

Module 9: Quality & Regulatory Framework in the Pharmaceutical Industry

Stage	1						
Semester	2						
Module Title	Quality & Regulatory Framework in the Pharmaceutical Industry						
Module Number/Reference	MS-IPM-QRFPI						
Module Status (Mandatory/Elective)	Mandatory						
Module ECTS credit	5						
Module NFQ level (only if applicable)	9						
Pre-requisite Module Titles	None						
Co-requisite Module Titles	None						
Is this a capstone module? (Yes or No)	No						
List of Module Teaching Personnel	Dr. Sonja Vucen, Dr. Katie Ryan, Dr Abina Crean						
Contact Hours				Non-contact Hours			Total Effort (Hours)
Lecture	Practical	Tutorial	Seminar	Assignment	Placement	Independent work	
30		6		14		75	125
Allocation of Marks (Within the Module)							
	Continuous Assessment	Project	Practical	Final Examination	Total		
Percentage contribution	60%			40%	100%		

Intended Module Learning Outcomes

On successful completion of this module, the learner will be able to:

1. Critique the processes involved in bringing drugs from the development stage through to market as registered pharmaceutical medicines.
2. Critically analyse the concepts of quality and quality assurance in the development, manufacture, and supply of medicines.
3. Evaluate the importance and impact of quality systems in the manufacture and

4. Critically assess the role and activities of different regulatory bodies and the necessity for such control in the development, manufacture, and supply of medicines.
5. Relate the impact and consequences of poor quality, deviations, complaints and recalls on the organisation, and describe approaches to address and prevent them.
6. Critically evaluate the role and responsibilities of key personnel and the organisational structure (QMS, management and Qualified Person (QP)) in ensuring the supply of medicines that meet standards of quality, safety and efficacy.
7. Critically assess the latest trends in quality systems, management, process control, medicines and regulation.

Module Objectives

This module aims to introduce learners to the quality systems and the regulatory framework that assures the quality, safety, and efficacy of medicinal products. The importance of pharmaceutical quality systems as a comprehensively designed and correctly implemented management system incorporating Good Manufacturing Practice (GMP) and Quality Risk Management is a fundamental part of this module. The module includes a broad overview of pharmaceutical product life cycle management in a regulatory and legal environment – from discovery through development and commercialization to patent expiry and post-market exclusivity.

Module Aims

This module aims to demonstrate the importance of pharmaceutical quality, and provide key information pertaining to quality approaches that apply to the development, manufacture, and supply of medicines. To integrate the principles of quality systems with management to enable learners to understand how they apply within business, and the effects of GxP on the business. It also aims to enable learners to understand the regulatory framework that underpins pharmaceutical product development from discovery through pre-clinical research, clinical trials, registration and release, and give learners an insight into the costs to the organisation of poor quality, how they are handled and appropriate strategies to mitigate against the risks. Finally the module aims to provide an overview of the evolution of product profile; pharmaceutical quality, quality improvement and risk management practices in manufacturing (GMP) and supply.

Module Curriculum

- **Stages of bringing medicinal products and devices to market**
 - Small molecule and biopharmaceutical products
 - Drug (pre)formulation
 - Route of Administration
 - Pharmaceutical Dosage forms

- Actives and Excipients
 - Sterile v Non-sterile
 - Biotechnology and biosimilars
 - Medical devices and combination products
 - Manufacturing and packaging Technologies
 - Pre-clinical studies and clinical trial data
 - Product traceability
- **Pharmaceutical quality systems**
 - Defining quality
 - Quality systems concepts
 - Quality assurance approaches
 - Requirements for quality systems
 - Quality managements systems
 - Quality control *versus* quality assurance
 - Pharmaceutical quality within the management structure
- **Quality systems in practice – from molecule to market**
 - Legal and legislative basis – EU, USA, Asia.
 - Regulations, guidelines and standards - CFR, EU Directives, Eudralex, ISO
 - Good manufacturing practice (GMP)
 - Good laboratory practice (GLP)
 - Good clinical practice (GCP)
 - Good distribution practice
 - Good documentation practice
- **Workshop 1: Assignment Workshop**
 - Review activities introduced in Lectures 1 – 6.
 - Relate theoretical concepts to practice.
- **Validation / Role of QP**
 - Validation strategies
 - Change-control / re-validation
 - Documentation life-cycle
 - Validation loop - Qualification versus validation
 - Qualified person – legal basis and responsibilities
 - Qualified person – role and qualification requirements
- **Regulatory affairs**
 - Role of regulatory bodies – HPRA, EMA, FDA
 - Licensing and enforcement
 - Assessment and registration - MA holders responsibility
 - Legislation for medicinal products, medical devices.
 - Pharmacovigilance
 - Auditing

