PROGRAMME SPECIFICATION	

1	**Awarding Institution**	Newcastle University
2	**Teaching Institution**	Newcastle University
3	**Final Award**	MSc/Diploma
4	**Programme Title**	Process Automation
5	**UCAS/Programme Code**	MSc – 5032; Dip - 3315
6	**Programme Accreditation**	IChemE, IET and InstMC
7	**QAA Subject Benchmark(s)**	not relevant
8	**FHEQ Level**	Masters
9	**Date ~~written~~/revised**	May 2008

This programme specification relates to an Integrated Graduate Development Scheme **(IGDS)** in Process Automation. It is an established part-time modular Scheme, leading to either an MSc degree or to a Diploma, organised on a Continuing Professional Development **(CPD)** basis. The IGDS is offered through the Partnership in Automation and Control Training **(PACT)** which consists of Newcastle University and a consortium of major companies from the UK chemicals and process industry sector. The PACT's origins were at Leeds and Sheffield Universities, the PACT being established in 1992 and EPSRC funding for the IGDS being approved in 1995. The IGDS moved to Newcastle in 2002 at which stage the PACT was reconstituted.

There is a Statement of Intent (**SoI**), dated May 2002, which articulates the relationships between the Faculty (**SAgE**), the School (**CEAM**) and the Local Management Committee (**LMC**) whose membership is dominated by representatives of the industrial members of the PACT. Amongst other things, the SoI legitimises the authority of the LMC and delegates to it responsibility for policy making with regard to all aspects of operation of the IGDS. This embraces admissions, course structure, module specification, curriculum development, assessment arrangements, quality auditing, administration, marketing, business planning and investment of PACT resources. Although the IGDS is administered from within CEAM, the LMC reports directly to SAgE.

10 Programme Aims

1 The aim of the PACT is to enable companies in the UK process sector to maintain and improve their competitive edge by creating a supply of personnel who understand and are able to effectively apply modern automation techniques.

2 The aim of the IGDS is to broaden and deepen the expertise and experience of personnel concerned with process automation, either in the design and development of control and related systems, in their application, or in the operation and the management thereof.

11 Learning Outcomes

The programme provides opportunities for students to develop and demonstrate knowledge and understanding, qualities, skills and other attributes in the following areas.

Knowledge and Understanding

On completing the programme delegates should have gained and be able to demonstrate :

A1 knowledge about modern control technology, including both instrumentation and control systems, hardware and software.

A2 understanding of a range of relevant and up-to-date strategies and techniques, and an appreciation of how and when to apply them in industry.
A3 knowledge about general management practice and, in particular, project management methods.
A4 familiarity with good industrial practice, relevant standards and legal requirements, especially in relation to safety.

Teaching and Learning Methods

The principal vehicle for **teaching** outcomes A1-A4 is a structured programme of lectures supplemented by a variety of worked examples, case studies, simulation exercises, lab work and demonstrations.

Tuition is intensive with delegates being taught in small groups rather than being lectured at.

Learning essentially comes from understanding the content of the lectures and is reinforced by doing the worked examples, simulation exercises, lab work, reading the course texts, etc.

Of particular significance is the **learning** that comes from interaction between the delegates.

Assessment Strategy

Every taught module has both a formal 2-hour written examination and an assignment for which a written report is submitted. Both the exams and the assignments assess outcomes A1-A4 although not all four outcomes are assessed in each exam and/or assignment.

Intellectual Skills

On completing the programme students should be able to:
B1 analyse complex problems, reduce them to their underlying issues, and synthesise solutions subject to constraints.
B2 develop qualitative and/or quantitative models of systems in terms of the functionality of their components and signals and interpret their input-output relationships.

Teaching and Learning Methods

Analysis aspects of skill B1 are **taught** in most of the modules through consideration of a variety of process scenarios by means of lectures, worked examples, etc. Synthesis aspects of skill B1 are developed, to a lesser extent, through case studies of a design nature.

Skill B2 pervades much of the content of many of the modules. The skill is **taught**, by example, through the development of models for many types of process and/or automation system, quantitative or otherwise.

Skills B1 and B2 are best **learned**, once the essentials have been taught, by trying to apply the various techniques to specimen problems, open ended or otherwise.

Opportunities to develop these skills are provided in the form of relatively simple problems posed during the lectures, more extensive problems in the form of assignments and the more complex open-ended real problems associated with the industrial project.

Assessment Strategy

Skill B1 is assessed through both the assignments and through the dissertation on the industrial project.
Skill B2 is assessed by means of the written examinations, the assignments for each of which a written report is submitted, and the project for which a dissertation is submitted.

