What Could a Formulation Curriculum Look Like?

Jim Bullock
iFormulate Ltd
March 2013

www.iformulate.biz
info@iformulate.biz

Dr Jim Bullock
E: jim@iformulate.biz
M: +44 (0)7450 436515

Dr David Calvert
E: david@iformulate.biz
M: +44 (0)7860 519582

iFormulate

Formulation Curriculum: Background

- Cogent plans an “Industrial Partnership” to develop skills in the science-based industries
- As a starting point for company engagement iFormulate was asked by Cogent to provide an outline draft curriculum covering Formulation Science and Technology
- This curriculum will be developed further in the Industrial Partnership proposal
- Today is the first opportunity to gain industry feedback
  - Initial draft based on prior knowledge of the area, published information and the Gold Standard consultation
- It’s not set in stone and is by no means perfect! So today is a chance for industry to shape the curriculum
  - What’s good and what’s not so good?
  - What should be added and what could be left out?
  - Have some job functions been neglected?
  - Are there innovative ways of delivering?
  - What about training providers?

iFormulate

Existing Relevant Training and Qualifications

- ☺ There is already a significant body of existing training provision in formulation
- ☺ Often of good quality, long-established and used by industry
- 😐 Sometimes very sector specific (pharma, cosmetics…)
- ☹ Usually not fitting within a structured framework
- ☹ Companies report gaps in provision
- ☹ Sometimes difficult to judge level and suitability
  - e.g. vocational training targeted at chemical using industry but formulation elements are not easily recognisable as such
- ☹ Difficult for companies to plan a pathway for development of individuals
  - e.g. plethora of short courses at professional level – overlap / not co-ordinated
- ☹ Accreditation is patchy
  - Some companies need it, some don't

Image: bplanet at freedigitalphotos.net

iFormulate

Examples of existing training and qualifications: Vocational level

Vocational Qualifications

- City & Guilds Certificate in Process Technology Level 2 – University of Teeside
- Level 2 Diploma in Process Technology Chemical Process - Grimsby Institute
- Level 3 Diploma in Process Technology (City and Guilds) – Hull College
- Level 3 Diploma in Operations and Technical Support in the Process Industries
- Applied Chemistry BTEC Level 3 Subsidiary Diploma – Halesowen College
- BTEC Level 4 HNC Diploma in Applied Chemistry – South Cheshire College
- BTEC HND/HNC in Applied Chemistry – West Cheshire College
- BTEC Higher National Certificate Applied Chemistry - Wirral Metropolitan College
- Higher National Certificate/Diploma Applied Science (Chemistry) (L5) – Liverpool Community College
- Foundation Degree in Pharmaceutical and Chemical Sciences – FdSc – Kingston University
- Foundation Degree in Pharmaceutical and Chemical Sciences – South Thames College

Examples of existing training and qualifications: Graduate level and above

Graduate and Postgraduate Qualifications

- Diploma in Cosmetic Science by Distance Learning – Society of Cosmetic Scientists
- Pharmaceutical and Cosmetic Science BSc – De Montfort University
- M.Sc. in Formulation Science – University of Greenwich
- MChem - Chemistry for Medicines Development – University of Bradford
- MSc Pharmaceutical and BioPharmaceutical Formulations – University of Sunderland
- MSc Pharmaceutical and Analytical Science – University of Huddersfield
- MSc Cosmetic Science – London School of Fashion
- Advanced Chemical Engineering Masters – University of Birmingham
- Eng. D. In Formulation Engineering – University of Birmingham

Training Courses

- Principles of Colloid Science – Formumetrics / Bristol
- eLearning in Formulation Technology – Formumetrics / Bristol
- Fundamentals of Formulation Science and Technology – Leeds
- Chemical Engineering for Scientists – IChemE
- Fundamentals of Process Safety – IChemE
- Particle Technology - IChemE
- Formulating with Surfactants – BACS
- Rheology - BACS
- Granulation Course – University of Sheffield
- Non Aqueous Colloids – University of Leeds
- Particle and Powder Characterisation – University of Leeds
- Rheology of Suspensions/Dispersions – University of Leeds
- Formulation for poorly soluble APIs - Pharmaterials
- Professional Paint Formulation - PRA

iFormulate

The Scope: How Did We Define Formulation?

