

## Specialist Diplomas in Science & Technology

### Background

The **modular programme in Science & Technology Studies** is an interdisciplinary course accredited and delivered by the National University of Ireland, Galway and the University of Limerick under the auspices of the Atlantic University Alliance (AUA). The programme currently offers awards at Diploma and Degree level (Bachelor of Science) and is now introducing new **Specialist Diplomas** in the following areas:

- |                                      |                    |                      |
|--------------------------------------|--------------------|----------------------|
| 1. Environmental Sustainability      | accredited by NUIG | start September 2009 |
| 2. Medical Device Science            | accredited by NUIG | start September 2009 |
| 3. Form & Function of the Human Body | accredited by NUIG | start September 2010 |
| 4. Lean & Quality Systems            | accredited by NUIG | start September 2011 |
| 5. Automation & Control              |                    | start TBC            |
| 6. Mechanical Design                 |                    | start TBC            |

<b>Course Level:</b>	Minor award at Honours Bachelors level (NFQ level 8)
<b>Course Type:</b>	Part-time via blended learning
<b>Duration:</b>	Normally 1 year, or a maximum of 2 years, subject to module availability
<b>Credit Weighting:</b>	5 modules of 6 ECTS each, 30 ECTS in total
<b>Award Title:</b>	Specialist Diploma in... <i>elective stream title</i>

### Target Market

The programme is largely targeted at those seeking professional development in a variety of technology-rich industries such as Medical Devices, Biotechnology and high end Manufacturing. The Specialist Diplomas are especially suitable for those requiring medium-term, up-skilling for career advancement in areas where the industry is experiencing skill shortages; or for those interested in focussed study in a subject of personal or topical interest. For example, 'Medical Device Science' will be of benefit to managers, operatives and quality personnel to gain a more encompassing view of production requirements. 'Form & Function of the Human Body' will be of benefit to Medical Device Engineers by providing insight into the ultimate environment of their products.

### Content

Each Specialist Diploma consists of four modules and a related project. Normally candidates will undertake two taught modules in the first semester and two taught modules in the second semester. The project is year long and will be company based where practical. The topic will be chosen by the candidate in consultation with their academic supervisor (and industry mentor if appropriate).

The full syllabus for each diploma is presented at the end of this document, the module titles are as follows:

1. **Environmental Sustainability:** Environmental Management Systems, Environmental Impact Assessment, Sustainable Energy, Design for Environment, Project
2. **Medical Device Science:** Human Anatomy & Physiology, Biocompatibility & Device Design, Mechanics of Solids, Medical Device Science, Project
3. **Form & Function of the Human Body:** Human Anatomy & Physiology, Biocompatibility & Device Design, Cell Biology, Immunology & Human Therapeutics, Project
4. **Lean & Quality Systems:** Lean Thinking & Lean Tools, Quality Science - Six Sigma, Problem Solving Tools & Techniques, Enterprise Modelling & Simulation, Project

### **Entry Criteria**

Applicants for entry to the specialist courses should be in receipt of the Diploma in Science & Technology Studies or a related Diploma (level 7 on the National Framework of Qualifications), or otherwise prove that they satisfy the prerequisites of each of the modules in the relevant course.

### **Assessment**

All modules will be individually assessed. Assessment will be in the form of a variety of continuous assignments potentially including laboratory sessions throughout the semester, and an end of semester exam. The project will be assessed based on a project proposal and final research report.

### **Attendance Requirements**

The course will be delivered via a blended learning model on a part-time basis over one year. Candidates will receive learning materials both in print format and online for each module. These materials include custom written course books specifically designed for independent study or prescribed text books with an associated study guide, and may be supplemented with digital learning resources. Student support will be provided both online and via face to face sessions. Tutorials are held largely on Saturdays in the accrediting institution (approximately 4 sessions of 2.5 hours each per module). The academic year consists of two semesters of 16 weeks duration each; September to December and January to June.

### **Award**

A minor award at level 8 may be awarded on successful completion of 30 ECTS from the specialist programmes by NUI Galway. In the event of non-completion of the full course of study an individual transcript may be awarded for any module successfully completed. On successful completion of the Specialist Diploma or individual modules students may use credits achieved toward completion of the full B.Sc. in Science & Technology.

