Study Scheme & Syllabus of Post Graduate Diploma in Drug Regulatory Affairs

Batch 2018 onwards

By

Board of Study Pharmacy

Department of Academics

IK Gujral Punjab Technical University

First Semester

Course Code	Course Type	Course Name	Load			Marks			Credits
			L	T	P	Internal	External	Total	
PGDDRA101-18	Core Theory-I	Fundamentals of Regulatory Affairs	4	-	-	40	60	100	4
PGDDRA102-18	Core Theory-II	International Regulatory Requirements	4	-	-	40	60	100	4
PGDDRA103-18	Core Theory-III	Pharmaceutical cGMP & Validation	4	-	-	40	60	100	4
PGDMAT104-18	Core Theory-IV	Modern Analytical Techniques	4	-		40	60	100	4
PGDDRA105-18	Core Practical-I	Pharmaceutical Regulatory Affairs Lab	-	-	4	60	40	100	2
PGDMAT106-18	Core Practical-II	Modern Analytical Techniques Lab		-	4	60	40	100	2
PGDDRA107-18	Skill Enhancement	Seminar/Journal Club	4	-	-	100	-	100	4
PGDDRA108-18	Skill Enhancement	Project-I	-	-	4	-	100	100	2
		Total	**20**		**12**	**380**	**420**	**800**	**26**

Second Semester

Course Code	Course Type	Course Name	Load			Marks			Credits
			L	T	P	Internal	External	Total	
PGDDRA201-18	Core Theory-V	Clinical Trial Regulations	4	-	-	40	60	100	4
PGDDRA202-18	Core Theory-VI	Preclinical Studies and Toxicity & Toxic kinetics	4	-	-	40	60	100	4
PGDIPR 203-18	Core Theory-VII	Intellectual Property Rights& Documentation	4	-	-	40	60	100	4
PGDDRA204-18	Core Practical-III	Clinical Trial Regulations Lab	-	-	4	60	40	100	2
PGDDRA205-18	Skill Enhancement	Seminar/Journal Club	4	-	4	100	-	100	2
PGDDRA206-18	Skill Enhancement	Industrial Training*	-	-	-	50	50	100	4
PGDDRA207-18	Skill Enhancement	Project-II	-	-	12	-	200	200	6
		Total	**16**		**16**	**330**	**470**	**800**	**28**

*Industrial Training of two weeks duration will be undertaken after 1st semester and before commencement of 2nd semester

1st SEMESTER

Course Code	Course Title	Teaching Load			Marks		Exam (hrs)		Credits
		L	T	P	Int.	Ext.	Int.	Ext.	
PGDDRA 101-18	Fundamentals of Regulatory Affairs	4	-	-	40	60	1.5	3	4

Objective: Course designed to impart advanced knowledge and skills required to learn the concept of generic drug and their development, various regulatory filings in different countries, different phases of clinical trials and submitting regulatory documents: filing process of IND, NDA and ANDA.

Course Outcomes: Upon completion of the course, it is expected that the students will be able to understand

1. The concepts of innovator and generic drugs, drug development process
2. The Regulatory guidance's and guidelines for filing and approval process
3. Preparation of Dossiers and their submission to regulatory agencies in different countries
4. Post approval regulatory requirements for actives and drug products
5. Submission of global documents in CTD/ eCTD formats
6. Clinical trials requirements for approvals for conducting clinical trials
7. Pharmacovigilence and process of monitoring in clinical trials. Important to Regulatory Affairs in Pharma Industry. Basic regulatory framework with respect to Regulated and Non-regulated market practices and procedures. Global Pharmaceutical Industry Scenario

Module 01 **07Hrs**

Basic ICH Requirement: ICH Topics,Q1 –Stability,Q2 -Analytical Validation, Q3 – Impurities,Q4-Pharmacopoeia, Q6–Specifications,Q7–GMP API, Q8–Pharmaceutical Development, Q9–QualityRisk Management, Q10 –Pharmaceutical Quality System, Q11 – Development and manufacture of drug.

