Nirma University

Institute of Pharmacy

Programme: **Master of Pharmacy in Regulatory Affairs**

NIRMA UNIVERSITY

Institute of Pharmacy (M.Pharm. - Regulatory Affairs)

(Semester - I)

L	T	P	C
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Course Code	**MRA101T**
Course Title	**Good Regulatory Practices**

Scope

This course is designed to impart fundamental knowledge on various Good Regulatory Practices viz., cGMP, GLP, GALP and GDP for Pharmaceuticals, Cosmetics, Food & Nutraceuticals, Medical devices, In-vitro Diagnostic Medical Devices (IVDs) and biological products and understand the rationale behind these requirements and will propose ways and means of complying with them.

Objectives

At completion of this course it is expected that students will be able to understand ,

1. The key regulatory and compliance elements with respect to Good Manufacturing Practices, Good Laboratory Practices, Good Automated Laboratory Practices and Good Documentation Practices.
2. Prepare and implement the check lists and SOPs for various Good Regulatory Practices
3. Implement Good Regulatory Practices in the Healthcare and related Industries
4. Prepare for the readiness and conduct of audits and inspections.

Course Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Understand the concepts of cGMP and GLP E-3
2. Describe the guidance documents for medical device and IVDs E-3
3. Discuss principles and requirements of GALP ENT-13
4. Review supply chain integrity in GDP S-20
5. Utilize the various elements of QMS ENT-13
6. Prepare SOP for equipments and processes E-3

Syllabus: **Teaching hours: 60 Hours**

UNIT-I **E** **12 Hours**

Current Good Manufacturing Practices: Introduction, US cGMP Part 210 and Part 211.EC Principles of GMP (Directive 91/356/EEC) Article 6 to Article 14 and WHO cGMP guidelines GAMP-5; Medical device and IVDs Global Harmonization Task Force (GHTF) Guidance docs.

UNIT-2 S **12 Hours**

Good Laboratory Practices: Introduction, USFDA GLP Regulations (Subpart A to Subpart K), Controlling the GLP inspection process, Documentation, Audit, goals of Laboratory Quality Audit, Audit tools, Future ofGLP regulations, relevant ISO and Quality Council of India(QCI) Standards

UNIT - III ENT **12 Hours**

Good Automated Laboratory Practices: Introduction to GALP, Principles of GALP, GALP Requirements, SOPs of GALP, Training Documentation,21 CFR Part 11, General check list of 21CFR Part 11, Software Evaluation checklist, relevant ISO and QCI Standards.

UNIT-IV **12 Hours**

Good Distribution Practices: Introduction to GDP, Legal GDP requirements put worldwide, Principles, Personnel, Documentation, Premises and Equipment, Deliveries to Customers, Returns, Self-Inspection, Provision of information, Stability testing principles, WHO GDP, USP GDP (Supply chain integrity), relevant CDSCO guidance and ISO standards

UNIT-V ENT **12 Hours**

Quality management systems: Concept of Quality, Total Quality Management, Quality by design, Six Sigma concept, Out of Specifications (OOS), Change control. Validation: Types of Validation, Types of Qualification, Validation master plan (VMP), Analytical Method Validation. Validation of utilities, [Compressed air, steam, water systems, Heat Ventilation and Air conditioning (HVAC)] and Cleaning Validation. The International Conference on Harmonization (ICH) process, ICH guidelines to establish quality, safety and efficacy of drug substances and products, ISO 13485, Sch MIii and other relevant CDSCO regulatory guidance documents.

Suggested ReadingsA: (Latest edition)

1. Weinberg, S. Good Laboratory Practice Regulations. Informa Healthcare.
2. Robinson, D. Good Pharmaceutical Manufacturing Practice: Rationale and Compliance by John Sharp. CRC Press.
3. Bliesner, D. M. Establishing a CGMP Laboratory Audit System: A Practical Guide. John Wiley & Sons.
4. Sharma, P. P. How to Practice GLP Good Laboratory Practice. Vandana Publications.
5. Singer, D. C., Stefan, R. I., & Van Staden, J. F. Laboratory Auditing for Quality and Regulatory Compliance. Taylor & Francis.
6. Drugs & Cosmetics Act, Rules & Amendments.

L= Lecture, T= Tutorial, P= Practical, C= Credit "

this is not an exhaustive list

(M.Pharm. - Regulatory Affairs)

(Semester - I)

L	T	P	C
4			4

Course Code	**MRA102T**
Course Title	**Documentation and Regulatory Writing**

Scope

This course 1s designed to impart fundamental knowledge on documentation and general principles involved in regulatory writing and submission to agencies.

Objectives

Upon completion of the course the student shall be able to,

1. Know the various documents pertaining to drugs in pharmaceutical industry
2. Understand the basics of regulatory compilation
3. Create and assemble the regulation submission as per the requirements of agencies
4. Follow up the submissions and post approval document requirements

Course Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Enist the different types of documents required for drug product management E-3
2. Understand the concept, content and format of CTD and eCTD submission. ENT-13
3. Describe various types of audits and audit strategies for manufacturing facilities NT-13
4. Explain the inspection process of pharmaceutical manufacturing practices along with CAPA ENT-13
5. E xpress life cycle management of different types of pharmaceutical dosage form S-20

Syllabus: UNIT-I E **Teaching hours: 60 Hours**

12 Hours

Documentation in pharmaceutical industry: Exploratory Product Development Brief (EPDB) for Drug substance and Drug product, Product Development Plan (PDP), Product Development Report (P@ , Master Formula Record, Batch Manufacturing Record and its calculations, Batch Reconciliation, Batch Packaging Records, Print pack specifications, Distribution records, Certificate of Analysis CoA: , Site Master File and Drug Master Files (DMF).

UNIT-II ENT **12 Hours**

Dossier preparation and submission: Introduction and overview of dossiers, contents and organization of dossier, binders and sections, compilation and review of dossier. Paper submissions, overview and modules of CTD, electronic CTD submissions; Electronic subm ission: Planning electronic subm ission, requirement

for submission, regulatory bindings and requirements, Tool and Technologies, electronic dossier submission process and validating the submission, Electronic Submission Gateway (ESG). Non eCTD electronic submissions (NeeS), Asian CTD formats (ACTD) submission. Organizing, process and validation of submission. Submission in Sugam system of CDSCO.

UNIT - III ENT **12 Hours**

Audits: Introduction, Definition, Summary, Types of audits, GMP compliance audit, Audit policy, Internal and External Audits, Second Party Audits , External third party audits, Auditing strategies, Preparation and conducting audit, Auditing strategies , audit analysis, audit report, audit follow up. Auditing/inspection of manufacturing facilities by regulatory agencies. Timelines for audits/inspection. GHTF study group 4 guidance document. ISO 13485.

UNIT-IV **ENT** **12 Hours**

Inspections: Pre-approval inspections , Inspection of pharmaceutical manufacturers, Inspection of drug distribution channels, Quality systems requirements for national good manufacturing practice inspectorates, inspection report, model certificate of good manufacturing practices, Root cause analysis, Corrective and Preventive action (CAPA).

UNIT-V **S** **12 Hours**

Product life cycle management: Prior Approval Supplement (PAS), Post Approval Changes [SUPAC], Changes Being Effected in 30 Days (CBE-30), Annual Report, Post marketing Reporting Requirements, Post approval Labeling Changes, Lifecycle Management, FDA Inspection and Enforcement, Establishment Inspection Report (EIR), Warning Letters, Recalls, Seizure and Injunctions. ISO Risk Management Standard

Suggested Readings A: (Latest edition)

1. Ginsbury, K., & Bismuth, G. Compliance Auditing for Pharmaceutical Manufacturers: A Practical Guide to In-Depth Systems Auditing. CRC Press.
2. Gad, S. C. (Ed.). Pharmaceutical manufacturing handbook: regulations and quality (Vol. 6). John Wiley & Sons.
3. Baird, R. M., Hodges, N. A., & Denyer, S. P. (Eds.). Handbook of Microbiological Quality Control in Pharmaceuticals and Medical Devices. CRC Press.
4. Singer, D. C., Stefan, R. I., & Van Staden, J. F. Laboratory Auditing for Quality and Regulatory Compliance. Taylor & Francis.
5. Endres, A. Implementing Juran's Road Map for Quality Leadership: Benchmarks and Results. John Wiley & Sons.
6. Antony , J., & Preece, D. (Eds.). Understanding, Managing and Implementing Quality: Frameworks, Techniques and Cases. Routledge.
7. Lawler, E. E., Mohrman, S. A., & Benson, G. Organizing For High Performance: Employee Involvement, TQM, Reengineering, and Knowledge Management in the Fortune 1000: The CEO report. Jossey-Bass.
8. Fairfield-Sonn, J. W. Corporate Culture and the Quality Organization. Greenwood Publishing Group.
9. Avery, C., & Zabel, D. The Quality Management Sourcebook: An International Guide to Materials and Resources. Routledge.
10. Tague,N. The Quality Toolbox. ASQ Publications
11. Joseph, M., Feo, J. Juran's Quality Handbook. ASQ Publications.
12. Okes, D. Root Cause Analysis: The Core of Problem Solving and Corrective Action-Chapter 1.ASQ Publications.
13. International Medical Device Regulators Forum (IMDRF) Medical Device Single Audit Program (MDSAP).

