# SAURASHTRA UNIVERSITY

# RAJKOT

**(ACCREDITED GRADE "A" BY NAAC)**

## FACULTY OF PHARMACY

Syllabus for

# POST GRADUTE DIPLOMA IN CLINICAL RESEARCH

Choice Based Credit System

**With Effect From: 2012-13**

# PROGRAM OUTCOMES
# POs of POST GRADUATE DIPLOMA IN CLINICAL RESEARCH (PGDCR)

**Students of all Post Graduate Diploma in Clinical Research programs at the time of program will be able to learn:**

**PO1.** The student will be able to learn an extensive knowledge of the fundamental area of clinical research.

**PO2.** The student will be able to strengthen skill, knowledge, proficiency and expertise to the standard expected of a clinical research professional.

**PO3.** The student will be able to learn empower the professionals working in the clinical research industry to move to senior position in the management hierarchy.

**PO4.** The course help to engage in high quality research which satisfies and economic needs, contributing to and, where appropriate, learning international research agendas.

**PO5.** The student will be able to learn the credibility of trials done and safety data accumulated by the Clinical Research group behind each new drug, cosmetic product, food supplement or any other healthcare consumable product or device launched in the market.

**PO6.** The student will be able to familiarize with the updated theoretical and practical aspects of the Clinical Research.

**PO7.** To provide participants with a broad understanding of the basic principles employed in diploma clinical research both domestically and internationally.

**PO8.** The student will be able to develop into research professionals and equip themselves with critical skill needed to practice clinical research

## PROGRAM SPECIFIC OUTCOMES
## PSOs of POST GRADUATE DIPLOMA IN CLINICAL RESEARCH (PGDCR)

**After completion of the program students are able:**

**POS1.** The student will be able to learn contemporary regulations of clinical research of India and abroad.

**POS2.** The student will be able to strengthen clinical skill such as BA/BE studies, Pharmacovigilance, clinical trials and other academic clinical research studies

**POS3.** The student will be able to learn Clinical Trial site monitoring.

## Department of Pharmaceutical Sciences
## Course structure and scheme for examination

## Semester I

| Subject Code | Title of the Course | Course Credits | No. of Hrs. Per Week | Weightage for Internal Examination | Weightage for Semester End Examination | Total Marks | Duration of Semester end Exam in hrs. |
|---|---|---|---|---|---|---|---|
| **Core - I (PGDCR-101)** | Subject specialization - I (Basics of Clinical Research) | 7 | 7 | 20 | 80 | 100 | 3 |
| **Core - II (PGDCR-102)** | Subject specialization – II (Pharmacokinetics and BA/BE studies) | 8 | 8 | 20 | 80 | 100 | 3 |
| **Core - III (PGDCR103)** | Subject specialization - III (clinical trials: Design and regulations) | 6 | 6 | 20 | 80 | 100 | 3 |
| **Core - IV (PGDRC-104)** | Subject specialization - IV (Pharmacovigilance and Pharmacoepidemiology) | 6 | 6 | 20 | 80 | 100 | 3 |
| **Total** | | **27** | | | | **400** | |


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## Department of Pharmaceutical Sciences
## Course structure and scheme for examination

### Semester II

| Subject Code | Title of the Course | Course Credits | No. of Hrs. Per Week | Weightage for Internal Examination | Weightage for Semester end Examination | Total Marks | Duration ff Semester end Exam in hrs. |
|---|---|---|---|---|---|---|---|
| **Core – V (PGDCR-201)** | DISSERTATION | 21 | 42 | 20 | 80 | 100 | 3 |

# POST GRADUATE DIPLOMA IN CLINICAL RESEARCH (PGDCR)
## SEMESTER-I
## Basics of Clinical Research Theory
## Course code: PGDCR-101

**Course Outcome:**

Upon Successful completion of the syllabus, a student will:

**CO1:** Describe the various types of clinical studies and the method used to appropriate design.

**CO2:** Discuss the collections, evaluation, and reporting of adverse event data in clinical trial.

**CO3:** Discuss the new drug discovery process in detail.

**CO4:** Understand the basic terminology used in clinical research.

CO5: Acquired knowledge about the systemic toxicology, Carcinogenicity, Mutagenicity, Teratogenicity, Reproductive toxicity, Genotoxicity, animal toxicity requirements.

