MODULE SPECIFICATION PROFORMA

Module Code:	COM555

Module Title:	Network Protocols and Algorithms

Level:	5	**Credit Value:**	20

Cost Centre(s):	GACP	JACS3 **code**: HECoS code:	I300 100374

Faculty:	Arts, Science and Technology	**Module Leader:**	Vic Grout

Scheduled learning and teaching hours	30 hrs
Guided independent study	170 hrs
Placement	0 hrs
Module duration (total hours)	200 hrs

Programme(s) in which to be offered (not including exit awards)	Core	Option
BSc (Hons) Computer Networks and Security	✓	☐
BSc (Hons) Computer Networks and Security (with Industrial Placement)	✓	☐

Pre-requisites
None.

Office use only
Initial approval: 03/04/2019 Version no:1
With effect from: 01/09/2019
Date and details of revision: Approved by APSC March 2019 Version no:

Module Aims

This module aims to introduce students to, and provide them with practical experience in, the essential protocols and algorithms at the heart of modern communications systems from basic point-to-point connectivity, through local area networks and their broadcast derivatives, wide area networks and beyond, through to the global Internet. Students will, through a combination of exercise, simulation and real-world configuration, work with protocols and algorithms for network design, optimisation, dimensioning, management, access control, scheduling, switching, routing, traffic shaping and security. The module offers a practical treatment of modern network processes: *not* a abstract study of mathematical graph theory.

Intended Learning Outcomes

Key skills for employability

KS1	Written, oral and media communication skills
KS2	Leadership, team working and networking skills
KS3	Opportunity, creativity and problem solving skills
KS4	Information technology skills and digital literacy
KS5	Information management skills
KS6	Research skills
KS7	Intercultural and sustainability skills
KS8	Career management skills
KS9	Learning to learn (managing personal and professional development, self-management)
KS10	Numeracy

At the end of this module, students will be able to		Key Skills	
1	Analyse and interpret a range of network problems and produce designs and models for appropriate offline algorithmic solutions	KS1	KS2
		KS3	KS4
		KS5	KS10
2	Implement network solutions that demonstrate proficiency in a range of centralised and distributed algorithmic techniques	KS1	KS2
		KS3	KS4
		KS5	KS10
3	Identify and evaluate problems and protocol solutions in terms of their application and efficiency	KS1	KS2
		KS3	KS4
		KS5	KS10
4	Find appropriate solutions to constrained real-time network problems	KS3	KS4
		KS6	KS10

Transferable skills and other attributes

Students will continue to develop their computational problem-solving skills and develop specific new techniques in design and optimisation.

Derogations

None.

Assessment:

Indicative Assessment Tasks:

Students will build an electronic portfolio of key network algorithms in solving a variety of communication, network and Internet problems. Approximately half of the portfolio's software will come from exercises worked upon in class with the remainder being extensions or variations developed, under guidance, by the students. The portfolio will include full testing throughout.

Students will also undertake a practical 'open book' timed class challenge requiring a designed and implemented algorithmic solution to a constrained network problem. Marking will be based on the appropriateness and effectiveness of the algorithm selected and how effectively this is coded/programmed.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)	Duration (if exam)	Word count (or equivalent if appropriate)
1	1 2 3	Portfolio	75		3,000
2	4	Practical	25	6 hours	

Learning and Teaching Strategies:

The delivery for the module will consist primarily of lecture and lab work, split approximately 50/50. However, the time will be used flexibly, when pertinent, to allow other modes of learning to be integrated, such as tutorials, guest speakers, or site visits. Module delivery will be supported by the use of the University's Virtual Learning Environment (VLE).

Lectures will be used to deliver the key theories and principles of the module, supported by reflection and practice of these through lab sessions and discussion.

Labs will provide students with the opportunity to put their knowledge and theories into practice, coding solutions in a relevant computer programming language, implementing algorithms on live networks and responding to exercises and briefs that form part of the on-going module portfolio assessment. Students are expected to work in small groups during lab sessions. Problems and scenarios will start off reasonably constrained, but will increase in complexity, scope, and duration as the module advances.

Syllabus outline:

Network models, standards and protocols
Nodes, links, costs and flows
Offline, real-time, centralised and distributed network problems
Problem solving with algorithms
Top down algorithmic design
Network optimisation
Exact and heuristic optimisation
Network design
Network dimensioning
Management protocols
Network control
Scheduling

Switching and routing
Network policies
Traffic shaping
Security protocols

Indicative Bibliography:

Essential reading

Hartpence, B., 2011. *Packet Guide to Core Network Protocols*. O'Reilly Media.

Olifer, N. & Olifer, V., 2005. *Computer Networks: Principles, Technologies and Protocols for Network Design*. John Wiley and Sons.

Other indicative reading

Mishra, A.R., 2018. *Fundamentals of Network Planning and Optimisation 2G/3G/4G: Evolution to 5G*. Wiley-Blackwell.

Serpanos, D. & Wolf, M., 2017. *Internet-of-Things (IoT) Systems: Architectures, Algorithms, Methodologies*. Springer.

Medhi, D. & Ramasamy, K., 2017. *Network Routing: Algorithms, Protocols and Architectures*. Morgan Kaufmann.

Di Martino, B., Li, K-C., Yang, L.T. & Esposito, A., 2017. *Internet of Everything: Algorithms, Methodologies, Technologies and Perspectives*. Springer.

Nakibly, G., 2014. *Traffic Engineering Algorithms for IP and MPLS Networks: Novel and practical algorithms for routing optimization of large operational networks*. Scholars' Press.

Rezaul, K.M. & Grout, V., 2007. *The Fractal Internet: Traffic Analysis, Simulation, Estimation and Control*. North East Wales Institute of Higher Education.

Grout, V., 2007. *Optimising the Internet: Key Topics in Modern Network Algorithms*. North East Wales Institute of Higher Education.

Robertazzi, T.G., 2007. *Networks and Grids: Technology and Theory (Information Technology: Transmission, Processing and Storage)*. Springer.