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(M.Pharm. - Regulatory Affairs)

(Semester - I)

L	T	P	C
4			4

Course Code	**MRA103T**
Course Title	**Clinical Research Regulations**

Scope

This course is designed to impart the fundamental knowledge on the clinical development process of drugs, pharmaceuticals and Medical Devices, phases and conduct of clinical trials and research, regulations and guidance governing the conduct of clinical research in India, USA and EU. It prepares the students to learn in detail on various laws, legislations and guidance related to safety, efficacy, ethical conduct and regulatory approval of clinical research.

Objectives

Upon completion of the course, the student shall be able to (know, do and appreciate)

1. History, origin and ethics of clinical and biomedical research and evaluation
2. Clinical drug, medical device development process and different types and phases of clinical trials
3. Regulatory requirements and guidance for conduct of clinical trials and research

Course Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Understand different phases of clinical trials for drug development process E-3
2. Describe the importance of ethics and documentation for clinical trials S-20
3. Differentiate clinical research regulations for drug products filing inIndia, USA and Europe ENT-13
4. Discuss different aspects of good clinical practices as per regulatory guidelines.S-20
5. Prepare different modules for dossier filing in USA and Europe ENT-13

Syllabus: **Teaching hours: 60 Hours**

UNIT-I **E** **12 Hours**

Clinical Drug Development Process

- Different types of Clinical Studies
- Phases of clinical trials, Clinical Trial protocol

- Phase O studies
- Phase I and subtype studies (single ascending, multiple ascending, dose escalation, methods, food effect studies, drug - drug interaction, PK end points
- Phase II studies (proof of concept or principle studies to establish efficacy)
- Phase III studies (Multi ethnicity, global clinical trial, registration studies)
- Phase IV studies (Post Marketing Studies; PSUR)

Clinical Investigation and Evaluation of Medical Devices & IVDs

Different Types of Studies

Key Concepts of Medical Device Clinical Evaluation

Key concepts of Clinical Investigation

UNIT-II S **12 Hours**

Ethics in Clinical Research:

- Historical Perspectives: Nuremberg Code, Thalidomide study, Nazis Trials, Tuskegee Syphilis Study, The Belmont Report, The declaration of Helsinki
- Origin of International Conference on Harmonization - Good Clinical Practice (ICH-GCP) guidelines.
- The ethics of randomized clinical trials
- The role of placebo in clinical trials
- Ethics of clinical research in special population
- Institutional Review Board/Independent Ethics Committee/Ethics Committee - composition, roles, responsibilities, review and approval process and ongoing monitoring of safety data
- Data safety monitoring boards.
- Responsibilities of sponsor, CRO, and investigator in ethical conduct of clinical research
- Ethical principles governing informed consent process
- Patient Information Sheet and lnfonned Consent Form
- The informed consent process and documentation

UNIT - III ENT **12 Hours**

Regulations governing Clinical Trials

India: Clinical Research regulations in India - Schedule Y & Medical Device Guidance USA:

Regulations to conduct drug studies in USA (FDA)

- NDA 505(b)(1) of the FD&C Act (Application for approval of a new drug)
- NDA 505(b)(2) of the FD&C Act (Application for approval of a new drug that relies, at least in part, on data not developed by the applicant)
- ANDA 505(j) of the FD&C Act (Application for approval of a generic drug product)
- FDA Guidance for Industry - Acceptance of Foreign Clinical Studies
- FDA Clinical Trials Guidance Document: Good Clinical Practice

EU: Clinical Research regulations in European Union (EMA)

UNIT-IV S **12 Hours**

Clinical Research Related Guidelines

- Good Clinical Practice Guidelines ([CH GCP *E6)*
- Indian GCP Guidelines
- ICMR Ethical Guidelines for Biomedical Research
- CDSCO guidelines

GHTF study group 5 guidance documents

Regulatory Guidance on Efficacy and Safety ICH Guidance's

- E4 - Dose Response Information to support Drug Registration
- E7 - Studies in support of General Population: Geriatrics
- ES - General Considerations of Clinical Trials
- E10 - Choice of Control Groups and Related Issues in Clinical Trials,
- E 11 - Clinical Investigation of Medicinal Products in the Pediatric Population
- General biostatics principle applied in clinical research

UNIT-V ENT **12 Hours**

USA & EU Guidance

USA: FDA Guidance

- CFR 21Part 50: Protection of Human Subjects
- CFR 21Part 54: Financial Disclosure by Clinical Investigators
- CFR 21Part 312: IND Application
- CFR 21Part 314: Application for FDA Approval to Market a New Drug
- CFR 21Part 320: Bioavailability and bioequivalence requirements
- CFR 21Part 812: Investigational Device Exemptions
- CFR 21Part 822: Post-market surveillance
- FDA Safety Reporting Requirements for INDs and BA/BE Studies
- FDA Med Watch
- Guidance for Industry: Good Pharmacovigilance Practices and Pharmacoepidemiologic Assessment

European Union: EMA Guidance

- EU Directives 2001
- EudraLex (EMEA) Volume 3 - Scientific guidelines for medicinal products for human use
- EU Annual Safety Report **(ASR)**
- Volume 9A- Pharmacovigilance for Medicinal Products for Human Use
- EU MDD with respect to clinical research
- ISO 14155

Suggested Readings": (Latest edition)

1. Rozovsky, F. A., & Adams, R. K. Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance.
2. Barnes, M., Kulynych, J. HIPAA and Human Subjects Research: A Question and Answer.
3. Gallin, J. I., & Ognibene, F. P. (Eds.). Principles and Practice of Clinical Research. Academic Press.
4. Karlberg, J. P. E., & Speers, **M.** A. (Eds.). Reviewing Clinical Trials: A Guide for the Ethics Committee. Clinical Trials Centre.
5. Cartwright, A. C., & Matthews, B. R. (Eds.). International Pharmaceutical Product Registration. CRC Press.
6. Guarino, R. New Drug Approval Process. Marcel Dekker Inc.
7. Pisano, D. J., & Mantus, D. FDA Regulatory Affairs. CRC Press.
8. Country Specific Guidelines from Official Websites.
9. Drugs & Cosmetics Act & Rules and Amendments

RECOMMENDED WEBSITES:

1. EU Clinical Research Directive 2001: http://www.eortc.be/services/doc /clinical- eudirective-04-april-01.pdf
2. Code of Federal Regulations, FDA: http://www.accessdata.fda.gov /scripts/cdrh/cfdocs/cfcfr/cfrsearch.cfm
3. Guidelines oflntemational Conference on Harmonization: http://www. ich.org/products/guidelines.html
4. Eudralex Guidelines: http://www.gmpcompliance .info/euguide.htm
5. FDA New Drug Application: http://www.fda.gov/regulatoryinformation/legislation/FederalFoodDrugandCosmeticActFDCAct/FDCActChapterVDrugsandDevices /ucm108125.htm
6. http://www.fda.gov/regulatoryinformation/legislation/FederalFoodDrugandCosmetic ActFDCAct/FDCActChapterVDrugsandDevices /ucm108125.htm
7. Medicines and Healthcare products Regulatory Agency: http://www .rnhra.gov.uk
8. Central Drugs Standard Control Organization Guidance for Industry: http://cdsco.nic.in/CDSCO-GuidanceForindustry.pdf
9. ICMR Ethical Guidelines for Biomedical Research: http://icmr.nic.in /ethical_guidelines.pdf

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(M.Pharm. - Regulatory Affairs)

(Semester - I)

L	T	P	C
4			4

Course Code	**MRA104T**
Course Title	**Regulations and Legislation for Drugs & Cosmetics, Medical Devices, Biologicals & Herbals, and Food & Nutraceuticals in India and Intellectual Property Rights**

Scope

This course is designed to impart fundamental knowledge on regulations and legislation in India w.r.t. Drugs & Cosmetics, Medical Devices, Biologicals & Herbals, and Food & Nutraceuticals. It prepares the students for basic regulatory requirements in India of Drugs & Cosmetics, Medical Devices, Biologicals & Herbals, and Food & Nutraceuticals. for manufacture, import & registration, export, sale, marketing authorization, clinical trials and intellectual property rights.

Objectives

Upon the completion of the course the student shall be able to:

1. Know different Acts and guidelines that regulate Drugs & Cosmetics, Medical Devices, Biologicals & Herbals, and Food & Nutraceuticals industry in India.
2. Understand the approval process and regulatory requirements for Drugs & Cosmetics, Medical Devices, Biologicals & Herbals, and Food & Nutraceuticals

Course Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Understand the rules and regulations for biologicals, herbals, food and nutraceuticals E-3 2.