Subject Specific and Professional Skills

Note the change of emphasis, from practical skills to subject specific and professional skills, which is more relevant in the context of an IGDS

On completing the programme students should be able to:

C1 adapt and apply control theory, related techniques and technology to the solution of industrial automation problems, open ended or otherwise.

C2 make judgements about and take responsibility for technical issues in an industrial context, eg operability, quality, reliability, safety and viability.

Teaching and Learning Methods

Skill C1 is **taught** by an applications oriented focus in which theory and techniques are applied to examples of typical problems. The expectation is that delegates will be able to extrapolate from these to solving real problems.

Skill C2 is largely **taught** by raising awareness of technical issues in lectures and considering the implications as appropriate. The industrial relevance is emphasised by the involvement of industrialists who deliver some 25 to 30% of the curriculum.

Skill C1 and, to a lesser extent, skill C2 are **learned** through the assignments. Most of the assignments consist of an industrially relevant problem to which appropriate theory and techniques can be applied. Some of the assignments are open ended but most, because of time constraints, have defined scopes.

Both skills C1 and C2 are substantially developed in the context of the industrial project. This is always an open ended non trivial problem, generated from within the delegate's company, which lends itself to the application of theory, techniques and technology as appropriate and, by definition, requires judgement about technical issues.

Assessment Strategy

Skill C1 and, to a much lesser extent, skill C2 are assessed by means of written examination, typically by asking delegates to apply theory and techniques to problems of a process nature, or to comment upon technical issues. Likewise for the assignments for each of which a written report is submitted.

Both skills C1 and C2 are assessed by means of the dissertation submitted for the industrial project.

Transferable/Key Skills

On completing the programme students should be able to:

D1 work independently and demonstrate self-discipline, self-motivation and self-sufficiency.

D2 communicate effectively, especially in the written form, with other persons, technical or otherwise, using terminology correctly according to context.

D3 competently use the Matlab and Simulink software packages.

Teaching and Learning Methods

Delegates **learn** skill D1 and the written aspects of skill D2 through all of the assignments which are done on a remote basis for which support is provided on an email basis. These skills are also developed through the industrial project which is done in their place of work.

Oral aspects of skill D2 are developed in all modules through group discussion of issues arising during lectures, case studies, demonstrations, etc.

Skill D3 is **learned** in a significant proportion of the modules through structured simulation exercises.

Assessment Strategy

Skill D1 and the written aspects of skill D2 are assessed through the reports submitted

for the assignments and the dissertation submitted for the industrial project.

Skill D3 is assessed in those modules for which the assignment is Matlab and/or Simulink based.

12 Programme Curriculum, Structure and Features

Basic structure of the programme

The IGDS is organised on a part-time modular basis for CPD purposes. Delegates may register for either the MSc (5032P) or for the Diploma (3315P) from the outset. However, in practice, most initially register under IGDS modules (5147P) and do several modules on an **occasiona**l (assessed) basis. Provided they satisfactorily complete the assessments for each module, credits are retrospectively counted towards the MSc or Diploma when their registration is transferred to such. There is also a significant number of delegates who register under IGDS modules (5147P) to do modules on an **ad-hoc** (not assessed) basis for CPD purposes who have no intention of progressing to the MSc or Diploma.

Payment is decoupled from registration for MSc/Diploma delegates who may pay on a module-at-a-time basis or on a lump-sum basis: they often start on a module-at-a-time basis and switch to a lump-sum basis later on. Delegates registered under IGDS modules always pay on a module-at-a-time basis.

There are 16 taught modules in the Scheme which are offered at the rate of one module per month in an 18 month cycle. Delegates choose which modules they wish to take according to their (and their sponsor's) interests subject to the constraints of availability, funding, prerequisites, etc. There is no start date: delegates register from when they do their first module. Also, there are no cohorts of students: rather a population of delegates all of whom have different start dates with changing registration status, doing different combinations of modules and progressing through the Scheme at different rates.

Each taught module (15 credits) consists of one week's full-time study, an assignment equivalent to another week's full-time study over the following two months, and a written exam about a fortnight thereafter. It takes approx 3 months to complete a module. Delegates typically complete two to three modules per year. For the MSc degree there is also an industrial project (45 credits) equivalent to three month's full-time effort. The maximum period of study is normally 5 years from initial registration. Delegates' registrations may be suspended, typically because of change in employment and/or family circumstances, if they are unable to continue for significant periods of time.