What is Formulation?

- Design and manufacture of complex formulated product.
- Formulated products are characterised by multiple functional (chemical) ingredients, a complex product microstructure, multiple application properties and defined physical processing steps in manufacture.

What are the Relevant Industries?

- Pharmaceuticals, personal care, cleaners and detergents (industrial and consumer), coatings & adhesives, processed food, agrochemicals, process additives (water, paper, oil, lubricants etc), lubricants etc.

What are the Main Relevant Scientific and Technological Disciplines and Themes?

- Colloid science, physical chemistry, chemical engineering, physical characterisation, rheology, materials science, sustainable chemistry
- Mixing, milling, dispersion, emulsification, granulating, tableting, drying, separation, crystallisation, product stabilisation, process control

Image: mrpuen at freedigitalphotos.net

iFormulate

From Job Roles to Programme Content

iFormulate

What Job Roles Did We Consider?

Senior/General Management		
Functional Management		
Formulation Scientist R&D	★	GS
Senior Formulation Technician	★	GS
Process Technician Formulation	★	GS
Process Operative and Supervisor		
QA, Technical Service, other Technical		
General Staff - non Technical		

iFormulate

Overview of Envisaged Programmes

Ref.	Programme	Level
A1 – A3	Formulation Awareness	General
I1-I9	Introduction to Formulation	Vocational
L1-L15	Laboratory Formulation	Vocational
M1-M15	Formulation Manufacturing	Vocational
Q1-Q3	Formulation Quickstart	Graduate and above
S1-S21	Formulation Science and Technology	Graduate and above
F1-Fn	Advanced Formulation	Graduate and above

- Outlines have been drawn up for each of these programmes – will show some examples shortly
- Each programme is modular – can select modules or all of them
- These programmes can be **connected** to provide **development pathways** – on following slides

iFormulate

Typical Pathway: Process Operative and Supervisor

(A1 – A3	*Formulation Awareness)*
I1-I9	Introduction to Formulation

Career Progression Options:
Select Modules from:

(M1-M15	Formulation Manufacturing)
(L1-L15	Laboratory Formulation)

Programmes could form part of vocational qualifications such as Intermediate, Advanced and Higher Level Apprenticeships

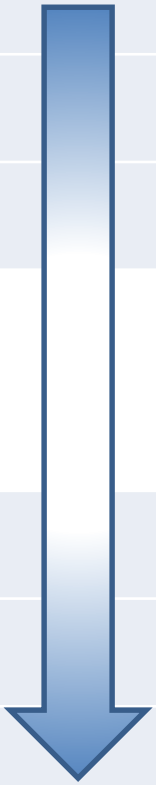
iFormulate

Typical Pathway: Senior Formulation Technician

(A1 – A3	*Formulation Awareness)*
I1-I9	Introduction to Formulation
L1-L15	Laboratory Formulation

Career Progression Options:
Full programme or modules from:

M1-M15	Formulation Manufacturing
Q1-Q3	Formulation Quickstart
S1-S21	Formulation Science and Technology



Programmes could form part of vocational qualifications such as Intermediate, Advanced and Higher Level Apprenticeships leading on to HNC/HND or foundation degree.

Could form part of academic qualifications e.g. BSc, M.Chem, MSc.

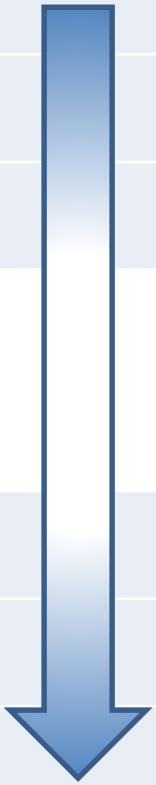
iFormulate

Typical Pathway: Process Technician Formulation

(A1 – A3	*Formulation Awareness)*
I1-I9	Introduction to Formulation
M1-M15	Formulation Manufacturing

Career Progression Options:
Full programme or modules from:

L1-L15	Laboratory Formulation
Q1-Q3	Formulation Quickstart
S1-S21	Formulation Science and Technology



Programmes could form part of vocational qualifications such as Intermediate, Advanced and Higher Level Apprenticeships leading on to HNC/HND or foundation degree.

