



Science Industry Partnership (SIP)

Modular Masters Qualification in Formulation Science and Technology

Proposal for Consultation

Science Industry Partnership

SIP Vision and Objectives

Vision: “a partnership of employers taking ownership of the skills needed to generate innovation and growth underpinning a world class UK science industry.”

Strategic Objectives:

- To have a pipeline of young people with the capability, drive and ambition to build a globally competitive science based industry in the UK
- To support the development of the existing workforce to acquire the skills it needs to adopt new technologies and innovate new products and services.

Science Industry Partnership - Background

- A major proposal for a new “**Science Industry Partnership**” (SIP) - led by GlaxoSmithKline (GSK) and co-ordinated by Cogent (Sector Skills Council),
- The Partnership is supported by a wide range of employers from e.g. pharma, biotech, consumer healthcare, chemicals, polymers and advanced materials.
- The proposed SIP (www.scienceindustrypartnership.com) will give employers leadership for skills for the science sectors and see a transformative approach to developing scientific talent by **directing public investment to key skills programmes**.
- The SIP is being **designed by employers for employers**, and businesses are now being invited to get involved now.
- The outline bid has been approved and a full bid will be submitted in October.
- SIP plans for **employer-designed skills programmes** from early 2014 to support innovation and growth.
- Cogent is working with employers before October to develop a SIP business plan so that they can get a say in what is developed and funded.

Science Industry Partnership: Formulation Strand

- The SIP will have a number of technical and industrial strands.
- Cogent has commissioned iFormulate Ltd to help develop the **strand for Formulation Science and Technology**.
- Formulation is a key capability for most of the industries engaged in the Partnership and employers have consistently been of the opinion that a **more co-ordinated and relevant approach** to skills in formulation is essential.
- Specifically, this is a consultation on a proposed **Modular Masters in Formulation Science and Technology**

Modular Masters in Formulation Science and Technology

- The Modular Masters will benefit companies of all sizes.
- Large companies may wish to integrate **training provision** from **within their own companies** with complementary provision from external providers.
- SMEs may benefit from access to **individual** Master's level **modules as and when required, and may be able to access some co-investment funding for this training.**
- Each module will be individually accredited, giving standalone value.
- Modules from different institutions in the programme can be completed over time if required, leading to a **postgraduate certificate, diploma or full Master's qualification.**
- To ensure that provision meets the needs of businesses, module content will be **driven by employers.**
- Programme to be guided by an employer-led **steering group**, which will approve the content of additional modules as these are developed, to ensure that **focus and quality** meets the needs of employers.

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1. Structure

- Fully flexible – several options depending on needs of student and employer
 - CPD: Attendance on individual modules as desired – no assessment
 - Postgraduate Certificate: 60 credits (assessed) from compulsory units
 - Postgraduate Diploma: 120 credits (assessed) from compulsory and optional units
 - Masters: 180 credits (assessed). Compulsory and optional units plus substantial research project (with dissertation).
- Typically 1 credit equates to around 1.5-2 hours “contact time” and 10 hours study time
- Modules can be selected from several providers
 - Location or delivery mode to suit need
 - Complementary content from different providers
 - Providers may be Universities/Colleges, Research/Professional Associations or private sector organisations. Accreditation to be put in place for modules provided by non-academic providers.

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2. Delivery

- Options for elements of distance learning, e-learning as well as traditional in-person (e.g. part-time day release) teaching.
- Formulation has a strong practical element, so each module will feature significant hands-on laboratory assignments as well as the underpinning theory.
- Students will also be expected to undertake a significant amount of study outside the formal teaching sessions.
- Individual employers will decide how much of an employee's total study time may be conducted in "company time" and how much in the employee's time.

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3. Providers

- Initial survey indicated at least 40 potential providers currently providing relevant content
- Mostly Universities providing taught courses as part of Masters level qualifications (assessed) or as CPD (not assessed) but also some private sector provision (CPD, not assessed).
- Potential providers are now being canvassed, so no final decisions but to keep the programme manageable likely to be 4-5 main providers plus a number of others with specialist expertise for individual modules.
- **Examples** of providers and relevant existing provision from initial survey:
 - University of Birmingham – Masters in Formulation Engineering / Advanced Chemical Engineering
 - University of Leeds – MSc in Chemical Engineering and Pharmaceutical Science and Engineering
 - University of Greenwich – MSc in Formulation Science
 - University of Manchester – Pharmaceutical Industrial Advanced Training (PIAT)
 - Glyndwr University – MSc in Formulation Science
 - Formumetrics Ltd – Spring School in Colloid Science (formerly run by University of Bristol)