### **Further Information**

Programme web site [www.modularbsc.ie](http://www.modularbsc.ie)

Programme Manager: Dr. Niamh Nolan; E [niamh.nolan@nuigalway.ie](mailto:niamh.nolan@nuigalway.ie)

Programme Administrator, Ms. Niamh McHugh; E [niamh.mchugh@nuigalway.ie](mailto:niamh.mchugh@nuigalway.ie), T 091 495845

## **Environmental Sustainability Syllabus**

### **BST139 Environmental Management Systems**

- Unit 1 Overview of Environmental Issues and Environmental Management
- Unit 2 Introduction to Environmental Management Systems
- Unit 3 Planning the Environmental Review
- Unit 4 Environmental Policy
- Unit 5 Environmental Objectives and Targets
- Unit 6 Roles and Responsibilities for Developing and Implementing the EMS
- Unit 7 Environmental Awareness and Training
- Unit 8 Environmental Communications and Documentation
- Unit 9 Operational Control
- Unit 10 Emergency Preparedness and Response
- Unit 11 Environmental Monitoring and Measurement
- Unit 12 Environmental Auditing
- Unit 13 Corrective Action
- Unit 14 Environmental Management Review
- Unit 15 Environmental Performance Reporting
- Unit 16 Module Review

### **BST140 Environmental Impact Assessment**

- Unit 1 Overview of Environmental Impact Assessment (EIA)
- Unit 2 Legal Framework for EIA
- Unit 3 EIA Topics that must be Addressed
- Unit 4 Screening for EIA
- Unit 5 Scoping For EIA
- Unit 6 Nature and Significance of Environmental Impacts
- Unit 7 Mitigation Measures for EIA
- Unit 8 Environmental Impact Statement (EIS)
- Unit 9 Managing EIA Project
- Unit 10 Review of EISS
- Unit 11 Roles of Participants in Practice
- Unit 12 Decision Making in EIA Process
- Unit 13 Post – Decision Follow-Up
- Unit 14 Critical Assessment of the EIA Process
- Unit 15 Strategic Environmental Assessment (SEA)
- Unit 16 Module Review

## **BST141 Sustainable Energy**

Unit 1 Energy Trends Current Options

Unit 2 Utilization of Energy – Sustainable Consumption and Energy Awareness

Unit 3 Tradition Fuels used for Energy Use

Unit 4 Solar Thermal Heating

Unit 5 Solar Photovoltaics

Unit 6 Bioenergy

Unit 7 Hydroelectricity

Unit 8 Tidal and Wave Power

Unit 9 Wind Energy

Unit 10 Geothermal Energy

Unit 11 Electricity Generation and Integration

Unit 12 Electricity Distribution

Unit 13 Nuclear Power

Unit 14 Sustainable Building

Unit 15 Passive Homes and Sick building syndrome

Unit 16 Case Studies

## **BST142 Design for Environment**

Unit 1 Introduction to DFE

Unit 2 Conceptual Principals of DFE

Unit 3 Product and Process Development

Unit 4 Environmental Performance Metrics

Unit 5 Methods for Assessing and Improving Environmental Performance

Unit 6 Integrated Lifecycle Management

Unit 7 Case Study: AT & T

Unit 8 Case Study: Environmental Conscious Products – An IBM Initiative

Unit 9 Case Study: Applied Materials Incorporated - Semi Conductor Equipment Design

Unit 10 Ten Ways to Prevent Pollution by Design

Unit 11 Organisational Issues in DFE

Unit 12 DFE: Corporate Planning and Compliance

Unit 13 Sustainability in Design Research and Practise

Unit 14 Environmentally Sustainable Design-orienting Tools

Unit 15 Design for Environment in Perspective

Unit 16 The Road to Eco – Efficiency

## **Medical Device Science Syllabus**

### **BST117 Anatomy & Human Physiology**

- Unit 1 The Human Body
- Unit 2 The Integumentary System
- Unit 3 The Skeletal System
- Unit 4 The Muscular System
- Unit 5 The Nervous System
- Unit 6 The Endocrine System
- Unit 7 The Cardiovascular System
- Unit 8 The Haematological System
- Unit 9 The Lymphatic System
- Unit 10 The Respiratory System
- Unit 11 The Digestive System
- Unit 12 The Urinary System
- Unit 13 The Reproductive System
- Unit 14 Pregnancy
- Unit 15 The Senses
- Unit 16 The Brain

