

# Training services in the domain of Micro & Nano Systems

Denis Koltsov  
d.koltsov@lancaster.ac.uk

# Overview

- Setting the scene
- Trends and demands on Nanoeducation
- Lancaster University offering
- EU Networks offering

# Nano-Activity

- U.S. government alone invests about \$1.4 billion yearly, an increase of more than 10-fold since 1997.
- Analysts at Yole ([www.yole.fr](http://www.yole.fr)) estimate the global market for MEMS devices at \$5.26 billion in 2006, growing to \$9.86 billion by 2010
- The European Nanotechnology Trade Alliance (ENTA) counts more than 529 nanotechnology companies in Europe.
- The National Science Foundation in America estimates the global market for products containing nanotechnology to be \$1 trillion yearly by 2015
- With this rate of growth, how do we find enough qualified personnel?

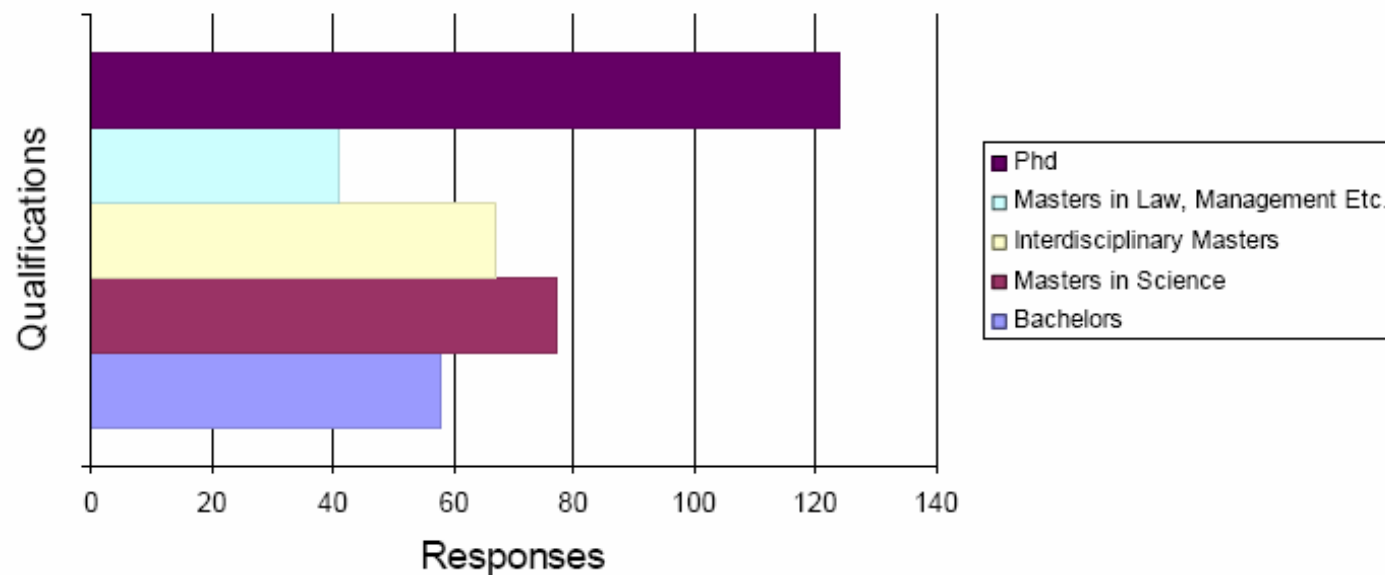
# Micro and Nano

- Particular features of MNT sector
  - Knowledge intensive
  - Interdisciplinary
  - Rapidly growing and changing
- Thus we require highly qualified personnel with a broad knowledge and in great numbers!