Describe the regulatory requirements and approval procedures for drugs, cosmetics,

medical devices etc. E-3

3. Discuss pharmacopoeia! standards and other standards like BIS and ISOENT-14,15
4. Explain regulatory requirements for bioequivalence study S-20
5. Tell IPR issues, patent filing, copyright and trademarks E-3

Syllabus: UNIT-I **E** **Teaching hours: 60 Hours**

12 Hours

Biologicals & Herbals, and Food & Nutraceuticals Acts and Rules (with latest amendments):

- Drugs and Cosmetics Act 1940 and Rules 1945: DPCO and NPPA
- Other relevant provisions (rules schedules and guidelines for approval of Drugs & Cosmetics, Medical Devices, Biologicals & Herbals, and Food & Nutraceuticals in India

Other relevant Acts: Narcotics Drugs and Psychotropic Substances Act; Medicinal and Toilet Preparations (Excise Duties) Act, 1955; Phannacy Act, 1948; Drugs and Magic Remedies (Objectionable Advertisements) Act, 1955; Prevention of Cruelty to Animals Act.

UNIT-II E **12 Hours**

Regulatory requirements and approval procedures for Drugs & Cosmetics Medical Devices, Biologicals & Herbals, and Food & Nutraceuticals

CDSCO (Central Drug Standard Control Organization) and State Licensing Authority: Organization, Responsibilities

- Rules, regulations, guidelines and standards for regulatory filing of Drugs & Cosmetics, Medical Devices, Biologicals & Herbals, and Food & Nutraceuticals
- Format and contents of Regulatory dossier filing Clinical trial/ investigations

UNIT - III ENT **12 Hours**

Indian Pharmacopoeia) Standards, BIS standards and ISO and other relevant standards

UNIT-IV **S 12 Hours**

Bioavailability and Bioequivalence data (BA &BE), BCS Classification of Drugs, Regulatory Requirements for Bioequivalence study

Stability requirements: ICH and WHO

Guidelines for Drug testing in animals/Preclinical Studies

Animal testing: Rationale for conducting studies, CPCSEA Guidelines

Ethical guidelines for human participants

ICMR-DBT Guidelines for Stem Cell Research

UNIT-V E **12 Hours**

Intellectual Property Rights: Patent, Trademark, Copyright, Industrial Designs and Geographical Indications, Indian Patent Scenario. IPR vs Regulatory Affairs

Suggested Readings": (Latest edition)

1. Manual of Patent Practice & Procedure, 3rd Edition, by The Patent Office oflndia.
2. Bessen, J., & Meurer, M. J. (2008). Patent failure: How judges, bureaucrats, and lawyers put innovators at risk. Princeton University Press.
3. Chin, R., & Lee, B. Y. (2008). Principles and practice of clinical trial medicine. Elsevier.
4. Ethical Guidelines for Biomedical Research on Human Participants by Indian Council of Medical Research New Delhi 2006.
5. CPCSEA Guidelines for Laboratory Animal Facility by Committee for the purpose of control and supervision on experiments on animals (CPCSEA).
6. ICH E6 Guideline - Good Clinical Practicell by ICH Harmonised Tripartite.
7. Guidance for Industry on Submission of Clinical Trial Application for Evaluating Safety and Efficacy by CDSCO (Central Drug Standard Control Organisation).
8. Guidance for Industry on Requirement of Chemical & Pharmaceutical Information including Stability Study Data before approval of clinical trials / BE studies by CDSCO.
9. Guidelines for Import and Manufacture of Medical Devices by CDSCO.
10. Guidelines from official website of CDSCO.

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(M.Pharm. - Regulatory Affairs)

(Semester - I)

L	T	P	C
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Course Code	**MRA105P**
Course Title	**Regulatory Affairs Practical I**

Syllabus: **Teaching hours: 180 Hours**

1. Case studies (4 Nos.) of each of Good Pharmaceutical Practices.
2. Documentation for in process and finished products Quality control tests for Solid, liquid, Semisolid and Sterile preparations.
3. Preparation of SOPs, Analytical reports (Stability and validation)
4. Protocol preparation for documentation of various types ofrecords (BMR, MFR, DR)
5. Labeling comparison between brand & generics.
6. Preparation of clinical trial protocol for registering trial in India
7. Registration for conducting BA/ BE studies in India
8. Import of drugs for research and developmental activities
9. Preparation ofregulatory dossier as per Indian CTD format and submission in SUGAM
10. Registering for different Intellectual Property Rights in India
11. GMP Audit Requirements as per CDSCO
12. Preparation and documentation for Indian Patent application.
13. Preparation of checklist for registration of IND as per ICH CTD format.
14. Preparation of checklist for registration ofNDA as per ICH CTD format.
15. Preparation of checklist for registration of ANDA as per ICH CTD format.
16. Case studies on response with scientific rationale to USFDA Warning Letter
17. Preparation of submission checklist of IMPD for EU submission.
18. Comparison study of marketing authorization procedures in EU.
19. Comparative study of DMF system in US, EU and Japan
20. Preparation of regulatory submission using eCTD software
21. Preparation of Clinical Trial Application (CTA) for US submission
22. Preparation of Clinical Trial Application (CTA) for EU submission
23. Comparison of Clinical Trial Application requirements of US, EU and Japan of a dosage form.
24. Regulatory requirements checklist for conducting clinical trials in India.
25. Regulatory requirements checklist for conducting clinical trials in Europe.
26. Regulatory requirements checklist for conducting clinical trials in USA

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(M.Pharm. - Regulatory Affairs)

(Semester - I)

L	T	p	C
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Course Code	**MRA106S**
Course Title	**Seminar /Assignment-I**

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Nirma University

Institute of Pharmacy

M. Pharm. Semester - I

COURSE NAME: ADVANCED INSTRUMENTAL METHODS [3PH106]

Learning outcomes:

After successful completion of the course, student will be able to:

- Understand the fundamentals of spectroscopy and chromatographic techniques.
- Use spectroscopy for the quantitative and qualitative analysis of drugs.
- Predict the structure of unknown compounds.

Theory (Detailed Syllabus) **L P C**

3 3 5

Applications and recent trends in the modem methodology used for the analysis of drugs and their metabolites of the following techniques

A) Spectroscopic Techniques

UV-Visible spectrophotometry: Theory of electronic spectroscopy , absorption by organic molecules, choice of solvent and solvent effect, applications ofUV-Visible spectroscopy, Woodward - Fischer rules for calculating absorption maximum, photometric titrations an its applications

Infra-red spectrophotometry: Absorption in the infrared region, factors influencing molecular vibrations, Canculation of vibrational frequencies, applications, interpretation of infra red spectra, FTIR- Theory, Instrumentation, Attenuated Total reflectance spectroscopy (ATR)

Nuclear Magnetic Resonance Spectroscopy: Basic principles, theory of PMR spectroscopy, Instrumentation, applications, Chemical shift, spin-spin coupling, factors affecting chemical shift and spin coupling, ^{13}C NMR spectroscopy, interpretation ofNMR spectra, 2D NMR spectroscopy Mass spectroscopy : Basic principles, ion formation and types, Fragmentation rules, recognition of molecular ion peak, Tandem mass spectroscopy, MALDI, FAB, SIMS, Structure elucidation of pharmaceutical compounds using different spectroscopic Techniques like UV-Visible, IR, NMR, MASS etc..

B) Separation Techniques

Classification of chromatographic methods based upon mechanism of separation, mode of separation, ion pair chromatography and applications

1. High Pressure Liquid Chromatography: RP-HPLC, chiral, Hydrophobic interaction, Size exclusion, Ion exchange, Affinity chromatography, ion chromatography
2. Gas chromatography: column operation, derivatization methods
3. Hyphenated techniques: LC-MS, LC-MS/MS, GC-MS, tandam mass spectroscopy
4. HPTLC
5. Super Critical Fluid Chromatography: Basic Principles, Instrumentation

Practical

I Analysis of drugs and raw materials using official pharmacopoeia! methods based on modern instrumental techniques.

2 Testing of related substances and foreign substances in raw materials as per LP.
3 Assay for the raw materials, calculated either on anhydrous or hydrous basis as per LP.
4 Interpretation of UV, IR, NMR and Mass spectra and its use in structure elucidation.

Books Recommended

1. R. M. Silversterin, G. C. Bassler and T. C. Morrihl, Spectrometric Identification of Organic Compounds, 6th edn, John Wiley, New York, 1998.
2. P. S. Kalsi, Spectroscopy of Organic Compounds, New Age Publication, 2002.
3. D. A. Skoog, E. J. Holler and T. A. Nieman, Principles oflnstrumental Analysis , Harcourt Asia Pte Ltd, 2001.
4. S. Lind say, High Performance Liquid Chromatog raphy, Analytical Chemistry by Open Learning (ACOL), Wiley, 1 987.
5. Sethi, P.D., High performance thin layer chromatography: Quantitative analysis of pharmaceutical formulations , 1996.