**CO6:** Understand the drug discovery and drug development process.

## Course content

**Unit 1:**

- Introduction to Drug Discovery and drug Development, Basic pharmacology and clinical research: Basic conceptual knowledge about receptors, drugs, preclinical studies, pharmacodynamic, pharmacokinetic (ADME), drug interactions, clinical research,
- Introduction to pharmacoeconomics.

**Unit 2:**

**Clinical trials:**

- New drug discovery process- purpose, main steps involved in new drug discovery process, timelines of each steps, advantages and purposes of each steps, ethics in clinical research, unethical trials like Tuskegee trials, Nazi's experiments, Nurembergh trials etc, thalidomide tragedy, Phase-I, II, III, IV trials.
- -Introduction and designing
- -Various phases of clinical trials
- -Post Marketing surveillance – methods
- -Principles of sampling
- -Inclusion and exclusion criteria

- -Methods of allocation and randomization
- -Informed consent process in brief
- -Monitoring treatment outcome
- -Termination of trial
- -Safety monitoring in clinical trials

**Unit 3:**

**Preclinical toxicology:**

- General principles, Systemic toxicology (Single dose and repeat dose toxicity studies), Carcinogenicity, Mutagenicity, Teratogenicity, Reproductive toxicity, Local toxicity, Genotoxicity, animal toxicity requirements.

**Unit 4:**

**Basic terminology used in clinical research:**

- Types of clinical trials, single blinding, double blinding, open access, randomized trials and their examples, interventional study, ethics committee and its members, cross over design, etc. and Institution Ethics Committee / Independent Ethics Committee Data Management in clinical Research
- Bioethics: Ethics in clinical trials, history and basic principles of ethics

**REFERENCES:**


1. Basic and Clinical Pharmacology, Prentice hall, International, Katzung, B.G.
2. Clinical Pharmacology, Scientific book agency, Laurence, DR and Bennet PN.
3. Clinical pharmacokinetics, Pub. Springer Verlab, Dr. D.R Krishna, V. Klotz
4. Remington Pharmaceutical Sciences, Lippincott, Williams and Wilkins
5. Drug interaction, Kven Stockley. Hamsten
6. Drug interaction, Basic Bussiness Publ, Bombay, J.K. Mehra
7. Clinical pharmacology and drug therapy Grahame smith and Aronson,
8. Text Book of Therapeutics Drug and Disease Management Hardbound. Richard A Helms.
9. Clinical Pharmacy and therapeutics Herfindal E T and Hirschman JL, Williams and Wilkins.

## POST GRADUATE DIPLOMA IN CLINICAL RESEARCH (PGDCR)
## SEMESTER-I
## Pharmacokinetics and BA/BE studies (Theory)
## (PGDCR-102)

**Course Outcome:** At the end of the course student will be able to

**CO1:** Acquired the knowledge about various clinical pharmacokinetics study.

**CO2:** Understand about Pharmacokinetic profile of drug and variuos factor that are affect the pharmacokinetic data of drug.

**CO3:** Student should able to Describe in detail about Phase-I and Phase-II metabolism.

**CO4:** Acquired knowledge about how to collect, evaluate, and report the adverse event data in clinical trial.

**CO5:** Explain about when and why TDM is required, and what is indication of TDM?

**CO6:** Select the correct Pharmacokinetic model based on plasma level or urinary excretion data that best describe the process of drug absorption, distribution, metabolism and elimination.

**CO7:** Define bioavailability and discuss various method of bioavailability enhancement.

**CO8:** Acquired knowledge about bioequivalence study.

### Course Content

**Unit 1:**

- **Clinical Pharmacokinetics:** Introduction to clinical pharmacokinetics, Steady-state pharmacokinetic. Linear and non-linear pharmacokinetics.
- **Absorption**: Definition, Mechanism of absorption, Factors influencing the absorption.
- **Distribution:** Definition, Binding of drugs, Physiological barriers, Drug disposition, Factors affecting the distribution.
- **Metabolism**: Definition, Phase-I and Phase-II metabolism with examples.
- **Excretion:** Definition, Clearance, Renal clearance, Hepatic clearance, Factors affecting the excretion of drugs.