- **Complaints, Quality defects and product recall**
 - What is a Complaint?
 - Investigation procedure of a complaint including RCA and CAPA's
 - Complaint management: GMPs v ISO
 - What is a Quality Defect?
 - Procedures to monitor defects
 - What is a Product Recall?
 - Example of a recall at market level, showing the effects on business

- **Quality improvement and Risk management**
 - Quality improvement
 - Quality tools - Statistical process control
 - Total quality management
 - Sig-sigma approach
 - ICH Q8 Quality by Design (QbD)
 - Approaches to pharmaceutical development and life-cycle management
 - Principles of risk management
 - Risk management tools in Pharmaceutical industry

- **Workshop 2: Revision**
 - Revision of key concepts
 - Exam preparation techniques
 - Exam sitting techniques

Teaching Plan

Weeks 1&2	Stages of bringing medicinal products and devices to market
Week 3	Pharmaceutical quality systems
Weeks 4,5&6	Quality systems in practice – from molecule to market
Week 7	Workshop 1: Assignment workshop
Week 8	Validation / Role of QP
Week 9	Regulatory affairs
Week 10	Complaints, Quality defects an product recall
Week 11	Quality improvement and Risk management
Week 12	Workshop 2: Revision

Reading lists and other learning materials

Books

Weintraub, S. et al. 2015. RESULTS: The Future of Pharmaceutical and Healthcare Marketing, 2015.

McCormick, Kate (2002). Quality (Pharmaceutical Engineering Series), 1st Edition.

Sharp, J. (2011), Quality in the manufacture of medicines and other healthcare products (2nd edn), Pharmaceutical Healthcare & Sciences Society.

Nally, J.D., (Ed), (2007), Good Manufacturing Practices for Pharmaceuticals, 6th Edition (Drugs and the Pharmaceutical Sciences)

Allport-Settle, M.J., (2009), Current Good Manufacturing Practices: Pharmaceutical, Biologics, and Medical Device Regulations and Guidance Documents Concise Reference

Rodriguez-Perez, J., (2012), Quality Risk Management in the FDA-Regulated Industry, American Society for Quality.

Quality Assurance of Pharmaceuticals - A Compendium of Guidelines and Related Materials - Vol 1 & 2

http://www.who.int/medicines/areas/quality_safety/quality_assurance/resources/en/

Journals

Cunningham, A. 2010. Just in Time: An Approach for a cGMP Fill-Finish Facility, *Pharmaceutical Engineering* magazine, March/April 2010 (ISPE).

Van Liedekerke, B., Maes, I., 2007. Pharmaceutical Manufacturing: Linking Vision and Decision Making to Achieve a Roadmap Toward cGMPs for the 21st Century, *Pharmaceutical Engineering* magazine, Jul/Aug 2007 (ISPE).

X. Yu, L and Woodcock, J., (2015), FDA pharmaceutical quality oversight, *International Journal of Pharmaceutics* 491 (2015) 2–7.