Nirma University
Institute of Pharmacy

M.Pharm. [Regulatory Affairs & Quality Assurance] SEMESTER- I

COURSE NAME : PHARMACEUTICAL REGULATORY PRACTICES [3PR101]

Learning Outcomes:

Upon completion of the course, the student will be able to

- Understand fundamentals & history of drug regulatory requirements in India and other countries.
- Determine the need of the documents & process required to file a new product in various countries.
- Create documentation required to carry out clinical studies and pharmacovigilance

Theory (Detailed Syllabus)

L	P	C
3	6	6

1. ***Drug Regulation***
   a. Objectives and Issues,
   Pharmaceutical Legislation

2. ***Regulatory Framework***
   a. Mission and Goals of Drug Regulation, Historical Development of Drug Regulation
   b. Indian Regulatory Authorities, Very brief introduction regarding D&C Act, 1940 and rules there under, Guidelines for Import, Export, Manufacturing and distribution of drugs in India.
   c. Regulatory Bodies of Different Countries like USA, UK, Brazil, Australia, Japan, China etc., Other Non-Regulatory Pharmaceutical Functions
3. Harmonization of Regulatory Guidelines. Guidelines given by ICH, Common Technical Document (CTD), Electronic CTD, Harmonization of Pharmacopoeia! standards.
4. WHO guidelines and its relevance in international registration.
5. Basics of Clinical trials and Clinical Research, Preclinical studies, Features of Clinical Trials, Good Clinical Practices, Bioavailability studies.
6. Introduction to drug safety and Pharmacovigilance

Practicals

Practicals related to the topics covered in theory

Resources:

1. Official websites related to various guidelines.
2. Drug & Cosmetic Act, 1940, Controller of Public ations, India.
3. www.ICH.org
4. Encyclopaedia of clinical pharmacy, Edited by Joseph T. Dipiro, Marcel Dekker.
5. Preclinical Development Handbook, Toxicology, Edited by Shayne Cox Gad, Wiley Interscience.
6. FDA regulatory affairs, Edited by, Douglas J. Pisano, CRS Press.
7. The Pharmaceutical Regulatory Process edited by Ira R.Berry, Marcel Dekker.

M.Pharm. [Regulatory Affairs & Quality Assurance) SEMESTER- I

COURSE NAME: VALIDATION IN PHARMCEUTICAL MANUFACTURING [3PA102]

Learning Outcomes:

Upon completion of the course, the student will be able to

- Utilize fundamentals of different types of validations in pharmaceutical manufacturing.
- Set up, develop and validate new analytical methods for new drugs and substances.
- Describe the process and documentation required like SOP, reports of various processes as well as able to carry out calibration of various equipments.

Theory (Detailed Syllabus)

	L	P	C
	3	3	5

1. Definition, Scope and design of process validation, Validation of API and finished products- Parenteral and nonparenteral.
2. Perspective & Retrospective Process Validation: Organization & documentation of process validation. IQ, OQ and PQ. Preparation of validation protocol.
3. Validation of Analytical Methods, Calibration oflnstruments and equipment like **pH** meter, Dry air oven, Autoclave etc.
4. Validation of sterilization methods and equipments, Dry heat sterilization, Autoclaving, Aseptic membrane filtration.
5. Validation of water supply system, distilled water and water for injection, Validation of air handling equipments in sterile and non-sterile areas.
6. Area qualification, Utility Qualification and Equipment Qualification
7. Introduction to validation of computer assisted process.
8. Cleaning validation.
9. PAT-Introduction, Importance and Application of PAT guidelines.

Practicals

Practicals related to

1. Calibration of different glasswares.
2. Calibration and validation of Instruments
3. Validation and optimization of manufacturing processes
4. Validation of sterile area.

Books Recommended

1. Validation in Pharmaceutical industry: concepts , approaches and guidelines by PP Sharma, vandana Publications Pvt Ltd., New Delhi , 2007.
2. Pharmaceutical Process Validaton by Robert A. Nash & Alfred **H.** Wachter , 3rd edition , Marcel dekker Inc., New York.
3. Analytical Method Validation and Instrument Performance Verification by Chung Chow Chan, Y.C. Lee., Herman Lam, Xue-Ming Zhang, JohnWiley & Sons Inc., 2004.
4. Validation of Active Pharmaceutical Ingredients by Ira R. Berry & Daniel Harpaz, 2nd edition , CRC Press, 2001.

M.Pharm. Semester - I

COURSE NAME: COMMUNICATION SKILLS FOR PHARMACISTS [3PH108]

Learning Outcomes:

After successful completion of the course student will be able to :

- Use appropriate vocabulary for fluent and confident oral communication
- Recognize and understand important aspects of non-verbal communication
- Demonstrate communication capacities in speaking, writing, listening and narrating in English
- Prepare curriculum vitae and job application

Tutorial (Detailed Syllabus)

L	T	C
	2	2

Practice Assignments based on the following topics be conducted

1. **Non-verbal communication**
   Meaning and process of pharmaceutical communication kinesics, types of communication, psychological and social aspects of communication, barriers to effective communication.
2. **Oral communication (verbal communication)**
   Effective presentation skills, group discussion dynamics, personal interview techniques, seminar presentation, media choice for oral presentation, active listening through recorded speech. correct pronunciation, group discussion. delivering the speech or presentation, traditional text based oral presentation. visual element of texts, tables, figures, charts, etc.
3. **Written communication**
   Technical - writing and discussion, technical instructions, writing research papers, paragraph development, curriculum vitae and job application.
4. **Mechanics of language and vocabulary building**
5. **Listening skills**
   Ty2es of listening, barriers to effective listening, tips to improve listening skills.

Books Recommended

1. Tindall W.N, Beardsley R.S., Kimberlin C.L., Communication Skills in Pharmacy Practice: A Practical Guide for Students and Practitioners, Lippincott Williams & Wilkins.
2. J. R. Matthews and R.W. Matthews, Successful Scientific Writing, Cambridge University Press Singapore.
3. R. A. Day, How to write and publish a scientific paper, Cambridge University Press Singapore.
4. A. J. Rutherford , Basic Communication Skills for Technology, Pearson.
5. R.C. Sharma and K. Mohan Business Correspondence and Report Writing Tata McGraw

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M. Pharm. Semester - I

COURSE NAME: SUBJECT SEMINAR [3PT104]

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NIRMA UNIVERSITY

Institute of Pharmacy

(M. Pharm - Regulatory Affairs)

(Semester - II)

L	T	P	C
4			4

Course Code	**MRA201T**
Course Title	**Regulatory Aspects of Drugs and Cosmetics**

Scope:

This course is designed to impart the fundamental knowledge on the drug development process, regulatory requirements for approval of new drugs, drug products and cosmetics in regulated and semi-regulated countries. It prepares the students to learn in detail on the regulatory requirements, documentation requirements, and registration procedures for marketing the drug products and cosmetics in regulated and semi-regulated countries.

Objectives:

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

1. Process of drug discovery and development and generic product development.
2. Regulatory approval process and registration procedures for API and drug products in US, EU.
3. Cosmetics regulations in regulated and semi-regulated countries.
4. A comparative study oflndia with other global regulated markets.

Course Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Understand the basics of global regulatory requirements. E-3
2. Describe the Process of drug discovery, development and generic Product development. S- 20
3. Explain the guidelines for registration and approval process for API, drug products (including orphan drugs) and cosmetics in US, Canada and EU. ENT-13,15
4. Express the organization, legislations, regulations and registration procedures of PMDA. ENT-13,15
5. Apply the knowledge of regulatory requirements for emerging market. E-3
6. Compare the regulatory requirement for registration of drugs in brazil, ASEAN, CIS and GCC countries. S-20

Syllabus: **Teaching hours: 60 Hours**

UNIT I **12 Hours**

USA & CANADA: E

Organization structure and functions of FDA. Federal register and Code of Federal Regulations (CFR), History and evolution of United States Federal, Food, Drug and Cosmetic Act (FFDCA), Hatch Waxman act and Orange book, Purple book, Drug Master Files (DMF) system in US, Regulatory Approval Process for Investigational New Drug ([IND) , New Drug Application (NDA), Abbreviated New Drug Application (ANDA), Supplemental New Drug Application (SNDA); Regulatory requirements for Orphan drugs and Combination Products, Changes to an approved NDA / ANDA. Regulatory considerations for manufacturing, packaging and labeling of pharmaceuticals in USA. Legislation and regulations for impo rt, manufacture, distribution and sale of cosmetics in USA and Canada.

UNIT II **12 Hours**

European Union & Australia: S

Organization and structure of EMA & EDQM, General guidelines, Active Substance Master Files (ASMF) system in EU, Content and approval process of IMPD, Marketing Authorization procedures in EU (Centralized procedure, Decentralized procedure, Mutual recognition procedure and National Procedure). Regulatory considerations for manufacturing, packaging and labeling of pharmaceuticals in EU, Eudralex directives for human medicines, Variations & extensions, Compliance of European Pharmacopoeia CEP / Certificate of Suitability (Co§) , Marketing Authorization (MA) transfers, Qualified Person (QP) in EU. Legislation and regulations for import, manufacture, distribution and sale of cosmetics in European Union & Australia.

UNIT III **12 Hours**

Japan: ENT

Organization of the PMDA, Pharmaceutical Laws and regulations, types of registration applications, DMF system in Japan, drug regulatory approval process, Regulatory considerations for manufacturing, packaging and labeling of pharmaceuticals in Japan, Post marketing surveillance in Japan. Legislation and regulations for import, manufacture, distribution and sale of cosmetics in Japan.