**Unit 2:**

- **Drug Interactions:** Definition, Epidemiology, Mechanism of drug interactions, Drug-food interactions.
- **Adverse Drug Reaction:** Epidemiology, Definition and Classification, Predisposing factors, Types of ADRs and their mechanism, Detection and Monitoring of ADR, Identification of ADR.

- **Therapeutic Drug Monitoring:** Introduction, When and why TDM is required? Necessity of the TDM, Indications for TDM, Protocol for TDM, TDM of selected drugs used in the following disease conditions: cardiovascular disease, CNS conditions etc.

**Unit 3:**

**Bioavailability studies**

- Introduction, Defination, objectives, factors affecting bioavailability, types: absolute vs relative, single vs multiple dose studies, healthy voluntiers vs patient studies, measurement of bioavailability, drug dissolution rate and Bioavailability, in vitro-in vivo correlation, methods for enhancement of bioavailability

**Unit 4:**

**Bioequivalence**

- Introduction, Definition, Bases for Determining Bioequivalence
- Design and Evaluation of Bioequivalence Studies
- Analytical Methods, Reference Standard, Extended-Release Formulations, Combination Drug Products,
- Study Designs
- Fasting Study, Food Intervention Study, Multiple-Dose (Steady-State) Study

**Crossover Designs**

- Replicated Crossover Design, Evaluation of the Data, Pharmacokinetic

**Statistical evaluation of the Data**

- Analysis of Variance (ANOVA),
- Two One-Sided Tests Procedure,
- Example Bioequivalence, Study Submission and Drug Review Process,
- Waivers of *In-Vivo* Bioequivalence Studies (Biowaivers)
- Dissolution Profile Comparison,

**The Biopharmaceutics Classification System (BCS)**

- Solubility, Permeability, Dissolution,
- Drug products for which bioavailability or bioequivalence may be self-evident, generic biologics,
- Clinical Significance of bioequivalence Studies, Special Concerns in Bioavailability and Bioequivalence Studies,
- Generic Substitution,
- Approved drug products with therapeutic equivalence evaluations (*Orange Book*),

**REFERENCES:**


1. Applied Therapeutics, The clinical uses of Drugs applied therapeutics INC
2. Text book of Biopharmaceutics, Dr. Brahmankar
3. Central Drugs Standard Control Organization. Good Clinical Practices-Guidelines for Clinical Trials on Pharmaceutical Products in India. New Delhi: Ministry of Health; 2001.
4. International Conference on Harmonization of Technical requirements for registration of Pharmaceuticals for human use. ICH Harmonized Tripartite Guideline. Guideline for Good Clinical Practice.E6; May 1996.
5. Principles of Pharmacology –The Pathophysiologic Basic –Golan David E.
6. Pharmacological Basis of Therapeutics-Goodman and Gilman
7. Pharmacology-Rang and Dale
8. Essentials of Pharmacotherapeutics-F.S. Barar
9. Principles of Pharmacology – Paul L. Munson
10. Pharmacology and Pharmacotherapeutics-R.S.Satoskar
11. Ethical Guidelines for Biomedical Research on Human Subjects 2000. Indian Council of Medical Research, New Delhi.
12. Textbook of Clinical Trials edited by David Machin, Simon Day and Sylvan Green, March 2005, John Wiley and Sons.
13. Principles of Clinical Research edited by Giovanna di Ignazio, Di Giovanna and Haynes.
14. Clinical Pharmacy and Therapeutics: Roger walker and Clive Edwards,Churchill Livingstone Edinburgh

## POST GRADUATE DIPLOMA IN CLINICAL RESEARCH (PGDCR)
## SEMESTER-I
## Clinical trials: Design and regulations Theory
## (PGDCR-103)

**Course Outcome:** At the end of each unit of learning students will be able to:

**CO1:** Discuss about various types and design of clinical trials.

**CO2:** Acquired knowledge about Schedule Y and ICMR guideline.

**CO3:** Discuss the role of Indian GCP guideline.

**CO4:** Acquired knowledge about how to apply for clinical trial in India.

**CO5:** Discuss Investigator Brochure and Informed Consent Form as essential document in clinical trial.

**Unit 1:**

- Types of clinical trials

**Unit 2:**

- Design and organization of phase-I, phase-II, phase-III, phase-IV trials

**Unit 3:**

**Various regulatory requirements in clinical trials:**

- Schedule Y, ICMR guidelines.