Could form part of academic qualifications e.g. BSc, M.Chem, MSc.

iFormulate

Typical Pathway: Formulation Scientist R&D

(A1 – A3	*Formulation Awareness)*
Q1-Q3	Formulation Quickstart
S1-S21	Formulation Science and Technology

Career Progression Options:
Modules from:

F1-Fn	Advanced Formulation

Could form part of academic qualifications e.g. BSc, M.Chem, MSc.

iFormulate

Overview of Envisaged Programmes

Ref.	Programme	Level
A1 – A3	Formulation Awareness	General
I1-I9	Introduction to Formulation	Vocational
L1-L15	Laboratory Formulation	Vocational
M1-M15	Formulation Manufacturing	Vocational
Q1-Q3	Formulation Quickstart	Graduate and above
S1-S21	Formulation Science and Technology	Graduate and above
F1-Fn	Advanced Formulation	Graduate and above

- Outlines have been drawn up for each of these programmes
- Selected examples follow – others available to look at if there are questions
- Modular – potential for companies to customise some modules with industry or company specific material.

iFormulate

Formulation Awareness A1-A3

Ref	A1	A2	A3
Module Title	**The Business of Formulation**	**Designing Formulations**	**Making Formulations**
Target Population	**General, Managerial, Non Technical, Non Specialist, Manufacturing Staff**		
Description	Industries, products and markets How formulation adds value Market drivers, trends and challenges Regulations Sustainability and formulation Formulation supply chain	Why do formulations need to be designed? New & improved products. Types of common formulation. What does the formulator need to consider? Approaches to formulation design.	The path from lab to plant. Scale-up. How are formulations made? Materials handling. Measurement and control. Safety. Quality systems, Lean Manufacturing, Resource Efficiency
Learning Aims	Gain basic understanding of: (1) businesses that formulate, opportunities and challenges (2) how and why formulations are designed in the lab, (3) how formulations are manufactured		
Assessment	Self assessment questionnaire, multiple choice. No formal qualification planned.		
Delivery Location	Classroom. Webinar, Online. Lab		
Pre-Requisites	None		
Comment	Opportunities for case studies, breakout groups / role playing / business game Potential to deliver as series of short online modules or in-person Chance to get a hands on feel and design a very simple formulation in lab or to view (and use?) pilot and full scale equipment.		
Duration	**1 day**	**0.5 days**	**0.5 days**

Learner Groups	A1	A2	A3
Senior/General Management			
Functional Management			
Formulation Scientist R&D			
Senior Formulation Technician			
Process Technician Formulation			
Process Operative and Supervisor			
QA, Tech Service, other Technical			
General Staff - non Technical			

