing performance of cloud computing management algorithm for high-traffic networks. In *2024 2nd International Conference on Disruptive Technologies (ICDT)* (pp. 482–487). IEEE. https://ieeexplore.ieee.org/document/10489018

Jeyaraman, J., Bayani, S. V., & Malaiyappan, J. N. A. (2024). Optimizing resource allocation in cloud computing using machine learning. *European Journal of Technology, 8*(3), 12–22. https://pdfs.semanticscholar.org/b1c7/af62ee7fc98fd5e423304035820f224d8ead.pdf

Koratagere, S., Koppal, R. K. C., & Umesh, I. M. (2023). Server virtualization in higher educational institutions: A case study. *International Journal of Electrical Computer Engineering, 13*(4). https://ijece.iaescore.com/index.php/IJECE/article/view/30325

Lambropoulos, G., Mitropoulos, S., Douligeris, C., & Maglaras, L. (2024). Implementing virtualization on single-board computers: A case study on edge computing. *Computers, 13*(2), 54. https://doi.org/10.3390/computers13020054

Mangalampalli, S., Sree, P. K., Swain, S. K., & Karri, G. R. (2023). Cloud computing and virtualization. In *Convergence of cloud with AI for big data analytics: Foundations and innovation* (pp. 13–40). https://researcher.manipal.edu/en/publications/cloud-computing-and-virtualization/

Munhoz, V., & Castro, M. (2024). Enabling the execution of HPC applications on public clouds with HPC@Cloud toolkit. *Concurrency and Computation: Practice and Experience, 36*(8), e7976. https://doi.org/10.1002/cpe.7976

Rehan, H. (2024). Revolutionizing America's cloud computing: The pivotal role of AI in driving innovation and security. *Journal of Artificial Intelligence General Science (JAIGS), 2*(1), 239–240. https://doi.org/10.60087/jaigs.v2i1.p208

Xu, Z., Gong, Y., Zhou, Y., Bao, Q., & Qian, W. (2024). Enhancing Kubernetes automated scheduling with deep learning and reinforcement techniques for large-scale cloud computing optimization. *arXiv preprint arXiv:2403.07905*. https://doi.org/10.48550/arXiv.2403.07905

Websites:

- Tutorial: Get started with Amazon EC2 Linux instances by Amazon (https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/EC2_GetStarted.html)
- Service-Oriented Architecture (https://aws.amazon.com/what-is/service-oriented-architecture/)
- Getting started with Amazon S3 (https://aws.amazon.com/getting-started/hands-on/getting-started-using-amazon-s3-intelligent-tiering/)
- AWS SDK and Tool Reference Guide: (https://docs.aws.amazon.com/sdkref/latest/guide/overview.html)
- Tools to build on AWS: (https://aws.amazon.com/developer/tools/)
- Amazon Relational Database Service (https://docs.aws.amazon.com/AmazonRDS/latest/UserGuide/Welcome.html)
- Amazon Dynamo DB (https://docs.aws.amazon.com/amazondynamodb/latest/developerguide/Introduction.html)

Suggested Periodicals:

- ACM Digital Library: https://dl.acm.org/
- Future Generation Computer Systems: https://www.journals.elsevier.com/future-generation-computer-systems/
- IEEE Transactions on Cloud Computing: https://www.computer.org/web/tcc