**Documents in clinical study:**

- Investigator Brochure (IB), Protocol & Amendment in Protocol, Case Report Form (CRF), Informed Consent Form (ICF), Content of Clinical Trial Report Essential Documents in Clinical Trial

**Good Clinical Practice:**

- ICH guidelines
- Indian GCP guidelines (CDCSO guidelines)
- ICMR Guidelines - Ethical Guidelines for Biomedical Research on Human Subjects

**Schedule Y**

- Roles & Responsibility of various clinical trial personnel like Sponsor, Investigator, Monitor, Auditors as per ICH GCP and ICMR guidelines

**Unit 4:**

- Study of various clinical trials (completed or ongoing), Clinical Trial Application in India, Import & Export of Drug in India, Investigational New Drug application (IND), Abbreviated New Drug Application (ANDA), New Drug Application (NDA).

**REFERENCES:**


1. Central Drugs Standard Control Organization. Good Clinical Practices-Guidelines for Clinical Trials on Pharmaceutical Products in India. New Delhi: Ministry of Health; 2001.
2. International Conference on Harmonization of Technical requirements for registration of Pharmaceuticals for human use. ICH Harmonized Tripartite Guideline. Guideline for Good Clinical Practice.E6; May 1996.
3. Ethical Guidelines for Biomedical Research on Human Subjects 2000. Indian Council of Medical Research, New Delhi.
4. Textbook of Clinical Trials edited by David Machin, Simon Day and Sylvan Green, March 2005, John Wiley and Sons.
5. Principles of Clinical Research edited by Giovanna di Ignazio, Di Giovanna and Haynes.
6. Clinical Pharmacy and Therapeutics Roger walker and Clive Edwards,Churchill Livingstone Edinburgh
7. Davidson's Principle and Practice of Medicine, EDs Christopher, Haslett, Edwin R.Chilvers.
8. Harrison's Principles of Internal medicine- Vol 1 and 2 Braunwald, Eugene & Others.
9. Textbook of Therapeutics Drug Disease Management- Eric T.Herfindal and Dick R.Gourley.
10. Comprehensive Pharmacy Review- Shargel Leon
11. Melmon and Morrells Clinical Pharmacology 4th Edition – S George Carrythers
12. A textbook of Clinical pharmacy practice- Parthasarthi G.
13. Rick NG. Drugs from Discovery to Approval. John Wiley & Sons, Inc 2004
14. Allen Cato, Lynda Sutton Clinical Drug Trials and Tribulations Second Edition, Revised and Expanded. Marcel Dekker, Inc. 2002
15. Deborah Rosenbaum, Michelle Dresser. Clinical Research Coordinator Handbook Second Edition Practical Clinical Trials Series GCP Tools and Techniques Interpharm/CRC New York Washington, D.C.© 2002
16. Tamas Bartfai, Graham V. Lees. Drug Discovery from Bedside to Wall Street. Elsevier Academic Press. London 2006
17. Ronald D. Mann, Elizabeth B. Andrews. Pharmacovigilance. John Wiley & Sons Ltd, 2002

**18.** Shayne C. Gad. Drug Safety Evaluation. A John Wiley & Sons, Inc., Publication **7.** Bert Spilker. Guide to Clinical Trials. **8.** Sandy Weinberg. Guidebook for Drug Regulatory Submissions. A John Wiley & Sons, inc.,2009

**19.** Duolao Wang and Ameet Bakhai Clinical Trials A Practical Guide to Design, Analysis, and Reporting. Remedica 2006

**20.** Textbook of Clinical Trial edited by David Machin, Simon Day and Sylvan Green, March 2005, John Wiley and Sons.

**21.** Various Guidelines like: ICH – GCP- International Conference on Harmonisation of Technical requirements for registration of pharmaceuticals for human use. ICH Harmonised Tripartite Guideline. Guideline for Good Clinical Practice. E6 1996. ICMR Guideline – Ethical Guidelines for Biomedical Research on Human Subjects. Indian GCP – Central Drugs Standard Control Organization. Good Clinical Practices– Guidelines for Clinical Trials on Pharmaceutical Products in India. New Delhi: Ministry of Health; 2001.