iFormulate

Introduction to Formulation I1-I9

Ref	I1	I2	I3	I4	I5	I6	I7	I8	I9
Module Title	Ingredients and their functions	Types of Formulations	Formulation Design	Measuring Formulations	Application Testing*	Wet Processing	Dry Processing	Control Systems	Quality Systems
Target Population	**Entry level technicians. Technical but non-specialist staff. Manufacturing staff.**								
Description	Ingredients: use, origin, functions, properties, chemical safety. Main types of formulated product. Intended use leads to the choice of product form. Main features & properties of product formats. Combining ingredients to create ormulation to meet needs. Lab equipment used to make & measure. Tests of formulation & application properties. Measurement & characterisation techniques used. Common generic & industry-specific application tests - related to characterisation methods and formulation design parameters. Introduction to pilot and manufacturing scale operations. Issues with materials handling and processability? Scale up factors. GMP, GLP, ISO xyz, Lean Manufacturing, Resource Efficiency								
Learning Aims	Gain basic grounding in ingredients for formulation, formulation types and product forms. Gain practical experience of basic formulation design, characterisation methods, common industry application tests, processing equipment, production considerations and constraints.								
Assessment	Assessment as existing vocational / apprentice schemes. Would ideally form part of recognised vocational qualification								
Delivery Location	Classroom. Webinar, Online, Lab, Pilot plant, Plant								
Pre-Requisites	Chemistry / Physical Science (basic vocational level or GCSE?)								
Comment	Foundation modules intended for entry level technical and manufacturing staff with modest amount of existing scientific qualification. Potentially part of an apprentice level qualification . Focus on hands-on practicalities rather than theory. Lots of lab experience and demos . Potential for variants for specific industries, e.g. pharma, cosmetics, coatings etc.								
Duration	1 day	1 day	1.5 days	1.5 days	1 day	1 day	1 day	1 day	1 day

Learner Groups		**I1**	**I2**	**I3**	**I4**	**I5**	**I6**	**I7**	**I8**	**I9**
Senior/General Management										
Functional Management										
Formulation Scientist R&D										
Senior Formulation Technician										
Process Technician Formulation										
Process Operative and Supervisor										
QA, Tech Service, other Technical										
General Staff - non Technical										

iFormulate

Formulation Quickstart Q1-Q3

Ref	Q1	Q2	Q3
Module Title	Colloids, Emulsions, Dispersions	Formulation Processing	Formulation Measurement
Target Population	New graduate or higher scientists in R&D or process development. Also as refresher		
Description	Making & stabilising colloids. Theory & practice. Steric and electrostatic stabilisation. Making and stabilising emulsions and dispersions, gels, foams etc. Ingredients and their use. Processing principles and equipment for the common “wet” and “dry” formulation types. Theory and use of characterisation and measurement techniques such as particle sizing, rheology, microscopy. Online measurement methods. High throughput technology for formulation development.		
Learning Aims	Enable graduate level scientists and engineers in R&D, manufacturing or other areas to get up to speed with most important elements of formulation science and technology to enable them to start leading technical teams, activities and projects. The programme covers relevant scientific theory as well as providing practical advice and case studies		
Assessment	Self assessment questionnaire with follow-up. Formal assessment if Masters qualification is to be followed.		
Delivery Location	Classroom and lab demo		
Pre-Requisites	First degree in relevant physical or life sciences . Or equivalent vocational (L or M modules) + relevant experience		
Comment	Introduction to formulation for new graduate or for more experienced scientists / engineers who are not formulation specialists		
Duration	1 day	1 day	1 day

Learner Groups	Q1	Q2	Q3
Senior/General Management			
Functional Management			
Formulation Scientist R&D			
Senior Formulation Technician			
Process Technician Formulation			
Process Operative and Supervisor			
QA, Tech Service, other Technical			
General Staff - non Technical			

iFormulate

Development Process

- The Industrial Partnership provides employers with the opportunity to shape formulation training in line with demand
- The IP will identify formulation courses that are available and can form part of workforce development
- Within the IP there is provision, with employer support, to develop workforce development courses
- The IP will identify formulation courses that are available and can form modules within a Masters programme
- Where gaps are identified there is the opportunity to work with HEFCE to develop new modules as part of a Masters programme
- These Masters modules would be available as stand-alone courses

Image: sheelamohan at freedigitalphotos.net

iFormulate

Delivery Modes?