### **BST118 Biocompatibility & Device Design**

- Unit 1 Biomaterials and Medical Devices
- Unit 2 Classes of Biomaterials
- Unit 3 Tissue Engineering
- Unit 4 Device Design
- Unit 5 Biomaterials Processing
- Unit 6 Device Fabrication
- Unit 7 Device Characterisation - Surface Properties
- Unit 8 Device Characterisation – Bulk Properties
- Unit 9 Device Characterisation – In Vitro Studies / Biological
- Unit 10 Device Characterisation – In Vivo Studies
- Unit 11 Devices Degradation & Failure
- Unit 12 Inflammation
- Unit 13 Wound Healing
- Unit 14 Infection
- Unit 15 Future Directions
- Unit 16 Clinical Trials

## **BST119 Mechanics of Solids**

- Unit 1 Introduction to Mechanics Of Solids
- Unit 2 Stress and Strain, Design 1
- Unit 3 Stress and Strain, Design 2
- Unit 4 Axially Loaded Member 1
- Unit 5 Axially Loaded Member 2
- Unit 6 Torsion 1
- Unit 7 Torsion 2
- Unit 8 Shear Force and Bending Moment 1
- Unit 9 Shear Force and Bending Moment 1
- Unit 10 Shear Force and Bending Moment 2
- Unit 11 Stresses in Beams 1
- Unit 12 Stresses in Beams 2
- Unit 13 Stresses in Beams 3
- Unit 14 Analysis of Stresses and Strains 1
- Unit 15 Analysis of Stresses and Strains 2
- Unit 16 Analysis of Stresses and Strains 3

## **BST120 Medical Device Science**

- Unit 1 Evolution of Medical Devices through Technology
- Unit 2 Medical Device Industry in Ireland
- Unit 3 Types of Medical Devices
- Unit 4 General Requirements for Medical Devices
- Unit 5 Material Used In Medicine I: Metals and Ceramics
- Unit 6 Materials Used In Medicine II: Polymers and Composites
- Unit 7 Strengths of Devices
- Unit 8 Mechanical Failure of Medical Devices
- Unit 9 Cardiovascular Devices I
- Unit 10 Cardiovascular Devices II
- Unit 11 Cardiovascular Devices III
- Unit 12 Joint Replacement I
- Unit 13 Joint Replacement II
- Unit 14 Fracture Fixation I
- Unit 15 Fracture Fixation II
- Unit 16 Patents

## **Form & Function of the Human Body Syllabus**

### **BST117 Anatomy & Human Physiology**

- Unit 1 The Human Body
- Unit 2 The Integumentary System
- Unit 3 The Skeletal System
- Unit 4 The Muscular System
- Unit 5 The Nervous System
- Unit 6 The Endocrine System
- Unit 7 The Cardiovascular System
- Unit 8 The Haematological System
- Unit 9 The Lymphatic System
- Unit 10 The Respiratory System
- Unit 11 The Digestive System
- Unit 12 The Urinary System
- Unit 13 The Reproductive System
- Unit 14 Pregnancy
- Unit 15 The Senses
- Unit 16 The Brain

### **BST118 Biocompatibility & Device Design**

- Unit 1 Biomaterials and Medical Devices
- Unit 2 Classes of Biomaterials
- Unit 3 Tissue Engineering
- Unit 4 Device Design
- Unit 5 Biomaterials Processing
- Unit 6 Device Fabrication
- Unit 7 Device Characterisation - Surface Properties
- Unit 8 Device Characterisation – Bulk Properties
- Unit 9 Device Characterisation – In Vitro Studies / Biological
- Unit 10 Device Characterisation – In Vivo Studies
- Unit 11 Devices Degradation & Failure
- Unit 12 Inflammation
- Unit 13 Wound Healing
- Unit 14 Infection
- Unit 15 Future Directions
- Unit 16 Clinical Trials

## **BST126 Cell Biology**

- Unit 1 Anatomy of Cells I
- Unit 2 Anatomy of Cells II
- Unit 3 Physiology of Cells I
- Unit 4 Physiology of Cells II
- Unit 5 The Nucleus of the Cell
- Unit 6 Cell Growth
- Unit 7 Cell Death
- Unit 8 Cell Growth and Differentiation
- Unit 9 Tissues I
- Unit 10 Tissues II
- Unit 11 Cancer Cells
- Unit 12 Cell Culture I
- Unit 13 Cell Culture II
- Unit 14 Biocompatibility
- Unit 15 Biocompatibility: Cytotoxicity
- Unit 16 Biocompatibility: Genotoxicity