Key features of the programme (including what makes the programme distinctive)

- organised in one-week blocks of intensive tuition which enables delegates to sensibly handle both work and family commitments alongside their studies.
- typically aged 25 to 50, delegates have often made a career move into process automation after gaining experience in other fields, and are mostly sponsored by their companies.
- a variety of modules which cater for delegates' different backgrounds (chemical, electrical, instrumentation, etc), their interests and direction.
- scope for delegates without first degrees (HND, HNC, etc), but with significant relevant industrial experience, to progress from Diploma to MSc.
- strong applications emphasis throughout, with approximately one third of tuition being given by industrialists.
- healthy balance between breadth and depth, theory and practice, classical and modern, conventional and advanced, technology and technique, information and

understanding.

- intensive tuition in small groups of delegates with similar interests (process automation) but different backgrounds (suppliers, contractors, end-users) which makes for good quality interaction.
- emphasis on teaching rather than lecturing: a typical module includes presentations, demonstrations, discussion (and argument), problem solving, case studies, practical work and simulation exercises.

Programme regulations (link to on-line version)

http://www.ncl.ac.uk/regulations/programme/

The regulations are in the process of being changed. The following are the new regulations.

There are 16 taught modules in the Scheme each of which is worth 15 credits and, subject to prerequisites, all are optional.

Mathematics & Matlab	CME 8360
Chemical Engineering Principles	CME 8362
Instrumentation & Measurement	CME 8366
Advanced Process Automation	CME 8368
Advanced Process Control	CME 8370
Batch Processing and Automation	CME 8372
Classical Control Systems Design	CME 8374
Control Schemes & Strategies	CME 8376
Control Systems Technology	CME 8378
Modelling and Simulation	CME 8380
Modern Control Systems Design	CME 8382
Dynamics and Control of Distillation Columns	CME 8384
Fuzzy, Neural and Expert Systems	CME 8386
Management of Automation Projects	CME 8388
Optimisation and Scheduling	CME 8390
Process Analytics Technology	CME 8392
Industrial Project (45 credits)	CME 8398

Award of the MSc degree requires satisfactory completion of 180 credits comprising 135 credits from taught modules, that is 9 taught modules at 15 credits each, **and** 45 credits from the Industrial Project.

Award of the Diploma requires satisfactory completion of 120 credits worth of taught modules.

Delegates registered for the Diploma who satisfactorily complete the assessments for four modules at MSc standard (60 credits) may have their registrations transferred to the MSc degree.

13 Criteria for admission

Entry qualifications

The normal entry requirement for the MSc degree is a first degree, eg BEng or BSc, in an appropriate subject with a minimum standard of 2.2 Honours, or equivalent.

The expectation is that the majority of candidates for admission will be graduates in chemical, electrical or mechanical engineering. However, applicants with degrees in subjects such as Chemistry, Physics or Computing could also be admitted.

Admissions policy/selection tools

Any delegate sponsored by a company and satisfying the entry requirement is normally admitted.

Non-standard Entry Requirements

The same criteria normally apply for the Diploma as for the MSc, except that candidates with 3rd class Honours degrees and non graduates, eg holders of HND or HNC qualifications with significant and relevant industrial experience, may be registered.

Additional Requirements

Full-time employment by a company within the chemical or process industry sector.

Level of English Language capability

Delegates whose mother tongue is not English will normally be expected to have achieved a minimum score of 6.5 in the International English Language Testing Service (IELTS) test administered by the British Council.

14 Support for Student Learning

Induction

There are no formal arrangements for induction: it is inappropriate for a Scheme organised on a CPD basis. Delegates doing their first module are sent the same joining instructions as all other delegates doing the same module.

Academic support

Support of an administrative nature, such as admissions policy, registration, module dates, module content, payment of fees, assessment arrangements, etc is provided by the PACT website (http://www.ncl.ac.uk/pact) where extensive information about the IGDS is available.

Support of a technical nature, especially in relation to the assignments and revision for examinations, is provided by means of email, fax, phone, etc. It is largely provided by the Director of the IGDS but queries are sometimes referred to other colleagues. Additionally, there is a good deal of networking between the delegates themselves.

Study skills support

Study skills are addressed by the Director of the IGDS on an exception basis. To date, the only issues have been in relation to examination technique and the expectation of being held by the hand in relation to assignments.

Pastoral support

The Director of the IGDS acts as personal tutor to all delegates and would normally provide pastoral care in the first instance. If necessary, professional advice would be sought from the centralised University support services: the Student Advice Centre, the Student Counselling Service, the Mature Student Support Service, the Childcare Support Officer, etc.

It should be remembered that delegates are typically between 25 and 50 years old,

they are all in full-time employment and, apart from the self-employed, have access to the infrastructures of their own organisations.