UNIT IV **12 Hours**

Emerging Market: ENT

Introduction, Countries covered, Study of the world map, study of various committees across the globe (ASEAN, APEC, EAC, GCC, PANDRH, SADC).

WHO: WHO, GMP, Regulatory Requirements for registration of drugs and post approval requirements in WHO through prequalification programme, Certificate of Pharmaceutical Product (Co - General and Country Specific (South Africa, Egypt, Algeria and Morocco, Nigeria, Kenya and Botswana).

Brazil, ASEAN, CIS and GCC Countries:

ASIAN Countries:

Introduction to ACTD, Regulatory Requirements for registration of drugs and post approval requirements in China and South Korea & Association of Southeast Asian Nations (ASEAN) Region i.e. Vietnam, Malaysia, Philippines, Singapore and Thailand.

CIS (Commonwealth Independent States):

Regulatory prerequisites related to Marketing authorization requirements for drugs and post approval requirements in CIS countries i.e. Russia, Kazakhstan and Ukraine.

GCC (Gulf Cooperation Council) for Arab states:

Regulatory pre-requisites related to Marketing authorization requirements for drugs and post approval requirements in Saudi Arabia and UAE.

Legislation and regulations for import, manufacture, distribution and sale of cosmetics in Brazil, ASEAN, CIS and GCC Countries.

Suggested Readings": (Latest edition)

1. Shargel, L., & Kanfer, I. *Generic drug product development: solid oral dosage forms.* CRC Press.
2. Ira, Berry, *The Pharmaceutical Regulatory Process,* Marcel Dekker Series, Vol 144.
3. Ira, Berry. & Robert, Martin. *The Pharmaceutical Regulatory Process, Drugs and the pharmaceutical sciences,* Vol.185. Informa Healthcare Publishers.
4. Richard, G. *New Drug Approval Process: Accelerating Global Registrations, Drugs and the Pharmaceutical Sciences,* Vol.190.
5. Weinberg, S. *Guidebook for Drug Regulatory Submissions.* John Wiley & Sons.
6. Ng, R. Drugs: *From discovery to approval.* John Wiley & Sons.
7. Mathieu, M. P., Keeney, R., & Milne, C. P. *New drug development: a regulatory overview.* Parexel International Corp.
8. Jeffrey, F., Wayne, Pines & Gary, H. *Pharmaceutical Risk Management.*
9. William, K. *Preparation and Maintenance of the IND Application in eCTD Format.*
10. http://www.pmda.go.jp/english
11. http://www.fda.gov
12. http://portal.anvisa.gov.br /wps/portal/anvisa-ingles
13. http://www.ema.europa.eu
14. Country Specific Guidelines from official websites
15. http://www.who.int/medicines /areas/quality_safety/regulation _leg is lation /ListMRAWebsit es.pdf
16. Denis, H. *Roadmap to an ASEAN economic community.* ISEAS Publications, Singapore , ISBN98 l-230-347-2
17. Rodolfo, S. *ASEAN.* !SEAS Publications , Singapore, ISBN 978-981-230-750-7

18. Kobayashi-Hillary, M. *Building a future with BRICS: the next decade for offshoring* (Vol. 4643). Springer Science & Business Media.
19. Kobayashi-Hillary, M. *Outsourcing to India: The offshore advantage.* Springer Science & Business Media.
20. *The world Bank,* Washington, DC, ISBN: 0-8212-5896-0.
21. Abbott, F. M., Dukes, M. N. G., & Dukes, G. *Global pharmaceutical policy: ensuring medicines for tomorrow's world.* Edward Elgar Publishing.
22. Low, L., & Salazar, L. C. *The Gulf Cooperation Council: a rising power and lessons for ASEAN* (No. 12). Institute of Southeast Asian Studies.
23. Bhasin, B. *Doing business in the ASEAN countries.* Business Expert Press.
24. Plummer, M. G., & Yue, C. S. *Realizing the ASEAN economic community: A comprehensive assessment. Institute of Southeast Asian Studies.*

L= Lecture, T= Tutorial, P= Practical, C= Credit "

this is not an exhaustive list

(M. Pharm - Regulatory Affairs)

(Semester - II)

L	T	P	C
4			4

Course Code	**MRA202T**
Course Title	**Regulatory Aspects of Herbal and Biologicals**

Scope:

This course is designed to impart fundamental knowledge on regulatory requirements, licensing and registration, regulation on labelling of biologics in India, USA and Europe. It prepares the students to learn in detail on regulatory requirements for biologics, vaccines and blood products.

Objectives:

Upon the completion of the course the student shall be able to -

1. Know the regulatory requirements for biologics and vaccines.
2. Understand the regulation for newly developed biologics and biosimilars.
3. Know the pre-clinical and clinical development considerations of biologics.
4. Understand the regulatory requirements of blood and/or its components including blood products and label requirements.

Course Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Understand the requirement of similar biologics from development to market authorization in India. E-3
2. D iscuss the regulatory requirements for the biosimilars in US and EU. S-20
3. Know preclinical and clinical development of biologics. ENT 13,15
4. Apply knowledge of regulatory aspects of vaccines, blood products and biological products in India, US and EU. ENT 13,15
5. Compare quality, safety, and legislation for herbal products in India, US and EU. S-20

Syllabus: UNITI E **Teaching hours: 60 Hours**

12 Hours

India:

Introduction, Applicable Regulations and Guidelines , Principles for Development of Similar Biologics, Data Requirements for Preclinical Studies, Data Requirements for Clinical Trial Application, Data Requirements for Market Authorization Application, Post-Market Data for Similar Biologics, Pharmacovigilance. GMP and GDP.

UNIT II S **12 Hours**

USA:

Introduction to Biologics; biologics, biological and biosimilars, different biological products, difference between generic drug and biosimilars, laws, regulations and guidance on biologics/ biosimilars, development and approval of biologics and biosimilars (IND, PMA, BLA, NDA, 510(k), pre-clinical and clinical development considerations, advertising, labelling and packing of biologics.

UNIT III ENT **12 Hours**

European Union:

Introduction to Biologics; directives, scientific guidelines and guidance related to biologics in EU, comparability/ biosimilarity assessment, Plasma master file, TSE/ BSE evaluation, development and regulatory approval of biologics (Investigational medicinal products and biosimilars), pre-clinical and clinical development considerations; stability, safety, advertising, labelling and packing of biologics in EU.

UNITIV ENT **12 Hours**

Vaccine regulations in India, US and European Union:

Clinical evaluation, Marketing authorisation, Registration or licensing, Quality assessment, Pharmacovigilance, Additional requirements Blood and Blood Products Regulations in India, US and European Union: Regulatory Requirements of Blood and/or Its Components Including Blood Products, Label Requirements, ISBT (International Society of Blood Transfusion) and IHN (International Haemovigilence Network).

UNITV S **12 Hours**

Herbal Products:

Quality, safety and legislation for herbal products in India, USA and European Union.

Suggested ReadingsA: (Latest edition)

1. Pisano, D. J., & Mantus, D. S. *FDA regulatory affairs: a guide for prescription drugs, medical devices, and biologics.* Taylor & Francis US.
2. Wang, W., & Singh, M. *Biological drug products: development and strategies.* John Wiley & Sons.
3. Singh , M. ,Srivastava, I. *Development of Vaccines: From Discovery to Clinical Testing,* Wiley.
4. www.who.int/biologicals/en
5. www.fda.gov/BiologicsBloodVaccines/GuidanceComplianceRegulato rylnformation/
6. www.ihn-org.com
7. www.isbtweb.org
8. *Guidelines on Similar Biologics: Regulatory Requirements for Marketing Authorization in India.*
9. www.cdsco.nic.in
10. www.ema.europa.eu > scientific guidelines > Biologicals
11. www.fda.gov/biologicsbloodVaccines/Guida Regulatory Information nceCompliance (Biologics)
12. www.ayush.gov.in

L= Lecture, T= Tutorial, P= Practical, C= Credit

A this is not an exhaustive list

(M. Pharm - Regulatory Affairs)

(Semester - II)

L	T	P	C
4			4

Course Code	**MRA203T**
Course Title	**Regulatory Aspects of Medical Devices**

Scope:

This course is designed to impart the fundamental knowledge on the medical devices and in vitro diagnostics, basis of classification and product life cycle of medical devices, regulatory requirements for approval of medical devices in regulated countries like US, EU and Asian countries along with WHO regulations. It prepares the students to learn in detail on the harmonization initiatives, quality and ethical considerations, regulatory and documentation requirements for marketing medical devices and IVDs in regulated countries.

Objectives:

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

1. Basics of medical devices and IVDs, process of development, ethical and quality considerations.
2. Harmonization initiatives for approval and marketing of medical devices and IVDs.
3. Regulatory approval process for medical devices and IVDs in India, US, Canada, EU, Japan and ASEAN.
4. Clinical evaluation and investigation of medical devices and IVDs.