4. Content for Formulation Masters: Compulsory Units

Compulsory Units (total 60 credits)	Credits	Content
Design Principles for Formulation and R&D Methodology	10	Design approaches. Factors to consider before experimentation. Information sources. Use of stakeholders, market data, performance criteria, regulatory constraints. DoE principles & practice and tools to assist DoE. Analysis of results -statistical and other methods. Use with data from HT experiments. Problem solving approaches (creative, rational).
Colloid Chemistry and Rheology	20	Colloid Science. Theory of colloidal stabilisation & destabilisation. DLVO. Surfaces & interfaces. Contact angle & wetting. Zeta potential. Emulsions. Surfactants & how to choose them. Liquid/liquid and gas/liquid systems. Complex emulsions. Processing methods. Measurement, stabilisation. Ingredients. Applications in real systems. Particles, dispersions & suspensions. Equipment used in lab and plant. Rheological control and measurement. Rheological behaviours- relate to microstructure and dynamics of system.
Characterisation for Formulation	10	Particle and Surface Characterisation. How & why to measure particles & surfaces. Principles of particle characterisation methods. Microscopy. Application to real formulations
Practical Liquid and Semi-solid Formulation Fundamentals	5	Practical assignment to produce a liquid or semi-solid formulation and adapt according to requirements
Practical Solid Formulation Fundamentals	5	Practical assignment to produce a liquid or semi-solid formulation and adapt according to requirements
Delivery Fundamentals	5	Approaches to manipulating delivery of ingredients via formulation design. Examples from different industries, e.g. encapsulation
Processing Principles for Formulation	5	Approaches to choosing processing technology for formulations. Basics of main unit operations for wet and dry formulations.

4. Content for Formulation Masters: Optional Units (1)

Optional (select to total 60 credits)	Credits	
Automation in Formulation Design	5	Overview of High Throughput & automated laboratory methods. Principles, operation
Drying Formulations	5	Drying techniques/principles. Scale up relationships. Product properties.
Powders in Formulations	5	Making, mixing & handling solid powders. Properties of derived products. Powder properties and measurement.
Granulation for Formulation	5	Granulation methods Materials properties, how to influence & measure - relationship to microstructure.
Compaction and Tableting	5	Desired properties, how to manipulate. How to make. Stability prediction & measurement
Encapsulation and Delivery	5	Micro & nanoencapsulation methods. Uses & properties. Controlled release & delivery technologies across industries
Processing Liquids and Semi-Solids	5	Choice of equipment for mixing, emulsification. Handling high viscosity in processing, pumping
Advanced Dispersions and Suspensions	5	Particle production for dispersions and suspensions. Nanoparticles. Bottom up and top down mechanisms. Stabilisation mechanisms. Ingredients for dispersion stabilisation and rheology modification
Modelling and Simulation Methods for Formulation	5	Molecular and materials modelling. Modelling surfaces, interfaces, particles and crystals. Mesoscale and multiscale modelling. Choice of appropriate methods and packages
Crystalline solids in formulations	5	Crystallisation - use in formulation for particle formation. Control of solid state and impact on formulations. Crystal polymorphs & stability. Amorphous solid forms.
Quality Systems for Formulation	5	QS/ QA/ ISO/ GLP/GMP. QBD & sustainable design principles

4. Content for Formulation Masters: Optional Units (2)

Optional (select to total 60 credits)	Credits	
Process Control and In Process Measurement	10	Strategy for controlling formulation processes. Principles of control mechanisms. Use of in-process measurement. What properties can be measured and how can they be used
Sustainable & Resource Efficient Formulation	10	Definitions of sustainability. Strategy for sustainability in formulated products. Impact of raw materials, production process, transport, use, disposal/recycle on e.g. CO ₂ , water use. LCA tools. Alternative sources for raw materials for formulations
Non-Aqueous Formulations	10	Non-aqueous colloids and rheology. Dispersion stabilisation mechanisms in non-aqueous systems. Practical case studies from e.g. coatings, lubricants
Advanced Cosmetic Formulation	10	Marketing claims and regulatory requirements on formulator. Legislation, EU, USA, World. Claims substantiation. Ingredients and functions for cosmetics. Microbiology of formulations. Main product formats for cosmetics and personal care in e.g. hair, skin, oral care
Advanced Pharmaceutical Formulation and Drug Delivery	10	Regulatory requirements of formulation and drug development. Legislation EU USA World. Development process and pre-formulation. Clinical trials. Product formats for pharma - how and when used. Formulation challenges - e.g. biologics, low solubility APIs. New approaches e.g. co-crystals. Drug delivery technologies