# Survey

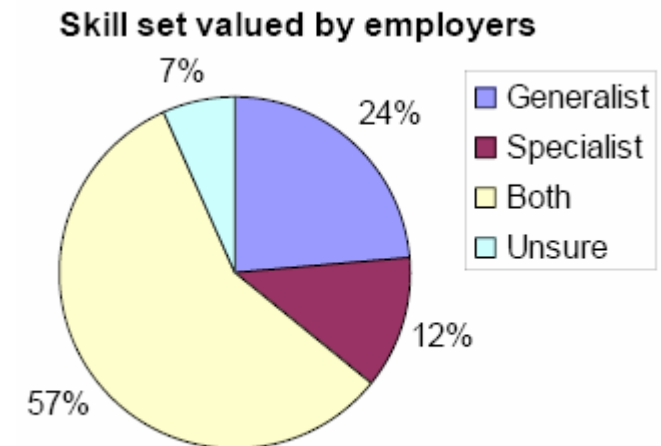
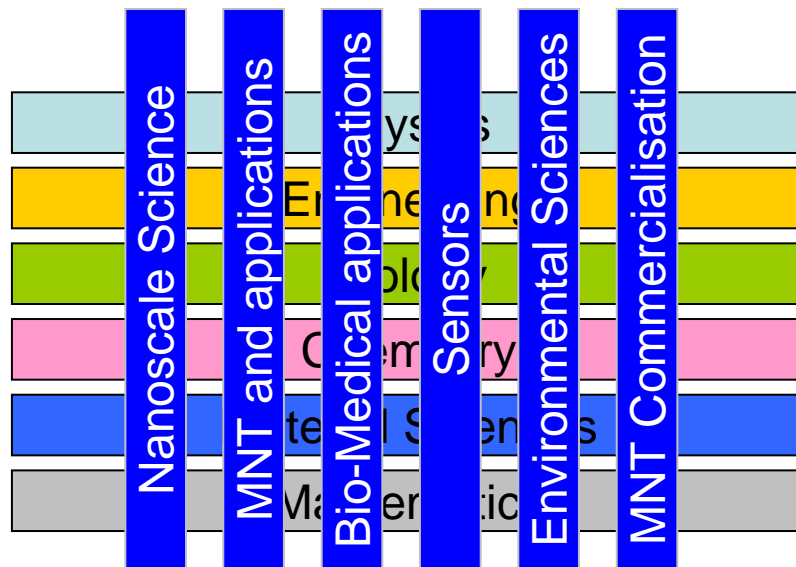
- IoN and Nanoforum conducted a survey to establish what training is needed by the MNT sector