Module 02 **08Hrs**

Regulatory Filing systems for Active Pharmaceutical Ingredients in different countries: EU - ASMF, CEP, EU DMF US – DMF application, preparation and annual report. Semi-regulated Markets- Requirement of API. Genotoxic Impurities, Elemental Impurities, Polymorphic form and characterization. Various types of DMF, CTD –Module 1,2,3. Quality Overall Summary (QOS), Quality by design concept applicable to API, Post approval changes and handling deficiencies.

Module 03 **07Hrs**

Regulatory Filing systems in Europe: EMEA Procedures –Centralized, Decentralized, Mutual recognition and national procedure. CTD-Module 1, 2, 3, 4, 5 (including QOS, quality design concept and bioequivalence).Variation and Renewals. Query-Response.

Module 04 **08 Hrs**

Regulatory Filing systems in US: Various Types of application - IND, NDA and ANDA.CTD- Module1, 2, 3 and CTD Overall summary -Module1, 2, 3 including quality overall summary and Quality by design CTD module. Module 4 and 5 (including Bioequivalence).Post approval changes.

Module 05 **07Hrs**

Registration procedures in various countries: Australia, New Zealand, Canada, South Africa/Africa, DCGI (India), Asia, Russia/CIS.

Module 06 **08 Hrs**

Pharmacovigilance in EU/US: Interviews for Regulatory Opening. Case study for both US and EU, Audit checklist, Prior Approval Inspections (PAI), Out of Specifications (OOS), Inspection and Audits, Deviations and Change Controls, Annual Product Reviews (APRs) for Pharmaceuticals.

Recommended Books (Latest Edition)

1. Generic Drug Product Development, Solid Oral Dosage forms, Leon Shargel and Isader Kaufer, Marcel Dekker series, Vol.143.
2. The Pharmaceutical Regulatory Process, Edited by Ira R. Berry and Robert P. Martin, Drugs and the Pharmaceutical Sciences,Vol.185, Informa Health care Publishers.
3. New Drug Approval Process: Accelerating Global Registrations by Richard A Guarino, MD, Drugs and the Pharmaceutical Sciences, Vol.190.
4. Guidebook for drug regulatory submissions / Sandy Weinberg. By John Wiley &Sons.Inc.
5. FDA regulatory affairs: a guide for prescription drugs, medical devices, and biologics/edited By Douglas J. Pisano, David Mantus.
6. Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance By Fay A. Rozovsky and Rodney K. Adams
7. www.ich.org/
8. www.fda.gov/
9. europa.eu/index_en.htm
10. https://www.tga.gov.au/tga-basics

Course Code	Course Title	Teaching Load			Marks		Exam (hrs)		Credits
		L	T	P	Int.	Ext.	Int.	Ext.	
PGDDRA 102-18	International Regulatory Requirements	4	-	-	40	60	1.5	3	4

Objectives:

1. To learn the concept of generic drug and their development
2. To understand the requirements for filing process of IND, NDA and ANDA
3. To know the approval process of various regulatory filings in different countries
4. To know the chemistry, manufacturing controls and their regulatory importance
5. To learn the documentation requirements for submitting regulatory documents
6. To learn the importance and different phases of clinical trials
7. To learn about pharmacovigilence and process of monitoring in clinical trials

Course Outcome: Upon completion of the course, it is expected that the students will be able to (know, do and appreciate)

1. Concepts of innovator and generic drugs, drug development process Regulatory guidance's and guidelines for filing and approval process
2. Preparation of Dossiers and their submission to regulatory agencies in different countries Post approval regulatory requirements for actives and drug products
3. Submission of global documents in CTD/ eCTD formats

Module 01 **08Hrs**

Generic Drug Product development: Introduction, Hatch-Waxman act and amendments, Code of Federal Regulations (CFR), Drug product performance-in vitro, ANDA Regulatory Approval Process, Bioequivalence and Drug Product Assessment- in vivo, Scale up Post approval changes, Post marketing surveillance. Outsourcing Bioavailability and Bioequivalence studies to Contract Research organizations, Pharmaceutical Labeling, Advertising and Promotion.