- Not considered in detail so far in draft curriculum
- However the proposed Industrial Partnership would allow novel delivery modes to be developed
- e.g. e-learning modules, webinar delivery, practicals, project work, mentoring at senior levels
- Opportunity also to build in follow-up to ensure learning is embedded
  - Link learning to business and R&D activities and projects
  - Avoid the “go on a training course and forget it” mentality!
- Can be developed as Industrial Partnership progresses

Image: David Castillo Dominici at freedigitalphotos.net

iFormulate

Next Steps

- Companies engaged in and leading the Industrial Partnership have opportunity to shape the curriculum
  - That process starts here
  - Make it relevant and beneficial for your industry, company, employees
- Providers of skills and training can also get involved
  - Opportunity to align your offer to formulation curriculum as it develops
  - Opportunity to devise innovative content and delivery modes
  - Opportunity for accreditation
- Employees can contribute by identifying needs, gaps and opportunities via employers, providers and professional bodies

Image: Sira Anamwong at freedigitalphotos.net

iFormulate

Questions for the Workshop Today

- How could the list of **job roles** be made more comprehensive or relevant?
- What additional **career pathways** could be considered?
- How could the list of **programmes** be improved?
- How comprehensive are the **individual modules** in the draft curriculum?
- How well does the draft curriculum reflect actual (or desired) **company or industry practice?**

