COURSE DETAILS

**Course Code**: B31TF  
**Full Course Title**: Sensors, Actuators and IoT  
**SCQF Level**: 11  
**SCAF Credits**: 15  
**Available as Elective**: Yes

DELIVERY LEVEL

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<th>Undergraduate:</th>
<th>No</th>
<th>Postgraduate Taught:</th>
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<th>Postgraduate Research:</th>
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Additional Information:

COURSE AIMS

Develop and use a significant range of principal and specialist skills, techniques and practices in the domain of actuation and sensing issues.

Develop and use a range of principal and specialist skills, techniques and practices in the domain of IoT technology and applications.

Develop detailed knowledge and skills to deal with diverse and complex technological systems that exist in Smart Systems engineering and a critical understanding of the range of tools and techniques available to support this process.

Develop a critical understanding of the relationships and interactions between the various components in a microsystem and Smart System (Hardware and software) to achieve the overall goal of the systems structure and operation.

Critically review existing practice and develop original and creative solutions to problems within the domain.

Communicate and work effectively with peers and academic staff in a variety of tasks, demonstrating appropriate levels of autonomy and responsibility.

Plan and execute a significant project of research, investigation or development in a specialist area, demonstrating extensive, detailed and critical understanding of that specialism.

LEARNING OUTCOMES – SUBJECT MASTERY

Critical understanding of the principal theories, principles and concepts relating to the use of actuation and sensing in the domain of Smart Systems engineering and scientific applications.

Extensive, detailed and critical understanding of some specialist areas within the domain of actuation and sensing for Microsystems and Smart Systems Integration.

Understanding and use of a significant range of the principal skills, techniques and practices in sensing and actuation, and a range of specialised skills, research and investigation techniques, and practices informed by leading-edge research and development.

A broad knowledge of the main areas of actuation and sensing techniques.

Critical understanding of IoT technology, applications and implementation.

Application-based knowledge and skills relating to the broad range of activities within the actuation and sensing domains, and specialist knowledge and skills in applications relating to a number of specialist areas within the domain.

Fundamental knowledge and skills to deal with diverse and complex technological systems that exist in engineering and science disciplines and a critical understanding of the range of tools and techniques available to support this process.

A critical understanding of the relationships and interactions between the various components in a system (Hardware and software) to achieve the overall goal of the systems structure and operation.
### LEARNING OUTCOMES – PERSONAL ABILITIES

Develop and apply skills in critical analysis, evaluation and synthesis in consideration of the range of theories, concepts and techniques in use within the domain of actuation and sensing, and in the design of projects and experimental models. Abilities to critically understand and apply relevant theories and technologies to developing analytical and design skills.

Develop and utilise advanced problem-solving skills and techniques in the development of original and creative solutions to general and specialist issues within the domain of Microsystems and Smart Systems engineering.

Demonstrate critical awareness of the current issues within the discipline, and make informed judgements with incomplete or inconsistent data, or where there are no professional/ethical codes or practices for guidance.

Work autonomously and within teams, as appropriate, demonstrating a capability for both taking and critically reflecting on roles and responsibilities.

Develop and demonstrate skills and techniques in communication with peers and academic/industrial staff, using a range of appropriate methods to suit different levels of knowledge and expertise within the audience.

Develop and demonstrate critical knowledge and skills in the planning and usage of software tools and numerical techniques to develop, present and communicate information on projects and processes.

### SYLLABUS

**Principles of actuation; Forces in micromechanics:** elastic forces, surface tension forces, electrostatic forces, electromagnetic forces, thermal and piezoelectric forces; Design of a sensor using CAD tools. Dynamics of structures: mass spring damper system.

**Microsystem fundamentals:** scaling laws; mechanical failure mechanisms;

- Different sensor types and examples: chemical sensors; optical sensors, RF sensor; biochemical sensors; biological sensors;
- inertial sensors; magnetic sensors.

Introduction to IoT and cyberphysical systems (CPS), IoT architecture, platforms and components, connected sensors, hardware systems, basic programming skills for IoT,

Communication protocols for IoT, wireless and cloud data transfer between server and devices and within IoT system

Group based IoT design project
### COURSE RELATIONSHIPS

N/A

### LOCATION AND ASSESSMENT METHODS

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