Module 02 **09 Hrs**

Regulatory requirements for product approvals: Active Pharmaceutical Ingredients, Biologics, Novel therapies obtaining New Drug Application(NDA), Abbreviated New Drug Application (ANDA) for generic drugs, ways and means of US Registration for foreign drugs.

Module 03 **10Hr**

Chemistry, Manufacturing and controls (CMC), Post approval Regulatory affairs, Regulation for combination products (Controlled release systems), and medical devices. Common Technical Document (CTD)/ electronic Common Technical Document (eCTD) Format, Industry and FDA Liaison.

Module 04 **10Hrs**

Non-clinical drug development: Global submission of Investigational New Drug application (IND), New Drug application (NDA), Abbreviated New Drug Application (ANDA), Investigation medicinal product Dossier (IMPD) &Investigator Brochure (IB).

Module 05 **08Hrs**

Clinical trials: Developing clinical trial protocols, Institutional Review Board/Independent Ethics committee-formation and working procedures, Informed consent-process and procedures, HIPAA- A new requirement to clinical study process. Pharmacovigilance-safety monitoring in clinical trials.

Recommended Books (Latest Edition)

1. Generic Drug Product Development, Solid Oral Dosage forms, Leon Shargel and IsaderKaufer, Marcel Dekker series, Vol.143.
2. The Pharmaceutical Regulatory Process, Second Edition Edited by Ira R. Berry and Robert P. Martin, Drugs and the Pharmaceutical Sciences,Vol.185, Informa Health care Publishers.
3. New Drug Approval Process: Accelerating Global Registrations By Richard A Guarino, MD, 5th edition, Drugs and the Pharmaceutical Sciences,Vol.190.
4. Guidebook for drug regulatory submissions / Sandy Weinberg. By John Wiley & Sons. Inc.
5. FDA regulatory affairs: a guide for prescription drugs, medical devices, and biologics/edited by Douglas J. Pisano, David Mantus.
6. Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance By Fay A. Rozovsky and Rodney K. Adams.

Course Code	Course Title	Teaching Load			Marks		Exam (hrs)		Credits
		L	T	P	Int.	Ext.	Int.	Ext.	
PGDDRA 103-18	Pharmaceutical cGMP & Validation	4	-	-	40	60	1.5	3	4

Objectives:

1. To learn the concept of validation and process of validation
2. To train the students about the importance and requirement of good clinical practices
3. To impart training in good manufacturing practices and its conduct in manufacturing process To understand the documentation procedures and their implementation
4. To introduce the basic concepts of validation and their implementation in APIs and products.

Course Outcome: Upon completion of the course, it is expected that the students will be able to (know, do and appreciate)

1. Concepts of quality, quality management and its implementation
2. Regulatory guidance's and guidelines like ICH, WHO and other relevant documents
3. Good Laboratory Practices, SOPs, handling of deviation
4. Documentation of BMR, MFR, DMF and relevant process related documents
5. Environment protection and occupational health safety requirements and requirements Validation of process, equipments and products

Module 01 **07Hrs**

Concept of Quality, Total Quality Management. Quality by design, six sigma concept. Stability testing: ICH and WHO guidelines, Photostability studies.

Module 02 **07Hrs**

Good Laboratory Practices (GLP): Scope of GLP, QA unit, Standard operating procedures (SOP). Quality evaluation and batch release: Change Control, Deviation-(planned and unplanned), Corrective Action and Preventive Action (CAPA), Handling of non-conformance. NABL

Module 03 **06Hrs**

cGMP of Pharmaceutical manufacturing · Evolution and Principles of cGMP, Schedule-M, WHO-GMP requirements and United States Food and Drug Administration (USFDA) guidelines on Pharmaceutical manufacturing.

