Unit Title	Broadcast Computation and Electronics
FHEQ Level	5
Unit Code	DTT18204
Credit Value	30
Unit Type	Compulsory: Taught

Learning Hours

Staff – Student Contact Hours		Independent Study Hours	
Classes	75	Independent Study	105
Supervised access to resources	0	Preparation for Assessment	75
	(75)	Unsupervised Access to Resources	45
Total			300

Unit Description

This unit continues the specialisation learning within the programme and builds upon your project choices from year 1. You will be taught to a deeper level of understanding on topics related to general mathematical principles and Applied Maths. Furthermore, you will be taught the importance of software, signal processing, and electronic interfacing within television broadcast systems. You will select a project that reflects your growing knowledge in a specialisation of your choice. The blended learning approach in this unit combines maths and engineering topics, including: compression, coding, algorithms and electronic design, with practical project work that provides an opportunity for you to apply your understanding through development platforms such as Arduino. Highly creative projects are encouraged, for example using human interactive interfaces. This unit will operate alongside Contemporary Broadcast and Network Systems to provide you with a comprehensive and correlated understanding of hardware and software in current broadcast infrastructures. This unit is a bridge to third year studies, particularly the Major Engineering Project unit.

The Five Principles underpin the Mindsets and Skillsets Manifesto and are the foundation upon which all course curriculum frameworks and unit specifications are based. The relevant Principles as stated below have been mapped against the Learning Outcomes relevant to each course unit and at each level (see Programme Specifications for full description of the Five Principles):

1. Cultivate / Where the individual thrives.
2. Collaborate / Where disciplines evolve.
3. Integrate / Where education engages industry.
4. **Advocate / Where purpose meets practice.**
5. Originate / creativity meets technology.

Unit Indicative Content

- Programming languages, particularly C++ and Java
- Integrated Development Environments such as Arduino and Raspberry Pi
- Software to hardware interfacing methods, particularly for video and audio

- Design methods, including schematics (using AutoCad), for electronic circuits
- Electronics projects for signal interfacing and measurement
- Signal measurement and processing techniques for video and audio, and the associated mathematics
- Signal compression techniques for broadcast signals and Internet related data, particularly streaming, and the associated mathematics
- Transferrable mathematical skills
- Introduction to mathematical modelling, processing, and computation in software environments

Unit Aims

1. To develop hardware and software knowledge suitable for television broadcasting (course aim)

2. To develop diagnostic and problem solving skills in a technology context (course aim)

3. To gain an understanding of the principles of compression for different types of media content and the effects of compression on picture and sound quality

4. To possess knowledge of techniques for conditional access and encryption

5. To apply mathematical equations, techniques, and processes to computation required for television broadcast signals

6. To acquire coding skills for platforms such as Arduino and Raspberry Pi for signals found in television broadcast systems

7. To design and build simple electronic interfaces between computing platforms and television broadcast signals

Unit Learning Outcomes

LO1: **Research/Inspiration**

Analyse and interpret information and data analysis techniques using a wide range of methods, providing visual and written application-specific case-studies.

Based on **ORIGINATE** principle.

LO2: **Concept/Ideation**

Analyse software and hardware techniques and components leading to the development of designs and concepts that inform and lead to electronic projects.

Based on **ORIGINATE** principle.

LO3: **Development/Prototyping**

Analyse a range of potential pathways that result in appropriate solutions, informed by an understanding of the principles of engineering design (hardware and/or software) and appropriate mathematical processes.

Based on **INTEGRATE** principle.

Learning and Teaching Methods

- Project briefings – in order to prepare students for the aims, content, delivery, learning outcomes, and assessments
- Seminars (including guest lecturers)
- Tutorials (individuals or small group with specialist tutor)
- Practical workshops (blended with seminars)
- VLE activities such as software coding examples and tutorials
- Individual and small group work
- Autonomous study
- Continual individual and small group formative feedback
- Summative assessment at end of unit that demonstrates degree to which learning outcomes have been met

Assessment methods and tasks

Brief description of assessment methods

Assessment tasks	Weighting (%) *(one grade or multi-grade unit)*
1. **Holistic assessment:** Individual presentation on a signal processing technique relevant to selected specialisation within television broadcast systems. (5 minutes + 2 minutes Q&A) Individual or small-group practical project Lab Report utilizing coding techniques and electronic interfacing. (1000 words (individual report))	50%
3. Applied Maths test (45 minutes)	50%

Indicative Assessment Criteria

Assessment criteria are the basis on which the judgment of the adequacy of the work is made. A more detailed assessment criteria will be specified in the brief.

Holistic assessment: is an individual presentation (PowerPoint, Prezi, AfterEffects, etc., of approximately 5 minutes in duration, with 2 minutes for questions and answers) and a practical project Lab Report with appropriate code examples, description, and diagrams (1000 words). The student chooses the signal processing or compression topic, and project. The presentation will be assessed through the following criteria:

1. Evidence breadth of understanding of television broadcasting systems hardware and software requirements. **LO2**
2. Demonstrate a high-level understanding of where and how mathematical techniques are applied in the end-to-end television broadcast signal chain. **LO1**
3. Evidence of intermediate technical explanation of signal processing or compression technique related to digital media, primarily video or audio. **LO2**
4. Evidence of the practical project through hardware design and

implementation, and the software code developed and used. **LO3** & **LO1**

Assessment 2 is an open-book Mathematics test of 45 minutes duration. The test will be assessed through the following criteria:

5. Demonstrate the underlying mathematical principles and techniques, explaining where necessary appropriate equations in the context of broadcast television. **LO1**
6. Evidence ability to solve maths problems encountered through appropriate mathematical processes. **LO3**

Essential Reading list

1. Bean K. and Lake S., 2012, Media: Concepts and Applications, South Western. ISBN: 978-0-538-74130-9
2. Kaufman C., Pearlman R., Speciner M., 2007, Network Security: Private Communication in a Public World, Prentice Hall,   ISBN: 978-0-13046-019-6
3. Rajaraman V., 2013, *Introduction to Information Technology*, 2nd Edn., PHI Learning   ISBN: 978-81-203-4731-1
4. Shklar, L., 2011, Studyguide for Web Application Architecture: Principles, Protocols and Practices. Academic Internet. ISBN: 978-0-470-51860-1
5. Simpson, W., 2008, *IPTV, Internet Video, H.264, P2P, Web TV, and Streaming: A Complete Guide to Understanding the Technology*, 2nd Edition, Focal Press.
6. Tozer E. P. J., 2012. Broadcast Engineer's Reference Book, CRC Press.

URLs

1. http://www.img.lx.it.pt/~fp/cav/Additional_material/MPEG2_overview.pdf Guide to MPEG Fundamentals and Protocol Analysis
2. http://www.img.lx.it.pt/~fp/cav/Additional_material/HEVC-Performance.pdf Comparison of the Coding Efficiency of VideoCoding Standards
3. https://ritdml.rit.edu/bitstream/handle/1850/412/EMajewiczIndependentStudy.pdf;jsessionid=06F88E77C619E6E8DF95E1578BB6BF7C?sequence=1 Analysis of Digital Audio Compression and Digital Rights Management
4. https://www.thebroadcastbridge.com/content/entry/8680/documentation-part-2-designing-and-documenting-an-ip-architecture System Design
5. https://tech.ebu.ch/docs/techreview/trev_301-middleware.pdf System Integration