## **BST127 Immunology & Human Therapeutics**

- Unit 1 Basic Components of Immunity: Structure and Function
- Unit 2 Immunity to Infection
- Unit 3 Immunodeficiency
- Unit 4 Anaphylaxis and Allergy
- Unit 5 Autoimmunity
- Unit 6 Transplantation
- Unit 7 Neuroimmunology
- Unit 8 Immune Manipulation
- Unit 9 Immunisation and Infection
- Unit 10 Antibodies
- Unit 11 Monoclonal Antibodies in Medicine
- Unit 12 Antibodies to Cytokines
- Unit 13 Antibodies as Therapeutic Agents
- Unit 14 Other Immunotherapies

## **Lean & Quality Systems Syllabus**

### **BST113 Lean Thinking / Lean Tools**

- Unit 1: History and Application of Lean Thinking
- Unit 2: Value Stream Mapping
- Unit 3: Cellular Manufacturing
- Unit 4: Work Standardisation and Standard Work
- Unit 5: Just-In-Time Manufacturing and Kanbans
- Unit 6: Single Minute Exchange of Dies (SMED)
- Unit 7: Creating and Sustaining an Orderly Work Environment with 5S
- Unit 8: Kaizen
- Unit 9: Visual Management and the Visual Factory
- Unit 10: Overall Equipment Effectiveness (OEE)
- Unit 11: Total Preventative Maintenance (TPM)
- Unit 12: Jidoka, Poke Yoke and Quality
- Unit 13: Lean Supply Chains
- Unit 14: Lean Product Development and Quality Function Deployment
- Unit 15: Building a Lean Organisation
- Unit 16: Lean Systems: Case Systems

### **BST114 Quality Science- Six Sigma**

- Unit 1 History and Development of Quality Science
- Unit 2 Review of the Six Sigma Methodology
- Unit 3 The Statistical Summary
- Unit 4 Statistical Tests I
- Unit 5 Establishing Linear Relationships
- Unit 6 Multiple Regression
- Unit 7 Multiple Regression II
- Unit 8 Non-Parametric Tests
- Unit 9 Process Control Concepts
- Unit 10 Process Capability Indices
- Unit 11 Statistical Process Control
- Unit 12 Statistical Process Control for Variable Data
- Unit 13 Statistical Process Control for Attribute Data
- Unit 14 Short Run SPC
- Unit 15 Introduction to Design of Experiments I
- Unit 16 Introduction to Design of Experiments II

## **BST115 Problem Solving Tools & Techniques**

- Unit 1 Foundations of Six Sigma: Principles of Quality Management
- Unit 2 Principles of Six Sigma
- Unit 3 Projection Management
- Unit 4 Project Selection and Definition
- Unit 5 Process Measurement – Part I
- Unit 6 Process Measurement – Part II
- Unit 7 Process Analysis – Part I
- Unit 8 Process Analysis – Part II
- Unit 9 Process Improvement – Part I
- Unit 10 Process Improvement – Part II
- Unit 11 Process Control – Part I
- Unit 12 Process Control – Part II
- Unit 13 Design for Six Sigma: Concept and Design Development – Part 1
- Unit 14 Design for Six Sigma: Concept and Design Development – Part II
- Unit 15 Design for Six Sigma: Optimisation and Verification
- Unit 16 Design for Six Sigma Implementation

## **BST116 Enterprise Modelling & Simulation**

- Unit 1 Introduction to Enterprise Modelling
- Unit 2 Common Enterprise Modelling Tools and Techniques
- Unit 3 Product Modelling and the Product Development Process – Introducing the Role of CAD and CAM
- Unit 4 Introduction to Simulation
- Unit 5 Business Process Reengineering – An Overview
- Unit 6 Enterprise Modelling For Business Process Improvement
- Unit 7 Case Study: Business Modelling for Improvement in the Medical Industry
- Unit 8 Case Study: Business Modelling in the Pharmaceutical Industry
- Unit 9 Case Study: Modelling and Simulation in the Animal Feed Supply Industry
- Unit 10 Case Study: Modelling and Simulation of a Food Supply Chain
- Unit 11 Case Study: Enterprise Modelling Activity for Process Improvement at a Hospital
- Unit 12 Case Study: Business Process Improvement Activity at an Accountancy Firm
- Unit 13 Case Study: Business Process Modelling in a Manufacturing Company