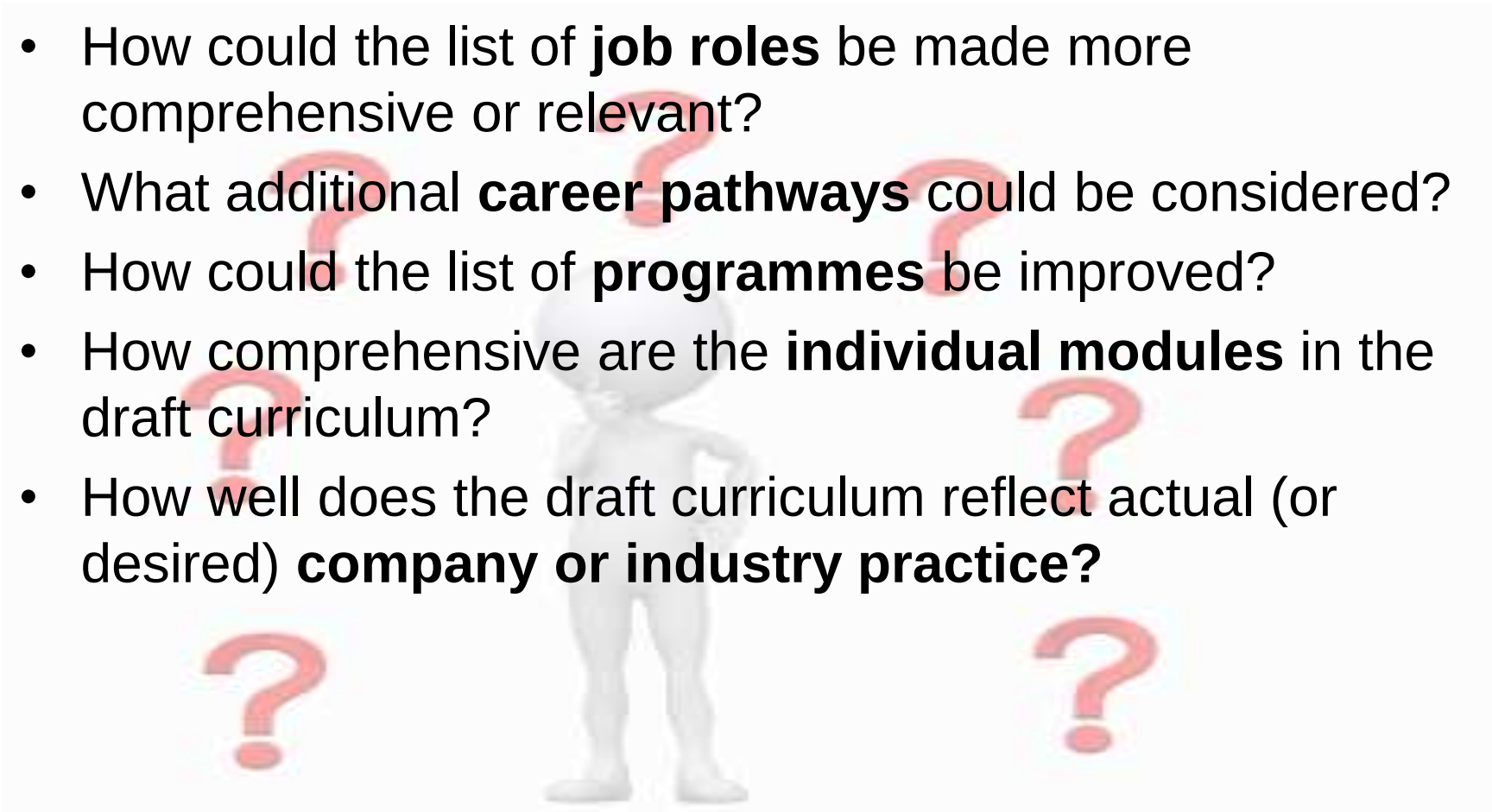


Image: David Castillo Dominici at freedigitalphotos.net

iFormulate

Thank You

…and an opportunity to mention some training happening already...

Forthcoming Courses from iFormulate

Solid State Stability of Formulations: *The Underlying Science and New Approaches For Rapid Determination*

- One-Day Training Course, UK - Nottingham/East Midlands – May 8th 2013

iFormulate*4Nano*: Formulating Nanoparticles

- One-Day Training Course, UK- Manchester – June 18th - in collaboration with the NanoFormulation2013 Conference

- **See www.iformulate.biz or e-mail info@iformulate.biz for details.**

www.iformulate.biz
info@iformulate.biz

Dr Jim Bullock
E: jim@iformulate.biz
M: +44 (0)7450 436515

Dr David Calvert
E: david@iformulate.biz
M: +44 (0)7860 519582

iFormulate

Appendix

Further Programmes not detailed in main presentation

iFormulate

Laboratory Formulation L1-L15

Ref	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15
Module Title	Colloids and Stabilis-ation	Emulsions Practicals	Practical Dispersions & Suspens-ions	Practical Rheo-logical Control	Pract-ical Drying	Practical Solids Process-ing	Particle size measure-ment for Formula-tion	Other Measure-ment Methods	Testing Application Properties	Design Analysis and Document-ation of Experiments	Laboratory Automation	Regulations Basics	Working Safely	Quality Systems	Project Assignment
Target Population	Mid-senior level technicians and other technical staff. Potential refresher for graduate staff														
Description	Colloids, emulsions, suspensions and dispersions. Ingredients - how to choose and use. Basic theory of colloidal stabilisation. How to measure e.g. zeta potential. Making and measuring emulsions and dispersions. Use of laboratory processing and measurement equipment. Wet milling, high shear mixing. Types of rheological behaviour and use in understanding your system. Rheology modifiers and how to use them. Gels and semi-solids - how to make them Drying, granulation and tableting technologies. Particle size and shape measurement. Practical use of equipment. Pros and cons, why use, when to use, when not to use. Optical, AFM and electron microscopy. DoE methodology - practical use of DoE software. Statistics, statistical analysis of results. Other analysis algorithms. Principles and use of software. Problem solving methodologies. Laboratory note-keeping, electronic notebooks. Types of lab automation available. Use of robotics to make and analyse formulations. Basic introduction to relevant regulations in the formulation industries. May wish to focus in on industries of interest: e.g. EU cosmetics directive, plant protection directive, REACH etc. ISO Quality standards for R&D labs. GMP/GLP. How they work and how to comply in laboratory setting. Project related to current or future activities in laboratory inside company. Could encompass practicalities of optimising or creating a formulation, implementing new equipment or measurement methods, evaluating or adapting software, laboratory efficiency, new working methods, introduction of quality systems etc														
Learning Aims	To provide laboratory technicians in an R&D environment with practical skills and background understanding to operate at a high level.														
Assessment	Assessment to follow existing vocational / HL apprentice schemes. Would ideally form part of a recognised vocational qualification														
Delivery Location	Laboratory and classroom. Some online / webinar elements possible.														
Pre-Requisites	I Programme or equivalent														
Comment	These modules are about developing high quality expertise in formulation technicians. They concentrate on practical and lab aspects. Basic theory only is covered and the modules are not overly mathematical. They would form part of a higher level apprenticeship or equivalent vocational qualification.														
Duration	0.5 day	1 day	1 day	1 day	1 day	2 days	2 days	1 day	1 day	1 day	0.5 days	0.5 days	1 day	1 day	10 days