Qualification preference in Industry



# Interdisciplinary

- Traditional teaching
- Interdisciplinary teaching

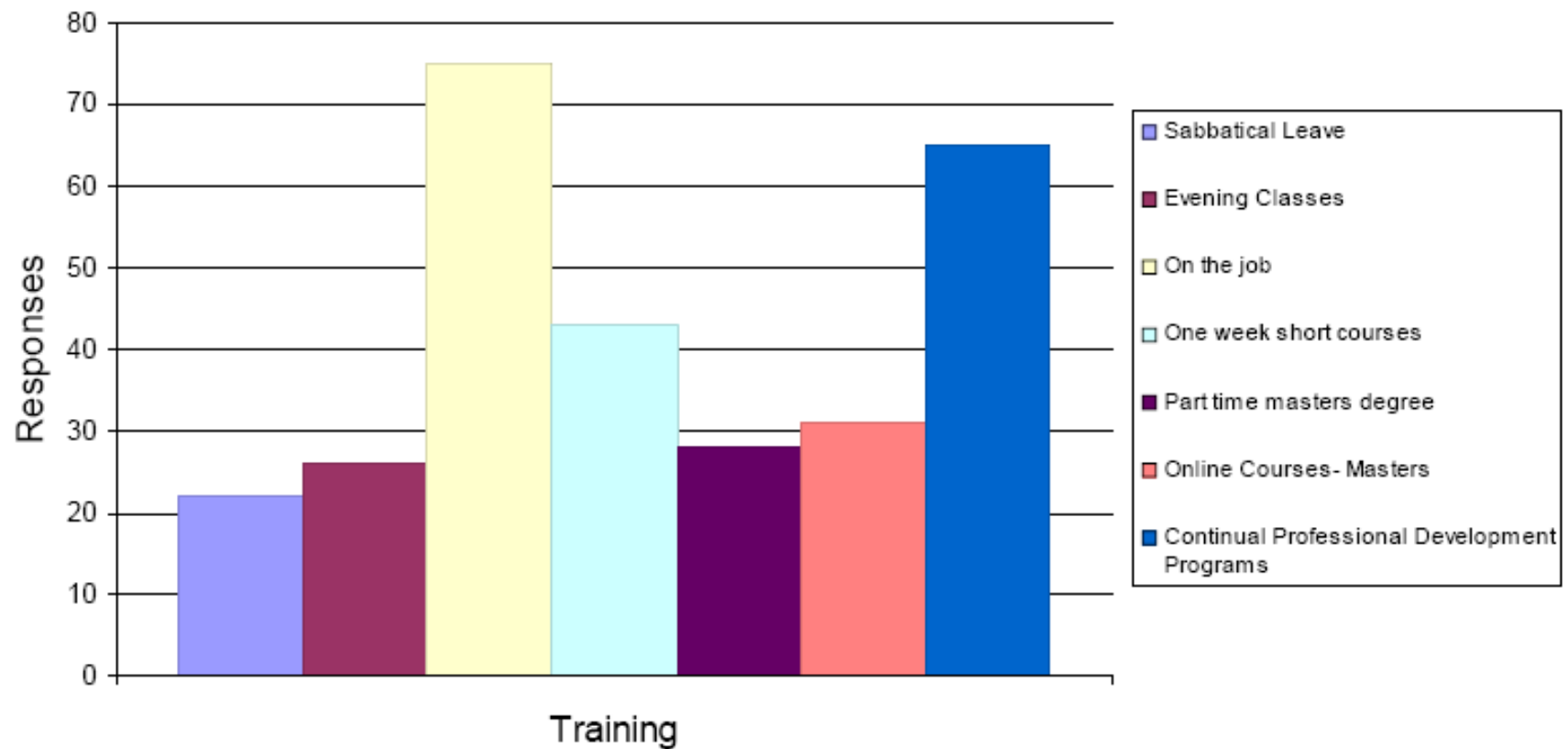


# Course Types

- NVQ, apprenticeships and foundation degrees (technician training)
- Undergraduate courses in MNT
- Masters programmes
- PhD Degrees (research based)
- CPD courses and on-the-job training

# Survey

## Preferred Training Method



# Lancaster University

- Undergraduate Course modules
- MSc in Micro and Nanotechnology – Engineering, Management and Society:
  - Modules:
    - Micro and Nanotechnology
    - Nanoscience and Nanomaterials
    - Design for manufacture and reliability testing
    - High-Tech Entrepreneurial Venture
    - Management Issues of the Technology-based Enterprise
    - The Ethical and Societal Dynamics of Nanotechnology
  - Features:
    - Each module is 1-2 weeks long
    - Course available as part-time or CPD
- MSc in Microelectronics and System-On-Chip
  - Modules:
    - Microsystem and System-on-Chip Technology
    - Advanced Computer-Aided Design and Test
    - Real Time Systems
    - Programming and Embedded Systems
    - Interfacing and Integration
- Short and custom-made Courses:
  - Micro and Nanotechnology for business



**MSc in**  
**Micro and Nanotechnology – Engineering, Management & Society**

Part-time modular industry-based course | Full-time course or

**Why this course?**  
Micro and Nanotechnology (MNT) could well be the next industrial revolution with radical changes in the way we setup, run and market our businesses. Novel and knowledge-based manufacturing has the potential to complement, if not replace, conventional manufacturing industries with their highly manufacturing processes. Development of a knowledge-based industry requires a highly educated workforce with key competences in the technical, management and societal dimensions of Micro and Nanotechnologies.

Although the spending on MNT will double in the next 2-3 years, there is still a profound skill shortage in the area. This means that not only will you have a top class degree, you will be highly sought after by employers in the UK and abroad.

**Who is it for?**  
Our Micro and Nanotechnology Masters course is a unique and timely opportunity for an engineering or sciences graduate to enter an interdisciplinary research or commercial R&D career in MNT. A good balance between technical, management and social science content makes this course directly applicable to entrepreneurs in existing, as well as new businesses in the MNT area. Existing technical personnel would find novel MNT technology topics essential for their professional development, especially since this course is organised in a modular structure that allows part time intensive learning.