4. Content for Formulation Masters: Optional Units (3)

Optional (select to total 60 credits)	Credits	
Advanced Coatings Formulation	10	Applications and market requirements drive performance of products. Regulatory requirements e.g low VOC, antifouling. Formulation types by application, ingredients and functions. Binder chemistries. Stabilisation mechanisms for coatings. Industry measurement methods for colour, gloss etc
Advanced Ink Formulation	10	Applications and market requirements drive performance of products. Regulatory requirements. Formulation types by application (e.g. conventional printing, ink-jet etc) ingredients and functions. Stabilisation mechanisms for inks. Industry measurement methods.
Advanced Food Formulation	10	Demands of market on food processing. Sensorial properties (mouth feel, rheology, sateity, flavour, fragrance) and how these are related to food microstructure. How to generate desired microstructure via processing (with or without heat). Regulatory demands and how they impact on food. Allowable ingredients and their function. Measurement methods and relation to sensorial properties. Food microbiology.
Functional Ingredients for Formulation	10	Ingredients and their function in formulations. Chemistry and how this determines functional properties of ingredients and derived properties. Ingredients to provide function: Dispersion, rheology modification, binding, colour, antimicrobial, solubilisation, adhesion, etc.
Industry of Company Specific Topic (could be delivered in house)	10	Content produced and delivered by company, trade association. Would be accredited by Univ as suitable for modular masters and OK'd by SIP steering team

4. Content for Formulation Masters: Project and Summer School

Activity	Credits	
Summer School	0	<p>Revision lectures and lectures/seminars/updates on special or novel topics. Speakers from industry and academia. 2-3 days long. Opportunity to include non-technical skills. Not assessed and credits not awarded so is an optional element. Option to include non-technical skills element here.</p> <p>Major benefit is networking with peers and with experts. Learning from other sectors. Could be hosted by a company and include lab/plant tours.</p>
Research Project	60	<p>Industrially relevant practical research project conducted in industry or academic institution with joint academic and industrial supervisors. Topic is nominated and defined by the student with the support of employer and academic.</p> <p>Equates to around 3 months practical work, plus additional literature, reading, planning, writing up.</p>

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5. Assessment

- Will include a combination of usual modes of formal assessment used in Masters qualifications, e.g.
 - Short answer examinations
 - Longer answer examinations
 - Assessed group presentations
 - Assessed reports on practical assignments
 - Long project dissertation

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6. Accreditation and Governance

- Modules to be accredited by one or more academic institutions
- Awarding institutions to mutually recognise accredited modules
 - Need to set up co-operation for this to happen, there are precedents
- Mechanism to accredit modules from non-academic providers
 - Potentially this could include private-sector providers, research associations, professional bodies as well as in-house provision
- Governance via board of employers, academics and professional bodies
 - Quality control, review success of programme, approve changes and improvements over time
- Co-operation with professional bodies to ensure option is available to recognise the Modular Masters as an element of e.g. Chartered status, CPD recognition.
 - RSC, IChemE, SCS
 - APS: Opportunity to integrate with and complement new APS Modular Masters activity in Pharmaceutical Science

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7. Costs

- Costs to employers not yet determined
- Expect fees to be of a similar order to those of comparable Masters qualifications
- Examples of current listed fees:
 - University of Leeds – One year full-time MSc in Pharmaceutical Science and Engineering: £10,000 (UK/EU)
 - University of Birmingham – One year full-time MSc in Advanced Chemical Engineering: £5130 (UK/EU)
 - Glyndwr University – One year full-time MSc in Formulation Science: £3195
 - University of Greenwich – One year full-time MSc in Formulation Science: £7000 (UK/EU)
- Fees may depend on proportion of distance learning, practical laboratory work, assessment and amount of in-company provision.
- SIP public funding is not used to subsidise attendance, but will be used to develop infrastructure of the programme, e.g. accreditation, new e-learning and distance learning modes, new modules and material.
- Intent is for modules to be open to all – not a closed shop.

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Next Steps (September)

- Incorporate further feedback from companies
- Identify gaps in content which will need to be filled
 - Initial survey indicates modelling, DoE, high-throughput experimentation are possible gaps
- Identify and consult with identified lead providers
 - Identify and outline plan to address any critical factors, e.g. accreditation assessment
- Letters of support from companies – non-binding
- Complete plan for October bid document
 - Include market data (numbers)
- If October bid is successful, expect SIP to start in earnest in early 2014 with first programme delivery in early 2015
- Detailed planning and programme implementation from early 2014

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Questions and Comments?

Contacts

If you're interested in learning more about the **formulation strand** of the Science Industry Partnership then please contact Jim Bullock or David Calvert at iFormulate:

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