Website resources:

Code of Federal Regulations CFR211, FDA

<http://www.fda.gov/Drugs/DevelopmentApprovalProcess/Manufacturing/ucm090016.htm>

Eudralex, Volume 4 Ed., EMA

http://ec.europa.eu/health/documents/eudralex/vol-4/index_en.htm

Quality by design

http://www.ema.europa.eu/ema/index.jsp?curl=pages/regulation/document_listing/docu

Pharmacovigilance

http://www.ema.europa.eu/ema/index.jsp?curl=pages/regulation/general/general_content_000258.jsp&mid=WC0b01ac05800241de

ICH Quality guidelines, ICH 8, 9 & 10

<http://www.ich.org/products/guidelines/quality/article/quality-guidelines.html>

Good manufacturing practice (GMP) resources

<http://www.ispe.org/gmp-resources>

Module Learning Environment

A classroom setting is used for the delivery of the module through a series of 10 lectures and 2 assessment-based workshops. Supports for learners include a set of printed notes incorporating syllabus, lecture notes, activities, short self-administered questionnaires, a case study, and related assessment tasks. These are supplemented with a module set book and online reading materials, PowerPoint presentations, and other activities using Moodle, the College's Virtual Learning Environment (VLE) provide additional support materials to help with self-study.

Module Teaching and Learning Strategy

Lectures 1 – 6 and Workshop 1 (session 7) deal with key concepts of product development, quality, and good practices governing manufacturing (GMP) and supply of medicines. These lectures provide information and background to help learners understand the key steps and quality processes involved in bringing drugs from development through to the market. The module includes a case study to underpin theoretical content enabling learners to explore individual aspects in more depth and in the context of their own work environment. Workshop 1 helps to bring together the practical and the theoretical content of the module and, helps learners to complete the continuous assessment element of the module. This assessment is worth 60% of the overall mark.

Lectures 8 – 11 and Workshop 2 (session 12) examine the processes and personnel involved in quality management. They examine role of personnel both within and beyond the organisation who have a role in ensuring the quality and safety of medicines. They highlight the roles and responsibilities of regulatory bodies in different jurisdictions and legislative requirements including those pertaining to personnel with the organisation (Qualified person (QP) - EU). The series of lectures also aims to provide learners with an overview of examples of poor quality and associated costs, in addition to approaches and tools to mitigate against these. The intention is to equip learners with a full understanding of the regulatory affairs and quality management systems that are relevant to batch release. This will be illustrated using a worked example, which marries all the key processes together and the decisions that are made prior to final sign-off of a batch. This is intended to widen the learner's scope of understanding and development later in their careers. Workshop 2 is a revision and exam preparation workshop that takes place towards the end of the module.

Typical assignment could include: Letter sent from HPBA detailing issues found with

formulate a reply to the letter outlining a course of action appropriate to the circumstances and their seriousness, e.g. giving assurance that the product does not need to be recalled. The assignment would also include the learner to propose further actions required, e.g. Investigate possible Root Causes and implement Corrective and Preventative Actions (CAPA's).

Module Assessment Strategy

Element Number	Weighting	Type	Description
1	60%	Written report	Case-study based
2	40%	Examination	End of semester

Learners are required to work on a 60% weighted assignment. This is a Work Based Activity (WBA), which requires learners to identify areas of pharmaceutical quality systems, GMP, the application of regulatory frameworks and the role of regulatory bodies in their own workplace or a context in which they plan to work in the future; and develop a written plan to advance their application of the theoretical to the practical.

Learners sit an end of semester examination which contributes 40% towards their final mark for this module. The exam paper will cover content related to Pharmaceutical Product Lifecycle Management – From molecule to market and relevant global regulatory frameworks that apply. The exam paper will consist of two sections; with section A consisting of short answer style questions and section B requiring learners to answer essay style questions.

Constructive Alignment of Assessment

Module Learning Outcomes	Assessment Strategy	
	Element 1	Element 2
Module Learning Outcome 1	Yes	Yes
Module Learning Outcome 2	Yes	Yes
Module Learning Outcome 3	Yes	Yes
Module Learning Outcome 4		Yes
Module Learning Outcome 5		Yes
Module Learning Outcome 6	Yes	Yes
Module Learning Outcome 7	Yes	Yes