**Course Outline**  
The course consists of 6 taught modules and a long project which will involve working in an academic or industrial environment in the area of MNT.

**Modules Offered:**  
Micro and Nanotechnology (Introduction to micro and nanotechnology, microfluidic electronics, MEMS, microfluidics and more)  
Nanoscience and Nanomaterials (Basis of solid state physics, material science, nanofabrication (top-down and bottom up) and nanoscience)  
Design for Manufacture and Reliability Testing (Introduction to design for manufacture, design testing and reliability assessment, issues with packaging, integration and manufacture)  
The High Technology Entrepreneurial Venture (Provides a broad view of the issues involved in starting up and running a business with a technological base)  
Management of the Technology Based Enterprise (Provides the framework for handling issues based on management of knowledge, people and resources)  
The Ethical and Societal Dynamics of Nanotechnology (Introduces a range of conceptual tools for thinking through the societal and ethical dynamics of MNT)

**Contact Information**  
Mrs. Evelyn Shaw  
Postgraduate Admissions Secretary  
Telephone: +44 (0) 1524 684668  
Fax: +44 (0) 1524 581707  
Email: [evelyn.shaw@lanc.ac.uk](mailto:evelyn.shaw@lanc.ac.uk)

Postal Address:  
Engineering Department  
Lancaster University  
Lancaster LA1 4YW  
UK

# Lancaster MNT Offering

- Lancaster is collaborating with SMEs to build a coherent teaching portfolio
- Lancaster is leading training and dissemination work package in INTEGRAM*plus* network
- Lancaster is running an outreach activity to MNT community through
  - Joint research projects
  - Student placements
  - Consulting
  - Events like this one
- Lancaster is involved in training work package in NoE PATENT DfMM

# STIMESI

Stimulation Action on MEMS and SiP



QinetiQ



- Activities:
  - Delivery of training courses (Main activity)
  - Course material development
  - Post-training homework support
  - Design kit update
  - Dissemination



MEMS Course at QinetiQ,  
Malvern, Nov 2006

# STIMESI

Stimulation Action on MEMS and SiP

## INTEGRAM*plus* MEMS Design and Prototyping Course

### Course Structure

- Day 1: Introduction to MEMS
- Day 2: Introduction to Design and INTEGRAM*plus* Services  
INTEGRAM*plus* Silicon MEMS Fabrication Services and Design Kits  
INTEGRAM*plus* Microfluidic Service  
Multi-domain and Multi-technology Integration
- Days 3-4: CAD tools for MEMS  
Introduction to Layout using L-Edit  
Practical layout and design rule exercises  
CoventorWare Training and Tutorials  
Accelerometer-based tutorial  
Freeform design session with trainer support

# INTEGRAM*plus*

- WP3 – responsible for training and dissemination
- Activity:
  - Converting the state of the art technology expertise of 10 partners into tutorials and courses
  - Organising courses
  - Custom made tutorials on INTEGRAM*plus* technology



# NoE PATENT DfMM

- Short Courses:
  - Micro and Nanotechnology for business
  - Modelling & Analysis of MEMS Packages
  - Thermal Issues in MEMS
  - Modelling Technology to support MEMS manufacture
- MSc Courses:
  - European Masters qualification in Design for Manufacturable Microsystems

# Scheduled Courses

- INTEGRAMplus MEMS Design and Prototyping Course (STIMESI 5-8 Nov 2007, Paris)
- Silicon / Polymer Microsystems for Life Sciences, CAS satellite event (INTEGRAMplus, 17 Oct 2007, Sinaia, Romania)
- Micro and Nanotechnology MSc course (Oct 2008, Lancaster University)
- Micro and Nanotechnology-Engineering, Business and Society (PATENT)



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# Thank you

## Contact

Denis K Koltsov

Centre for Microsystems Engineering

Engineering Department

Lancaster

LA1 4YR

Tel: +44 1524 594395

Fax: +44 1524 592 777

[d.koltsov@lancaster.ac.uk](mailto:d.koltsov@lancaster.ac.uk)

<http://www.engineering.lancs.ac.uk/microsystems/>