Generally speaking, pastoral support is only required when delegates circumstances change such as change of job function, family commitments, working overseas, etc. The issues are normally resolved by agreeing extensions to assignments or suspending registrations.

Support for students with disabilities

Support for students with special needs will be arranged if and when required. If necessary, professional advice will be sought from University's Disability Support Service. To date the only support required has been in relation to dyslexia.

Learning resources

The learning resource requirements for the IGDS are related to its pattern of delivery: short bursts of intensive activity. The specific requirements are rooms of appropriate quality for small group teaching, computing facilities for computer based exercises and simulations, and process control laboratory facilities for practical work.

The load falls on the School as opposed to the infrastructure of the Faculty or University. The IGDS is administered entirely from within CEAM, including registrations, examinations and finance, and places negligible load on the central administration. The delegates are all part-time and remote: they place virtually zero demand on centrally provided library, computing and support facilities.

15 Methods for evaluating and improving the quality and standards of teaching and learning

The LMC has its own committee structure. That includes a Quality Committee which reports to the LMC and an Examinations Board which reports through the LMC to the Faculty. Most of the business of a conventional Board of Studies **(BoS)** is carried out by the LMC itself and by the Quality Committee. The IGDS is represented by its Director on CEAM's postgraduate BoS which is a combined BoS for all of CEAM's MSc courses. This interface enables the LMC to report (in the sense of informing rather than being responsible) to CEAM and to keep abreast of developments within CEAM and SAgE.

Module reviews

The Quality Committee is responsible for the implementation of the University and Faculty's quality procedures in relation to the IGDS. Members of the Quality Committee, being drawn from the LMC, represent the delegates' sponsoring companies and have a keen interest in closing the quality loop.

The whole Scheme is reviewed every 4 years, the Quality Committee doing an in depth review of 4 of the Scheme's 16 modules each year. The review is based upon the delegate questionnaires, course materials (notes, exercises, lab sheets, etc), exam papers, marked scripts, assignments, results sheets and external examiners comments. The IGDS' quality procedures are fully documented in the course manual. It is the Director of the IGDS' responsibility to ensure that recommendations made by the Quality Committee are implemented.

Programme reviews

Programme review is carried out through the submission of an Annual Monitoring and Review (AMR) report submitted to the Faculty Teaching and Learning

Committee **(FTLC)** through CEAM's combined postgraduate BoS for MSc courses.

External Examiner reports

External Examiner reports are considered by the both the LMC and CEAM's combined postgraduate BoS.

Student evaluations

For each module there is a pre and post module questionnaire. In essence the pre module questionnaire establishes delegates' expectations at the start of the module. That provides an objective basis for the post module questionnaire in which delegates experience and attainment is measured. There is virtually a 100% completion rate. On a scale of 1 = awful, 2 = bad, 3 = OK, 4 = good and 5 = excellent, the results are consistently and overwhelmingly in the 3-5 range.

For each module, the statistics from the questionnaires are collated and the comments summarised: these are then circulated to all the staff involved. They also form a major input to the module review process as outlined above.

Mechanisms for gaining student feedback

There is no staff-student committee. The delegates are part-time and scattered around the country. It is difficult to see how a staff-student committee would function, let alone seeing sponsoring companies agreeing to delegates taking days off work and incurring travel and hotel costs to attend meetings of such.

Delegate opinion is sought through the end of module questionnaires, informal contact with the lecturers, on going contact with the Director of the IGDS, and through Members of the LMC who are in work related contact with many of the delegates.

Feedback to students is effected through the same informal channels, through the PACT Newsletter (email version) and through the PACT website.

Faculty and University Review Mechanisms

The LMC is responsible for review of the IGDS. This embraces module review as outlined above as well as on going review of the IGDS as a whole. The intent of the review process is to monitor the quality of module delivery and to ensure that both individual modules and the IGDS as a whole are kept up to date and relevant to the needs of the industry.

Along with other MSc courses offered by CEAM, the IGDS is subject to the University's quinquennial Internal Subject Review (ISR) process. This was last carried out in the spring of 2006.

Accreditation reports

The modules of the IGDS are approved by the IChemE and Inst MC for CPD purposes. The IGDS as a whole (MSc, Diploma and individual modules) are endorsed by the IET and deemed to be 'appropriate for the maintenance or enhancement of a competence relevant to an individual's professional development'.

The MSc degree in Process Automation is accredited for further learning to Master's level under the UK-SPEC guidelines by the:

- IChemE, for graduates with an accredited BEng degree in chemical engineering

who register for the MSc between Sept 2004 and Sept 2009.