Module 04 **09Hrs**

Documentation in pharmaceutical industry: Batch Formula Record, Master-Form Record, Distribution records, Drug Master Files. Brief study of following laws Drugs a Cosmetics Act 1940 and its rules 1945 The Environmental Protection Act-1986 Occupational Safety and Health Administration (OSHA).

Module 05 **08Hrs**

An Introduction to the Basic Concepts of Process Validation & How it Differs from Qualification (Installation Qualification (IQ), Operational Qualification(OQ) & Performance Qualification (PQ) Procedures, Validation master plan (VMP).

Module 06 **08Hrs**

A Review of Prospective, Concurrent, Retrospective Validation & Revalidation including the use of Statistical Process Control (SPC). Process Validation of Active Pharmaceutical Ingredients (APIs) and finished products.

Recommended Books (Latest Edition)

1. Pharmaceutical master validation plan: The ultimate guide to FDA, GMP and GLP Compliance by Syed Imitiaz Haider.
2. Pharmaceutical dosage forms: Parenterals Vol-2, II Edition, by Kenneth EA and Leon Lachman.
3. Pharmaceutical Process Validation, 3rd Edition, Edited by Robert Nash and Alfred Wachter, Marcel Dekker.
4. Good Manufacturing Practices for Pharmaceuticals: A Plan for Total Quality Control From Manufacturer to Consumer, Sidney J. Willig, Marcel Dekker.
5. Quality planning and Analysis by JM Juran and FM Gryna, Tata McGrawHill- India.
6. Total Quality Management, Dale H. Besterfield, Pearson Education.
7. Total Quality Management, Principles, Implementation & Cases, Sharma D.D., Sultan Chand & Sons, New Delhi.

Course Code	Course Title	Teaching Load			Marks		Exam (hrs)		Credits
		L	T	P	Int.	Ext.	Int.	Ext.	
PGDMAT 104-18	Modern Analytical Techniques	4	-	-	40	60	1.5	3	4

Scope: This subject deals with the application of instrumental methods in qualitative and quantitative analysis of drugs. This subject is designed to impart advanced knowledge on the principles and instrumentation of spectroscopic and chromatographic hyphenated techniques. This also emphasizes on theoretical and practical knowledge on modern analytical instruments that are used for drug testing.

Objectives: Upon completion of the course, the student shall be able to know

1. Analysis of drugs using various analytical instruments
2. Understand the chromatographic separation and analysis of drugs
3. Understand the advanced instruments used and its applications in drug analysis

Module 01 **08Hrs**

a. Pharmaceutical analysis-Definition and scope , Different techniques of analysis , Methods of expressing concentration , Primary and secondary standards, Preparation and standardization of various molar and normal solutions- Oxalic acid, sodium hydroxide, hydrochloric acid, sodium thiosulphate, sulphuric acid, potassium permanganate and ceric ammonium sulphate
b. Pharmacopoeia, Sources of impurities in medicinal agents, limit tests.
c. Calibration and validation-as per ICH and USFDA guidelines Calibration of following Instruments Electronic balance, UV-Visible spectrophotometer, IR spectrophotometer, Fluorimeter, Flame Photometer, HPLC and GC

Module 02 **11Hrs**

a. UV Visible spectroscopy: Introduction, Electronic transitions, chromophores, auxochromes, spectral shifts, solvent effect on absorption spectra, Beer and Lambert's law, Derivation and deviations. Instrumentation - Sources of radiation, wavelength selectors, sample cells, detectors- Photo tube, Photomultiplier tube, Photo voltaic cell, Silicon Photodiode. Applications
b. IR spectroscopy: Introduction, fundamental modes of vibrations in poly atomic molecules, sample handling, factors affecting vibrations Instrumentation - Sources of radiation, wavelength selectors, detectors - Golay cell, Bolometer, Thermocouple, Thermister, Pyroelectric detector and applications