Learner Groups	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15
Senior/General Management															
Functional Management															
Formulation Scientist R&D															
Senior Formulation Technician															
Process Technician Formulation															
Process Operative and Supervisor															
QA, Tech Service, other Technical															
General Staff - non Technical															

Formulation Manufacturing M1-M15

Ref	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15
Module Title	Principles of Formulation Manu-facturing	Mixing liquids	Making particles	Wet milling and dispersion	Drying Formul-ations	Mixing Powders and Solids	Granulat-ion and Tableting	Separation for Formulat-ion	Process Control	Measure-ment and Analysis	Safe Formulat-ion Manufact-uring	Regulations	Quality Systems	Sustainable and Resource Efficient Formulation Manufact-uring	Project Assignment
Target Population	Mid-senior level technicians and other technical staff. Potential refresher for graduate staff														
Description	How do we choose how to make a product,. How are processes designed? Scale up - why is it important? Overview of unit operations used in formulation. Overview of purposes of QC/QA. Handling, packaging and logistics. Lean Manufacturing, Resource Efficiency, Sustainability principles and practice. Processing and handling liquids. Rheological behaviour. Processing equipment and key features. Precipitation and crystallisation from liquids. Wet milling practicalities, mills, media. Wetting of powders and dispersion. High speed/shear dispersion. Operation of production equipment. Different drying techniques principles of operation of dryers. What kind of equipment can be used to mix and blend solids. Principles of operation. Handling solids and powders in production environment, Dust control. Why do we granulate solids? What methods and equipment can be used, principles of operation. Downstream processing such as compression and tableting. Separation by crystallisation, filtration, and membrane processing Practical use of equipment. Principles of process control and instrumentation. How and why? Safety, regulatory overview, QS/QA/GMP/GLP/ISO. Practical project top cover real industrial challenge in manufacturing (QS introduction/compliance, new systems, cost savings, greener processing etc).														
Learning Aims	To provide process manufacturing technicians with practical skills and background understanding to operate at a high level.														
Assessment	Assessment to follow existing vocational / HL apprentice schemes. Would ideally form part of a recognised vocational qualification														
Delivery Location	Laboratory, pilot plant and classroom. Some online / webinar elements possible.														
Pre-Requisites	I Programme or equivalent														
Comment	These modules are about developing high quality expertise in formulation manufacturing technicians. They concentrate on practical and lab aspects. Basic theory only is covered and the modules are not overly mathematical. They would form part of a higher level apprenticeship or equivalent vocational qualification.														
Duration	1 day	1 day	1 day	1 day	1 day	1 day	1 day	1 day	1 day	1 day	1 day	0.5 days	1 day	0.5 days	10 days

Learner Groups	**M1**	**M2**	**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**M10**	**M11**	**M12**	**M13**	**M14**	**M15**
Senior/General Management															
Functional Management															
Formulation Scientist R&D															
Senior Formulation Technician															
Process Technician Formulation															
Process Operative and Supervisor															
QA, Tech Service, other Technical															
General Staff - non Technical															