Course Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Understand the definition, classification and principlesof medical devices and IVDs. E-3
2. Describe the principle of ethics in clinical investigations of medical devices.E-3
3. Explain the quality system regulations and ISO certification for medical devices.ENT- 13,15
4. Report regulatory approval process for medical device in US and EU. ENT-13,15
5. Apply the knowledge of regulatory approval process for medical device in ASEAN, China and Japan. S-20

Syllabus: UNIT I **E** **Teaching hours : 60 Hours**

12 Hours

Medical Devices:

Introduction, Definition, Risk based classification and Essential Principles of Medical Devices and IVDs. Differentiating medical devices IVDs and Combination Products from that of pharmaceuticals, History of Medical Device Regulation, Product Lifecycle of Medical Devices and Classification of Medical Devices.

IMDRF/GHTF:

Introduction, Organizational Structure , Purpose and Functions, Regulatory Guidelines, Working Groups, Summary Technical Document (STED), Global Medical Device Nomenclature (GMDN).

UNIT II **E 12 Hours**

Ethics:

Clinical Investigation of Medical Devices, Clinical Investigation Plan for Medical Devices, Good Clinical Practice for Clinical Investigation of medical devices (ISO 14155:2011).

Quality: Quality System Regulations of Medical Devices:

ISO 13485, Quality Risk Management of Medical Devices: ISO 14971, Validation and Verification of Medical device, Adverse Event Reporting of Medical device.

UNIT III USA: **ENT**

Introduction, Classification, Regulatory approval process for Medical Devices (51Ok) Premarket Notification, Pre-Market Approval (PMA,), Investigational Device Exemption (IDE) and In vitro Diagnostics, Quality System Requirements 21 CFR Part 820, Labeling requirements 21 CFR Part 801, Post marketing surveillance of MD and Unique Device Identification (μ) I). Basics of In vitro diagnostics, classification and approval process.

UNITIV ENT **12 Hours**

European Union:

Introduction, Classification, Regulatory approval process for Medical Devices (Medical Device Directive, Active Implantable Medical Device Directive) and In vitro Diagnostics (In Vitro Diagnostics Directive), CE certification process. Basics of In vitro diagnostics, classification and approval process.

UNITV S **12 Hours**

ASEAN, China & Japan:

Medical Devices and IVDs, Regulatory registration procedures, Quality System requirements and clinical evaluation and in vestigation.

IMDRF study groups and guidance documents.

Suggested Readings A: (Latest edition)

1. Pisano, D. J., & Mantus, D. S. *FDA regulatory affairs: a guide for prescription drugs, medical devices , and biologics*. Taylor & Francis US.
2. Kahan, J. S. *Medical Device Development: A Regulatory Overvie.*
3. Tobin, J. J., & Walsh, G. *Medical product regulatory affairs: pharmaceuticals, diagnostics, medical devices* . John Wiley & Sons.
4. Medina, C. *Compliance Handbook for Pharmaceuticals, Medical Devices, and Biologics.* CRC Press.
5. Country Specific Guidelines from official websites.
6. http://www.pmda.go.jp/english
7. http://www.fda.gov
8. http://www.ema.europa.eu
9. www.1so.org
10. www.eng.sfda.gov.cn
11. www.asean.org

L= Lecture, T= Tutorial, P= Practical, C= Credit

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(M. Pharm - Regulatory Affairs)

(Semester - II)

L	T	P	C
4			4

Course Code	**MRA204T**
Course Title	**Regulatory Aspects of Food & Nutraceuticals**

Scope:

This course 1s designed to impart the fundamental knowledge on regulatory requirements, registration and labeling regulations of nutraceuticals in India, USA and Europe. It prepares the students to learn in detail on regulatory aspects for nutraceuticals and food supplements.

Objectives:

Upon completion of the course, the student shall be able to -

1. Know the regulatory requirements for nutraceuticals.
2. Understand the regulation for registration and labeling of nutraceuticals and food supplements in India, USA and Europe.

Course Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. Understand the terminologies for food and nutraceuticals. E-3
2. Discuss the guidelines and GMPs for nutraceuticals. ENT-13,15

B. E xplain regulations for food safety and nutraceuticals in India. ENT-13, 15
4. Report regulations for food safety and nutraceuticals in US. S-20
5. Apply the knowledge of food safety and nutraceuticals in EU. E-3

Syllabus: UNIT I E **Teaching hours: 60 Hours**

12 Hours

Nutraceuticals:

Introduction, History of Food and Nutraceutical Regulations, Meaning of Nutraceuticals, Dietary Supplements, Functional Foods, Medical Foods, Scope and Opportunities in Nutraceutical Market.

UNITII ENT **12 Hours**

Global Aspects:

WHO guidelines on nutrition. NSF International: Its Role in the Dietary Supplements and Nutraceuticals Industries, NSF Certification, NSF Standards for Food And Dietary Supplements. Good Manufacturing Practices for Nutraceuticals.

UNIT III ENT **12 Hours**

India:

Food Safety and Standards Act, Food Safety and Standards Authority of India: Organization and Functions, Regulations for import, manufacture and sale of nutraceutical products in India, Recommended Dietary Allowances (RDA) in India.

UNIT IV USA: **S**

US FDA Food Safety Modernization Act, Dietary Supplement Health and Education Act. U.S. regulations for manufacture and sale of nutraceuticals and dietary supplements, Labelling Requirements and Label Claims for Dietary Supplements, Recommended Dietary Allowances (RDA) in the U.S.

UNITV E **12 Hours**

European Union:

European Food Safety Authority (EFSA): Organization and Functions. EU Directives and regulations for manufacture and sale of nutraceuticals and dietary supplements.

Nutrition labelling. European Regulation on Novel Foods and Novel Food Ingredients. Recommended Dietary Allowances (RDA) in Europe.

Suggested Readings A: (Latest edition)

1. Hasler, C. **M.** *Regulation of functional foods and nutraceuticals: a global perspective* (Vol. 5). John Wiley & Sons.
2. Bagchi, D. *Nutraceutical and functional food regulations in the United States and around the world.* Academic press.
3. http://www.who.int/publications/guidelines/nutrition /en/

4. http://www.europarl.europa .eu/RegData /etudes/STUD/2015/536324/IPOL_STU(2015)536324_EN.pdf
5. Pathak, Y. V. *Handbook of Nutraceuticals Volume II: Scale-Up, Processing and Automation* (Vol. 2). CRC Press.
6. Fortin, N. D. *Food regulation: law, science, policy, and practice.* John Wiley & Sons.
7. Country Specific Guidelines from official websites
8. www.cdsco.nic.in
9. www.fda.gov
10. www.ema.europa.eu
11. www.who.int
12. www.nsf.org

L	T	P	C
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L= Lecture, T= Tutorial, P= Practical, C= Credit "
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(M. Pharm - Regulatory Affairs)
(Semester - II)

Course Code	MRA205P
Course Title	Regulatory Affairs Practical II

Syllabus: **Teaching hours: 180 Hours**

1. Case studies on change management/ change control deviations and Corrective & Preventive Actions (CAPA).
2. Documentation of raw materials analysis as per official monographs.
3. Preparation of audit checklist for various agencies.
4. Preparation of submission to FDA usin g eCTD software.
5. Preparation of submission to EMA using eCTD software.
6. Preparation of submission to MHRA using eCTD software.
7. Preparation of Biologics License Applications (BLA).
8. Preparation of documents required for Vaccine Product Approval.
9. Comparison of clinical trial application requirements of US, EU and India of Biologics
10. Preparation of Checklist for Registration of Blood and Blood Products.
11. Registration requirement comparison study in 5 emerging markets (WHO) and preparing check list for market authorization.
12. Registration requirement comparison study in emerging markets (BRICS) and preparing check list for market authorization.
13. Registration requirement comparison study in emerging markets (China and South Korea) and preparing check list for market authorization.
14. Registration requirement comparison study in emerging markets (ASEAN) and preparing check list for market authorization.
15. Registration requirement comparison study in emerging markets (GCC) and preparing check

list for market authorization.

16. Checklists for 51Ok and PMA for US market.
17. Checklist for CE marking for various classes of devices for EU.
18. STED Application for Class III Devices.
19. Audit Checklist for Medical Device Facility.
20. Clinical Investigation Plan for Medical Devices.

L= Lecture, T= Tutorial, P= Practical, C= Credit "

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(M. Pharm - Regulatory Affairs)
(Semester - II)

L	T	P	C
		12	6

Course Code	**MRA206S**
Course Title	**Seminar / Assignment – II**

M. Pharm Semester - II

COURSE NAME : APPROACHES TO PHARMACEUTICAL RESEARCH [3PH201]

Learning Outcomes:

After successful completion of the course student will be able to :

- Understand the research process, research design and various aspects related to pharmaceutical research.
- Recall the brilliant discoveries done in past from some of the top pharmaceutical industries through case studies.
- Identify the various governmental and non-governmental funding agencies with their basic criterion for getting research grants.
- Apply the concepts of bio-statistics and its role in the pharmaceutical research.