Module 03 **11Hrs**

a. Nuclear Magnetic Resonance spectroscopy: Principles of ^{1}H-NMR and ^{13}C-NMR, chemical shift, factors affecting chemical shift, coupling constant, Spin - spin coupling, relaxation, instrumentation and applications
b. Mass Spectrometry: Principles, Fragmentation, Ionization techniques – Electron impact, chemical ionization, MALDI, FAB, Analyzers-Time of flight and Quadrupole, instrumentation, applications

Module 04 **15Hrs**

a. Introduction to chromatography
b. Thin layer chromatography- Introduction, Principle, Methodology, Rf values, advantages, disadvantages and applications.
c. Paper chromatography-Introduction, methodology, development techniques, advantages, disadvantages and applications
d. Gas chromatography - Introduction, theory, instrumentation, derivatization, temperature programming, advantages, disadvantages and applications
e. High performance liquid chromatography (HPLC) - Introduction, theory, instrumentation, advantages and applications.

Recommended Books (Latest Edition)

1. Instrumental Methods of Chemical Analysis by B.K Sharma
2. Organic spectroscopy by Y.R Sharma
3. Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel
4. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake
5. Organic spectroscopy by William Kemp
6. Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi
7. Spectrophotometric identification of Organic Compounds by Silverstein
8. Text book of Pharmaceutical Analysis Vol, II and III by Arora and Arora S. Vikas and company Jalandhar

Course Code	Course Title	Teaching Load			Marks		Exam (hrs)		Credits
		L	T	P	Int.	Ext.	Int.	Ext.	
PGDDRA 105-18	Pharmaceutical Regulatory Affairs Lab	-	-	4	60	40	6	6	2

1. Documentation for in process and finished products Quality control tests for Solid, Semisolid and Sterile preparations.
2. Protocol preparation for documentation of various types of records (BFR, MFR, DR, etc.)
3. Preparation of protocols on various validation requirements
4. Validation of machines & analytical instruments used for Pharmaceutical formulations.
5. Process Validation of various pharmaceutical dosage forms.
6. Preparation of SOPs for various equipments and manufacturing processes as per ISO requirements.
7. Accelerated and Photostability studies on dosage forms as per ICH Guidelines
8. Preparation of final clinical trial report (Phase I, II and III) for submission to regulatory authorities
9. Documentation for audits and inspection of manufacturing facilities.
10. Preparation of regulatory compliance checklist tabulating cGMP requirements as per 21 CFR 210 and 211.
11. Preparation of global list of documents for registration of IND, NDA, ANDA as per ICH CTD format.
12. Case studies on response with scientific rationale to USFDA Warning Letter
13. Preparation of an IMPD for EU submission.
14. Preparation of a Clinical Trial Protocol for submission to Regulatory agency.
15. Preparation and documentation for Indian Patent.
16. Patent challenge / non infringement (Para IV) case studies

Course Code	Course Title	Teaching Load			Marks		Exam (hrs)		Credits
		L	T	P	Int.	Ext.	Int.	Ext.	
PGDMAT 106-18	Modern Analytical Techniques Lab	-	-	4	60	40	6	6	2

1. Measurement of absorption maxima of some standard Pharmacopoeial drugs
2. Separation of compounds of a mixture by TLC
3. Demonstration experiment on HPLC
4. Demonstration experiment on GC
5. Assay of Pharmacopoeial drugs (minimum 5)

Course Code	Course Title	Teaching Load			Marks		Exam (hrs)		Credits
		L	T	P	Int.	Ext.	Int.	Ext.	
PGDDRA 108-18	Project-I	-	-	4	100	-	1	-	2

The candidate shall prepare a report on a topic of recent development assigned by the mentor. The candidate shall also give a presentation to be evaluated by both internal and external examiners.

Evaluation Scheme

Report	:	25 marks
Presentation	:	25 marks
Viva-Voce	:	50 marks