Formulation Science and Technology S1-S21

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21
Ref																					
Module Title	Design Principles for Formulation	Colloid Science	Emulsions	Particles, Dispersions and Suspensions	Rheological Control and measurement	Crystalline solids in formulations	Particle and Surface Characterisation	The Formulation Toolkit - Ingredients	The Formulation Toolkit - R&D Methodology	Automation in Formulation Design	Processing Principles for Formulation	Drying Formulations	Powders in Formulations	Granulation for Formulation	Compaction and tableting	Encapsulation	Process control and in process measurement	Quality Systems for Formulation	Sustainable & Reosurce Efficient Formulation	Regulations for Formulation	Project Assignment
Target Population	Graduate, MSc, PhD scientists in R&D or process development.																				
Description	Design approaches. Factors to consider before experimentation. Information sources. Use of stakeholders, market data, performance criteria, regulatory constraints. Theory of colloidal stabilisation & destabilisation. DLVO. Surfaces & interfaces. Contact angle & wetting. Zeta potential. 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. Ingredients. Equipment used in lab and plant. Rheological behaviours- relate to microstructure and dynamics of system. Rheology control through microstructure & modifiers. Crystallisation - use in formulation for particle formation. Crystal polymorphs & stability. How & why to measure particles & surfaces. Principles of particle characterisation methods. Microscopy. Application to real formulations. Ingredients: Functions in formulations – how to achieve these functions chemically. 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). Overview of HT & automated laboratory methods. Principles, operation. Drying techniques/principles. Scale up relationships. Product properties. Making, mixing & handling solid powders. Properties of derived products. Powder properties and measurement. Granulation methods Materials properties, how to influence & measure - relationship to microstructure. Stability prediction & measurement. Micro & nanoencapsulation methods. Uses & properties. Controlled release & delivery. Process control & in-process measurement. QS/ QA/ ISO/ GLP/GMP. QBD & sustainable design principles. Efficient use of resources. Regulations – why, how, what. Project is extensive & real industrial project at MSc level.																				
Learning Aims	To provide the specialist senior formulator with comprehensive set of knowledge & practical skills for everyday product and process design																				
Assessment	The S Modules have potential to be a Masters level course e.g. M FormSci and assessed accordingly																				
Delivery Location	Classroom - interactive sessions. Lab demos and some lab work. Online / webinar delivery can replace some classroom delivery.																				
Pre-Requisites	First degree in relevant physical or life sciences as well as Q1-Q3 modules. Or equivalent vocational (L or M modules) + relevant experience + Q modules																				
Comment	Intended for the would-be specialist formulator who already has some experience in industry. Ideally builds to a Masters level qualification.																				
Duration	2 days	2 days	2 days	2 days	1.5 days	1 day	2 days	2 days	2 days	0.5 days	2 days	1 day	1 day	2 days	1 day	1 day	1 day	1 day	1 day	1 day	20 days

Learner Groups	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21
Senior/General Management																					
Functional Management																					
Formulation Scientist R&D																					
Senior Formulation Technician																					
Process Technician Formulation																					
Process Operative and Supervisor																					
QA, Tech Service, other Technical																					
General Staff - non Technical																					

Advanced Formulation F1-Fn

Ref	**F1-Fn**
Module Title	Advanced Formulation
Target Population	Experienced senior scientists and technologists
Description	The Advanced Formulation Programme would be a set of customised and highly specialised modules each lasting 1 - 3 days for experienced and advanced level practitioners. The programme would be designed for individuals or small gorups with close involvement of senior and line management as this would be strategic investment in a small number of individuals. The Programme could include customised intensive learning (and self-learning) using consultants, academics, conference and seminar attendance, secondments (e.g. to Universities or other organisations) and substantial project assignment components
Learning Aims	To develop to a very high level the skills and knowledge of experienced career formulators on a company “scientific and technical” ladder. To ensure these skills are used in a real industrial environment.
Assessment	Potential to be part of a Masters (or even doctoral) level course e.g. M FormSci and assessed accordingly
Delivery Location	Flexible as needed. Substantial opportunity for web/self learning.
Pre-Requisites	S1-S21 (or equivalent) plus significant industrial experience.
Comment	Individuals would most likely become company experts and mentors – so broader non-technical skills would need to be considered as part of a wider competency framework and career planning.
Duration	Custom

Learner Groups	**F1-Fn**
Senior/General Management	
Functional Management	
Formulation Scientist R&D	
Senior Formulation Technician	
Process Technician Formulation	
Process Operative and Supervisor	
QA, Tech Service, other Technical	
General Staff - non Technical	

iFormulate