Theory (Detailed Syllabus)

L	T	C
2	2	4

I. Research
   - Aim objective & purpose and need for Research,
   - Types of Research
   - Selecting a problem and preparing a research proposal,
   - Methods, Design and Tools used in research
   - Literature Survey, Printing & Secondary Sources oflnformation
   - £-Resources
   - Documentation - How, techniques, importance and uses of computers
   - The research Report/Paper writing/thesis writing and Scientific Writing
   - Patent Search and Reading of Patents

II. Presentation of Experimental Data

III. Ethics in Research & Publication

IV. Procurement of Research Grants from various agencies, International Agencies, Government bodies and Private bodies.

V. Industry - Institute Interaction & Interaction with Research Organization.

VI. Case studies of development of pharmaceuticals from Lab sources to the market.

Biostatistics: robability theory and distributions, sampling distributions and the central limit theorem. Population parameters and their sample estimates; descriptive statistics for central tendency and dispersion; hypothesis testing and confidence intervals for means, variances, and proportions; the chi-square statistic; categorical data analysis; linear correlation and regression model; analysis of variance; and nonparametric methods, application in pharmaceutical research

Tutorial

1. Case studies of the above topics mentioned in the theory section.
2. Assignments based on the above syllabus. 3. Writing applications to agencies for Research Grants.

Books Recommended

6. Research In education : John V. Best, James V. Kahn
7. Presentation Skills- Michael Halton- Indian Society for Institute Education
8. A practical Introduction to copyright- Gravin Mcfarlane
9. Thesis Projects in science and Engineering_ Richard M. Davis
10. Scientists in legal System- Ann Labor Science
11. Thesis and Assignment Writing- Jonathan Anderson

M.Pharm. [Regulatory Affairs & Quality Assurance) SEMESTER- II

COURSE NAME: PHARMACEUTICAL QUALITY ASSURANCE [3PA206]

Learning Outcomes:

Upon completion of the course, the student will be able to

- Analyze raw materials, in-process samples, and finished product in accordance with pharmacopoeia compendia standards.
- Demonstrate a variety of Quality Control activities including developing QC policies and Standard Operation Procedures, analyzing and archiving data, and interpreting results.
- Operationalize, validate, and calibrate a variety of laboratory equipment used in pharmaceutical industrial labs.
- Correlate and Identify unexpected results during routine analyses and help to provide solutions based on scientific and regulatory considerations by implementing preventive action and corrective actions programs.
- Describe the concept of quality systems and compliance in the regulated industry and the role of quality assurance.

Theory (Detailed Syllabus)

L	P	C
3	6	6

1. Concepts and Philosophy of TQM, GMP, ISO-9000.
2. Organization and personnel, responsibilities, training, hygiene.
3. Premises: Location, Design, Plan Layout, Construction , Maintenance and Sanitations. Environmental control, Sterile areas, control of contamination.
4. Equipments : Selection, purchase specifications, maintenance
5. Raw Materials: Purchase specifications, Maintenance of stores, Selection of vendors, Controls on Raw materials .
6. Manufacture of and controls on dosage forms: Manufacturing Documents, Master Formula, Batch Formula Records, Quality audits of manufacturing processes and facilities.
7. Standard operating procedures for various manufacturing steps, for the operation of equipments and instruments etc.
8. Packaging and labeling controls, line clearance, reconciliation oflabels; cartons and other packaging material; types and tests assuring quality of glass. Types of plastics used, permeation, leaching, sorption, chemical reactions, biological tests, modification of plastics by drugs; Different types of closures and closure liners
9. Finished product release: Quality review, Quality audits, Batch release document.
10. Warehousing: Good warehousing practice, Materials, Managements.
11. Distribution: Good distribution Practice, Distribution of records, Handling of returned goods, Recovered materials and Reprocessing.
12. Complaints and Recalls: Evaluation of complaints, Recall procedures, related records and documents.
13. Waste disposal, Scrap disposal procedure and records.
14. Loan License Auditing: Concepts, Auditing.
15. Risk management

16. Documentation of the records

Practicals

1. Calibration of volumetric glass wares.
2. Testing containers, closures, liners, glass, plastics used for packing.
3. Sterility testing of areas.
4. Testing ofrelated substances and foreign substances in raw materials as per I.P.
5. Assay for the raw materials, calculated either on anhydrous or hydrous basis as per I.P.

Books Recommended

1. Quality Assurance Guide Vol I and II, Organization of Pharmaceutical products of India.
2. Sandy Wein berg, Good Laboratory Practice Regulations, 2nd Edition, Vo. 69, Decker Series.
3. Quality Assurance of Pharmaceuticals - A compendium of guidelines and related materials - Vol. I - WHO Publications.
4. Kaushik Maitra and Sedhan K.Ghosh , A guide to Total Quality Management.
5. P. P. Sharma, How to practice GMPs, Vandana Publications Pvt Ltd., Delhi, 2001.
6. ISO 9000 and Total Quality Management - Sadhank. G. Ghosh.
7. The International Pharmacopoeia Vol. 1,2,3,4 - 3rd Edition, General Methods of Analysis and Quality specification for Phannaceutical Substances, Excipients and Dosage forms
8. Controller of Publication, Govt. of India - Indian Pharmacopeia, Vol. I, II, III - 2008.

M.Pharm. [Regulatory Affairs & Quality Assurance] SEMESTER- II

COURSE NAME: GLOBAL REGULATORY AFFAIRS [3PR202]

Learning Outcomes:

Upon completion of the course, the student will be able to

- Explain the process of drug discovery and development and generic product development in pharmaceutical sector.
- Compare between regulatory approval process and registration procedures for drug products as per requirement of different countries like US, EU, Japan, Australia, UK and Canada
- Prepare necessary documents for regulatory approval process for Medical Devices, In vitro Diagnostics, biologics, biosimilars etc.

Theory (Detailed Syllabus)	**L**	**P**	**C**
	3	**3**	**5**

1. Regulatory Requirements as per US-FDA guidelines
   - Drug Approval Process like IND, NDA, ANDA
   - Regulation of Non-Prescription Healthcare Products (OTC drugs), Orphan drug Indications, and Orange Book
   - Regulation of Dietary Supplements, Botanicals and Nutraceuticals
   - Post Approval Changes (PAC) including SUPAC, BACPAC
   - Post market surveillance
2. Regulatory requirements in European Union (EU) including EU community code on medical products, EEPIA and ABPI codes.
3. Regulatory guidelines of Brazil (ANVISA) and Australia (TGA)
4. Public policy, Regulatory, Ethical and Legal issues related to vaccines
5. Regulations related to biotechnology derived products and biosimilars
6. Regulation of Medical Devices including device classification, investigational device exemption (IDE) applications and humanitarian device exemptions
7. Human Genetic Research and Bioethics

Practicals

Practical/ assignments based on theory.

Case studies related to prepare dossiers of drug or formulations as per the requirement of different countries

Resources

1. http://www.pmda.go .jp/english
2. http://www.fda. gov
3. http://portal.anvisa.gov.br/wps/portal/anvisa-ingles
4. http://www.cdsco. nic.in
5. https://www.tga.gov.au
6. http://www.ema.eu ropa.eu
7. http://www.mhra.org.uk
8. FDA Regulatory Affairs, Edited by David Mantus & Douglas J. Pisano, CRC Press, Tailor & Francis Group, 2014.

NIRMA UNIVERSITY

Institute of Pharmacy

(M. Pharm)

(Semester - III)

L	T	P	C
4			4

Course Code	MRM301T
Course Title	Research Methodology & Biostatistics

Course Learning Outcomes (CLO):

At the end of the course, students will be able to -

1. List various types of research and significance of review of literature
2. Describe the parametric and non- parametric tests related to biostatistics
3. Discuss various types of medical research
4. Explain CPCSEA guidelines for laboratory animal facility
5. Express the role of declaration of Helsinki

Syllabus: UNIT I **Teaching hours: 60 Hours**

15 Hours

General Research Methodology: Research, objective, protocol design, requirements, practical difficulties, review of literature, study design, types of studies, strategies to eliminate errors/bias, controls, randomization, crossover design, placebo, blinding and related labelling techniques, conduct, monitoring, analysis and interpretation, reporting and record keeping, Scientific writing.

UNIT II **20 Hours**

Biostatistics: Definition, application, sample size, importance of sample size, factors influencing sample size, dropouts, statistical tests of significance, type of significance tests, parametric tests (students "t" test, ANOVA, Correlation coefficient, regression), non-parametric tests (wilcoxan rank tests, analysis of variance, correlation, chi square test), null hypothesis, P values, degree of

freedom, interpretation of P values, application based case studies.

UNIT III **10 Hours**

Medical Research: History, values in medical ethics, autonomy, beneficence, non-maleficence, double effect, conflicts between autonomy and beneficence/non-maleficence, euthanasia, informed consent, confidentiality, criticisms of orthodox medical ethics, importance of communication, control resolution, guidelines, ethics committees, cultural concerns, truth telling, online business practices, conflicts of interest, referral, vendor relationships, treatment of family members, sexual relationships, fatality.