**22.** Schedule Y, Drug and Cosmetic act 1940 and rules 1945,

## Pharmacovigilance and Pharmacoepidemiology Theory (PGDCR-104)

**Course Outcome:**

**CO1:** Discuss about Pharmacovigilance study.

**CO2:** Understand how to detect signal and report ADR.

**CO3:** What is the role of clinical pharmacist in Reporting, evaluation, monitoring, prevention and management of ADR.

**CO4:** Describe the Various types of Pharmacoepidemiology study.

**CO5:** Differentiate the epidemiology and clinical medicines.

**CO6:** How to measure epidemiology data.

## Course content

**Unit 1:**

**Pharmacovigilance**

- Scope, definition and aims of pharmacovigilance Adverse drug reactions – Classification, mechanism, predisposing factors and causality assessment. Role of clinical pharmacist in Reporting, evaluation, monitoring, prevention and management of ADR, Adverse drug reaction reporting and monitoring, Drug induced diseases

**Unit 2:**

**Pharmacoepidemiology,**

- Defination: epidemiology, Disease distribution, disease determination, disease frequency, Aims of epidemiology, Difference between epidemiology and clinical medicines, Epidemiological approach, Measurements in epidemiology, (rates, ratios, and proportions)

**Measurement of mortality:**

- international death certificate, limitations and use of mortality data, mortality rates and ratios, crude death rates, specific death rates, case fatality ratio, proportional mortality ratio, survival rate, standardize rates, direct standardization, indirect standardization,

**Measurement of morbidity:**

- Incidence, Prevalence, uses of prevalence, relationship between incidence and prevalence,

**Unit III**

**Epidemiological methods:**

1. **Descriptive epidemiology:**
    1. Time distributions:
        - Short term fluctuations: Types of Epidemics- single exposure/point source exposure epidemics, continuous exposure epidemics, propagated epidemics, slow epidemics
        - Periodic fluctuations
        - Long term fluctuations
    2. Place Distributions:
        - International variance,
        - National variance,
        - Rural-Urban variations,
        - Local distributions.
    3. Person distributions:
2. **Analytical epidemiology:**
    1. Case control study:
        - Selection of cases, selection of controls, matching, measurements of exposure, analysis, odds ratio, bias in case control study., advantages, disadvantages and some examples of case control study
        - Cohort study Concept, framework, prospective and retrospective cohort study, combination of prospective and retrospective cohort study, elements of cohort study, relative risk, attributable risk, advantages, disadvantages and examples of cohort study.
    2. Experimental epidemiology:
        - Randomized controlled trials: Protocol, selecting reference and populations, randomization, manipulation, follow-ups, assessment, study designs in randomized trials like parallel and cross over study, Types of randomized controlled trials: clinical trial, preventive trials, risk factor trials, cessation trials, trial of aeitiological agents,

**REFERENCES:**

1. International Conference on Harmonization of Technical requirements for registration of Pharmaceuticals for human use. ICH Harmonized Tripartite Guideline. Guideline for Good Clinical Practice.E6; May 1996.

**2.** Ethical Guidelines for Biomedical Research on Human Subjects 2000. Indian Council of Medical Research, New Delhi.

**3.** Textbook of Clinical Trials edited by David Machin, Simon Day and Sylvan Green, March 2005, John Wiley and Sons.

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**5.** Clinical Pharmacy and Therapeutics Roger walker and Clive Edwards,Churchill Livingstone Edinburgh

**6.** Davidson's Principle and Practice of Medicine, EDs Christopher, Haslett, Edwin R. Chilvers.

**7.** Harrison's Principles of Internal medicine- Vol 1 and 2 Braunwald, Eugene & Others.

**8.** Textbook of Therapeutics Drug Disease Management- Eric T.Herfindal and Dick R. Gourley.

**9.** Comprehensive Pharmacy Review- Shargel Leon

**10.** Melmon and Morrells Clinical Pharmacology 4th Edition – S George Carrythers

**11.** A textbook of Clinical pharmacy practice- Parthasarthi G.

## POST GRADUATE DIPLOMA IN CLINICAL RESEARCH (PGDCR)
## SEMESTER - II
## Dissertation
## (PGDCR-201)

**Course Outcome:**

**CO1:** Identify Research methods

**CO2:** Identify literature review

**CO3:** Apply knowledge and understanding in clinical research.

**CO4:** Demonstrate advanced critical research skill in relation to career development or work-related learning studies.

### Course Content

**1.** Introduction to Dissertation work,

**2.** Practical training/dissertation work.