- IET, for graduates with an accredited BEng degree in any discipline who register for the MSc between Sept 2006 and Sept 2010.
- InstMC, for graduates with an accredited BEng degree in any discipline, who register for the MSc between Sept 2003 and Sept 2009.

Thus, subject to significant and relevant industrial experience and a position of responsibility:

BEng + MSc (Process Automation) $\Rightarrow$ CEng

16 Regulation of assessment

The assessment regulations have been modified in the light of the changes to the programme regulations referred to in Section 12.

Within the IGDS a 16 point scale is used for assessment purposes and providing feedback to delegates. The mapping between the 16 point scale and % marks, degree classifications, descriptors, etc, is published on the PACT website and provided to delegates with their results. **See separate Grade Schedule**. It should be noted that the grade boundaries align exactly with the degree classifications of the University's Postgraduate Examination Conventions. Results are reported to the University on that basis.
Examinations are marked on a % basis and converted into grades on the 16 point scale. Assignments are marked directly on the 16 point scale. The result for each module is the average of the exam and assignment grades with equal weighting.

To be awarded an MSc with Distinction, the following criteria **normally** apply:

A **total** of 180 credits of which:

Optional modules contribute a total of 135 credits (9 modules).
The industrial project contributes 45 credits.

and a **minimum** of grade 14 for the **overall average** grade based on 135 credits worth of modules.

and a **minimum** of grade 14 for the industrial project.

To be awarded an MSc with Merit:

Exactly the same criteria apply as for the MSc with Distinction, except that the threshold is grade 11.

To be awarded an MSc, the following criteria will **normally** apply:

A **minimum** of 150 credits based upon the same combination of modules as above,

with there being no individual module less than grade 5,

and a **minimum** of grade 8 for the **overall average** grade based on 135 credits worth of modules,

and a **minimum** of grade 8 for the industrial project.

To be awarded a Postgraduate Diploma, the following criteria will **normally** apply:

A **minimum** of 90 credits,

with there being no individual module less than grade 5,

and a **minimum** of grade 8 for the **overall average** grade based on 120 credits

worth of optional modules.

The Diploma may be awarded with Distinction or Merit at the discretion of the Examinations Board.

Delegates registered for the Diploma, who have obtained a **minimum** average of grade 8 for at least four modules, may have their registrations transferred to the MSc degree.

Role of the External Examiner

The External Examiner, a distinguished member of the subject community, is appointed by FTLC, after recommendation by the LMC. The External Examiner for the IGDS does the following:

- Inspects and approves every examination paper.
- Moderates examination and assignment marking on a random check basis.
- May conduct a viva on the basis of any delegate's dissertation.
- Attends the Sept/October Board of Examiners meeting.
- Reports to the University on the standards of the programme.

In addition, information relating to the programme is provided in:

The PACT website: **http://www.ncl.ac.uk/pact**

The University Prospectus (see http://www.ncl.ac.uk/postgraduate/

The School Brochure (contact enquiries@ncl.ac.uk)

The University Regulations (see http://www.ncl.ac.uk/calendar/university.regs/)

Please note. This specification provides a concise summary of the main features of the programme and of the learning outcomes that a typical student might reasonably be expected to achieve if she/he takes full advantage of the learning opportunities provided. The accuracy of the information contained is reviewed by the University and may be checked by the Quality Assurance Agency for Higher Education.

Annex

Mapping of Intended Learning Outcomes onto Curriculum/Modules

Modules (optional)	Learning outcomes										
	A1	**A2**	**A3**	**A4**	**B1**	**B2**	**C1**	**C2**	**D1**	**D2**	**D3**
CME 8360						X			X	X	X
CME 8362						X		X	X	X	
CME 8366	X			X		X		X	X	X	
CME 8368	X	X		X	X	X	X	X	X	X	X
CME 8370	X	X			X	X	X	X	X	X	X
CME 8372	X	X	X	X	X	X		X	X	X	
CME 8374		X				X	X		X	X	X
CME 8376		X			X	X		X	X	X	
CME 8378	X			X	X	X	X	X	X	X	
CME 8380	X	X			X	X	X		X	X	X
CME 8382		X			X	X	X		X	X	X
CME 8384		X		X	X	X		X	X	X	X
CME 8386	X	X		X	X	X	X	X	X	X	
CME 8388			X	X		X	X		X	X	
CME 8390	X	X		X	X	X	X	X	X	X	X
CME 8392	X			X		X		X	X	X	
	Industrial project (compulsory for MSc)										
CME 8398	X	X	X	X	X	X	X	X	X	X	X