UNIT IV **05 Hours**

CPCSEA guidelines for laboratory animal facility: Goals, veterinary care, quarantine, surveillance, diagnosis, treatment and control of disease, personal hygiene, location of animal facilities to laboratories, anesthesia, euthanasia, physical facilities, environment, animal husbandry, record keeping, SOPs, personnel and training, transport of lab animals, Import of animals.

UNITV **10 Hours**

General Guidelines of clinical research, ICH E9 guidelines, Declaration of Helsinki: History, introduction, basic principles for all medical research, and additional principles for medical research combined with medical care.

Suggested Readings": (Latest Edition)

1. Best, J.W., Kahn, J.V., *Research in Education.* New Delhi, Prentice Hall oflndia Pvt. Ltd.
2. Halton, M., *Presentation Skills.* Indian Society for Institute Education
3. Mcfarlane, G., *A Practical introduction to Copyright.* McGraw Hill
4. Davis, R.M., *Thesis Projects in Science and Engineering.* St. Martin's Press.
5. Anderson, J., *Thesis and Assignment Writing.* John Wiley & Sons.

L= Lecture, T= Tutorial, P= Practical, C= Credit "
this is not an exhaustive list

(M. Pharm - Regulatory Affairs)

(Semester - III)

L	T	P	C
1			1

Course Code	MRA302T
Course Title	Journal Club – I

/

(M. Pharm - Regulatory Affairs)

(Semester - III)

L	T	P	C
2			2

Course Code	MRA303T
Course Title	Discussion / Presentation (Proposal Presentation)

(M. Pharm - Regulatory Affairs)

(Semester - III)

L	T	P	C
		28	14

Course Code	MRA304P
Course Title	Research Work

(M. Pharm - Regulatory Affairs)
(Semester - IV)

L	T	P	C
1			1

Course Code	**MRA401T**
Course Title	**Journal Club – II**

(M. Pharm - Regulatory Affairs)
(Semester - IV)

L	T	P	C
		31	16

Course Code	**MRA402P**
Course Title	**Research Work and Colloquium**

(M. Pharm - Regulatory Affairs)
(Semester - IV)

L	T	P	C
3			3

Course Code	**MRA403T**
Course Title	**Discussion / Final Presentation**

M.Pharm. [Regulatory Affairs & Quality Assurance) SEMESTER- III

COURSE NAME: PHARMACEUTICAL REGULATORY MANAGEMENT & IPR

(Self-Study Course) [3PR301]

Learning Outcomes:

Upon completion of the course, the student will be able to

- Set-up , initiate and carry out proper actions between regulatory authorities and the marketing application authorization applicant/holder.
- Test and evaluate critical scientific data and conclusions intended for regulatory review.
- Systematize regulatory environment by implementing and upholding good regulatory practices.
- Develop independent responsibility for own professional development

Theory (Detailed Syllabus)

L	P	C
		4

1. **Regulatory Capacity of Organisation**
   Legal Basis, Organizational Structure and Authority, Human Resources, Financing Drug Regulation
2. **CMC Post-approval Regulatory Affairs**
3. **Licensing of Manufacturing, Distribution and Retail Sale**
   Power and Process, Human Resources, Paying For Licensing Performance
4. **Inspection and Surveillance**
   Power and Process: Comparing Structures And Processes, Human Resources, Paying For Inspection, Planning, Process And Performance
5. **Product Assessment and Registration**
   Power and Process, Human Resources, Paying For Registration Performance, Adverse Drug eaction Monitoring, Clinical Trials
6. **Control of Drug Promotion and Advertising**
   Power and Process: Comparing Structures and Processes, Performance
7. **Drug Quality Control Laboratory**
   Power and Process, Human Resources, Performance
8. **Assessing Regulatory Performance**
   Assessing Government Functions: An Essential Part of Policy-Making Monitoring and Evaluating the Effectiveness and Efficiency of Drug Regulation, Monitoring and Evaluating the Accountability and Transparency of Drug Regulation
9. **Intellectual Property Rights**
   a. Intellectual Property rights, TRIPS and GATT agreement, Patent, Copyright and Trademarks , Exclusive Marketing Rights.
   b. Patent systems in India: Types of patent, patent rights, claims, patent infringement, forms & filings.
   c. Patent applications in foreign countries.
   d. Scientific Exchange in Genomic Research

Resources

1. Official websites related to various guidelines .
2. Drug & Cosmetic Act, 1940, Controller of Pub lications, India.
3. www.ICH.Org
4. International IT Regulations and compliance Quality standards in the pharmaceutical and regulated Industries, Siri **H.** Segalsatd. A John Wiley and Sons. Ltd, Publication .
5. FDA regulatory affairs, Edited by, Douglas **J.** Pisano, CRS Press.
6. The Pharmaceutical Regulatory Process edited by Ira R.Berry, Marcel Dekker.
7. Effective drug regulation, A multi country study, Ms Sauwakon Ratanawijitrasin and Mr Eshetu Wondemagegnehu, WHO 2002 ISBN 92 4 156206 4

M.Pharm. [Regulatory Affairs & Quality Assurance) SEMESTER- III

COURSE NAME: MAJOR PROJECT PART – I [3PR303]

L	P	C
		16

M.Pharm. [Regulatory Affairs & Quality Assurance) SEMESTER- IV

COURSE NAME: MAJOR PROJECT PART – II [3PR401]

L	P	C
		20

Nirma University
Institute of Pharmac
Syllabus of M.Pharm Electives offered:

COURSE NAME: CLINICAL TRIALS AND PHARMACOVIGILANCE
Course Code: 3EP2P36

Learning Outcomes:

After successful completion of course, students will be able to:

- Design and conduct the various phases of clinical trials.
- Evaluate, monitor, prevent and manage the adverse drug reactions
- Develop the pharmacovigilance programmes.

Theory (Detailed Syllabus)	L	P	C
	2		2

1) Introduction to clinical trials
2) Research design and conduct of clinical trials
   a) Role of pharmacist in clinical trial.
   b) Various phases of clinical trials
   c) Planning and execution of clinical trials
   d) Guidelines of good clinical research practice and ethical requirements
   e) Monitoring and auditing of clinical trials
3) Pharmacovigilance
   - Scope, definition and aim
   - Adverse Drug Reactions (ADRs): Classification, mechanism, predisposing factors, causality assessment
   - Reporting, evaluation, monitoring, preventing and management of ADRs
   - Role of pharmacists in management of ADR
   - Counterfeit medicines

Books Recommended

1. Fundamental of Clinical Trials. Lawrence M. Friedman, Curt D. Furberg and David L. DeMets. Springer verlag, New York , Inc.
2. Clinical Trials, A Practical Approach. Stuart J. Pocock. John Wiley & Sons, Ltd.
3. Clinical Trials, A Methodologic Perspective. Steven Piantadosi. John Wiley & Sons, Inc, NZ.
4. Clinical Trials in oncology, Stephanie Green, Jacqueline Benedetti, John Crowley, Chapman & Hall/CRC, London.

Nirma University
Institute of Pharmac
Syllabus of M.Pharm Electives offered:

COURSE NAME: QUALITY BY DESIGN FOR PHARMACEUTICALS
Course Code: 3EP2T52

Learning outcomes:

After successful completion of the course, student will be able to

- Understand the concept of quality by design and its applications in pharmaceutical research
- Apply quality by design for optimization of dosage forms, method development, drug discovery and clinical trials
- Analyze data generated using factorial design, composite design, simplex lattice design etc.
- Evaluate experimental design data using softwares and statistical tools.
- Create methodology to develop cost effective robust formulation/method as per regulatory requirements .

Theory (Detailed Syllabus)

L	P	C
3		3

1. **Introduction**
   History of existing formulation development methodology, Basic concepts & objectives of quality by design (QbD) approaches. Importance with special emphasis on safety, effectiveness and quality from the perspective of patients requirements.
2. **Fundamentals of QbD**
   Defining target product profile, target product quality profile and critical quality attributes, risk assessment, fishbone diagram, Design space and control strategies.
3. **QbD for formulation of dosage forms**
   Implementation of QbD at formulation development and manufacturing liquid, semisolid, solid and sterile formulations.
4. **Design of Ex_l!e riment(DOE)and Process analytical tool (PAT)**
   Introduction, types, scope and applications, brief overview of screenmg designs, response surface methodology etc., concepts and application of PAT
5. **An overview of pharmaceutical development guidelines like Q8, Q9, QlO and other regulatory guidelines related to QbD.**

Total Lectures: 45

Books Recommended :

1. Pharmaceutical Statistics by Sanford Bolton, 2nd Edition, 2008, Marcel Dekker Inc., New York, USA.
2. New Drug Approval Process: Accelerating Global Registrations by Richard A. Guarino , 2005, Marcel Dekker, New York, USA.
3. Pharmaceutical Experimental Design by Gareth A. Lewis, Didier Mathieu and Roger Phan-Tan-Luu,, 2005, Marcel and Dekker, New York, USA.
4. http://www.fda.gov/ Quality by design for ANDAs: An example for imm ediate/modified release dosage forms.